

architecture interiors & technology engineering



Integrated Design Solutions

Project Manual

Troy School District
Services Building
UPS Replacement
TSD Bid No. 9546

IDS Project No. 03234-2007

August 15, 2008
Bids

Project Manual

**Troy School District
Services Building
UPS Replacement
TSD Bid No. 9546
Troy, Michigan**

for

**Troy School District
4400 Livernois Road
Troy, Mi 48098**

Integrated Design Solutions LLC

Architecture, Engineering, Interiors & Technology
888 W Big Beaver, Suite 200
Troy, Michigan 48084
248.823.2100
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IDS Project No. 03234-2007

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Troy School District
Services Building
UPS Replacement
TSD Bid No. 9546
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IDS Project No. 03234-2007

SECTION 00100 - ADVERTISEMENT FOR BIDS

DATE: August 15, 2008

PROJECT: Troy School District
Services Building
UPS Replacement
TSD Bid No. 9546
Troy, Michigan

OWNER: Troy School District
4400 Livernois
Troy, Michigan 48098

**ENGINEERING/
TECHNOLOGY
DESIGNER:** Integrated Design Solutions, LLC
Architecture, Engineering, Interiors & Technology
888 W. Big Beaver, Suite 200
Troy, MI 48084
(248) 823-2100
(248) 823-2200 fax

BIDS RECEIVED: Until 3:00 pm local time on September 2, 2008, the Owner will receive sealed Bids for the work as set forth in the Bidding Documents at:

Troy School District
Purchasing Department
1140 Rankin
Troy, Michigan 48083

ATTN: Frank Lams
Purchasing Supervisor

All bids will be publicly opened and read aloud at 3:01 pm. A bid tabulation summary will be available.

The Bidding Documents will be on file on and after August 15, 2008 and may be examined at the following locations during regular business hours, Monday through Friday.

World Wide Web: Troy School District
Specifications Only: http://www.troy.k12.mi.us/purchasing/items_out_for_bid.htm

The offices of: Integrated Design Solutions, LLC, 888 W. Big Beaver, Suite 200, Troy, MI 48084, (248) 823-2100
Construction Association of Michigan, 43636 Woodward Ave., Bloomfield Hills, MI 48302, (248) 972-1000
McGraw Hill Construction, 20475 Woodingham Dr., Detroit, MI 48221, (313) 342-6449

The Engineer will furnish one (1) set of documents to the bidders at a \$50 refundable deposit.

A recommended pre-bid conference is scheduled for August 26, 2008 at 11:00 a.m. local time. All Bidders are responsible for attendance at the pre-bid conference. Bidders shall meet in Conference Room C at Troy School District Services Building, 4420 Livernois, Troy, Michigan 48098.

Troy School District
Services Building
UPS Replacement
TSD Bid No. 9546
Troy, Michigan

IDS Project No. 03234-2007

Immediately following the pre-bid conference, the Owner will make available the building for Bidders to examine site and local conditions.

Each Bid shall be accompanied by a Bid Security in the form of a certified check, cashier's check, money order or bid bond made payable to Troy School District in an amount not less than five percent (5%) of the base bid as a Bid guarantee.

The successful Bidder shall provide a Performance Bond and a Labor and Material Payment Bond covering the faithful performance of the Contract and payment of all obligations arising thereunder, each in the amount of one hundred percent (100%) of the contract amount. The cost of such bonds shall be included in the Bid.

The bid security of Bidders under consideration will be returned immediately after execution of the Contract by the Owner. The amount of the bid security shall be forfeited to the Owner if the successful Bidder fails to enter into a contract and furnish required bonds and insurance certificates within ten (10) days after award of Contract.

Withdrawal of any Bid is prohibited for a period of sixty (60) days after the actual date of the opening thereof.

Each Bidder agrees to waive any claim it has or may have with the Owner, the Engineering Consultant, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any bid.

The Owner reserves the right to reject any or all Bids, either in whole or in part, to reject a Bid not accompanied by the required bid security or by other data required by the Bidding Documents or to reject a Bid which is any way incomplete or irregular and to waive informality and irregularity in the bids and in the bidding.

The Owner reserves the right to accept Alternates in any order or combination and to determine the low Bidder on the basis of the sum of the base bid and the Alternates accepted.

END OF ADVERTISEMENT FOR BIDS

SECTION 00200 - INSTRUCTIONS TO BIDDERS

1. DEFINITIONS

- A. Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement for Bids, Instruction to Bidders, the Bid Form and other bidding and contract forms. The proposed Contract Documents consist of the form of an Agreement between Owner and Contractor, General and Supplementary Conditions of the Contract, Specifications, Drawings and Addenda issued prior to execution of the Contract.
- B. Addenda are written or graphic instruments issued by the Engineer prior to the execution of the Contract, which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.
- C. A Bidder is a person or entity who submits a Bid.
- D. A Bid is a complete and properly signed proposal to do the work for the sums stipulated therein submitted in accordance with the Bidding Documents.
- E. The Base Bid is the amount stated in the Bid for which the Bidder offers to perform the work as described in the Bidding Documents as the base, to which work may be added to or deleted from, for the amounts stated in the Alternates.
- F. An Alternate is an amount stated in the Bid Form to be added to or deducted from the amount of the Base Bid if the described Alternate is accepted.
- G. A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the work as described in the Bidding Documents.

2. SECURING BIDDING DOCUMENTS

- A. Bidding is by public advertisement and invitation. Copies of the Bidding Documents may be obtained from Integrated Design Solutions, LLC, upon conditions set forth in the Advertisement for Bids.
- B. Only complete sets of Bidding Documents will be furnished. The Owner or Engineer assumes no responsibility for errors or misinterpretations resulting from use of incomplete sets of Bidding Documents.
- C. All copies of the Bidding Documents received for bidding purposes shall be returned in usable condition within ten (10) days of receipt of bids. Incomplete bidding documents or bidding documents returned later than ten (10) days after receipt of bids will result in a forfeiture of the Bidder's deposit.
- D. Bidding Documents remain the property of the Engineer.

3. PREPARATION AND SUBMISSION OF BIDS

- A. Bids shall be submitted on forms bound in the Project Manual of the Bidding Documents.
- B. All blanks on the Bid Form must be filled in by typewriter or by hand in ink.

- C. Amounts shall be expressed in both words and figures. In case of a discrepancy the amount stated in words shall govern.
- D. Alterations by erasure or interlineations must be initialed by the Bidder.
- E. All Alternates must be bid. If no change in the Base Bid is required, enter "No Change."
- F. Submit the Bid, along with the bid security and any other documents required to be submitted with the Bid, to the Owner, and deliver to the address given in the Advertisement for Bids on or before the day and hour set for receipt of the Bids.
 - 1. Enclose each Bid in a sealed opaque envelope bearing the title of the work SERVICES BUILDING, UPS REPLACEMENT, TSD Bid No. 9546, the name of the Bidder, and the date and hour of the Bid opening, with the notation "SEALED BID ENCLOSED".
 - 2. Do not change the wording of the Bid Form, and do not add words to, or delete words from the Bid Form.
 - 3. Unauthorized conditions, limitations, or provisions attached to the Bid will be cause for rejection of the Bid.
 - 4. Submit only duplicate signed copies of the Bid. Clearly distinguish the original bid from the duplicated copies of the bid.
 - 5. It is the sole responsibility of the Bidder to see that his bid is received on time.
 - 6. Telephonic, telegraphic, facsimile (fax), or e-mail Bids or telephonic, telegraphic, facsimile (fax) or e-mail modification of a Bid will not be considered.
 - 7. Bids received after the time fixed for receiving them will not be considered and will be returned to the Bidder unopened.
 - 8. Properly identified Bids received on time will be publicly opened and read aloud. A bid tabulation summary will be available.
 - 9. The "AFFIDAVIT OF BIDDER" found in the bid form must be completed.
- G. The Bidder in submitting a Bid represents that:
 - 1. The Bidder has read and understands the Bidding Documents, including the Drawings, Specifications and other proposed Contract Documents.
 - 2. The Bid is made in compliance with the Bidding Documents.
 - 3. The Bidder has visited the site of the Work and become informed as to existing conditions and limitations under which the Work is to be performed and included in their Bid a sum to cover the cost necessary to perform the Work as set forth in the Bidding Documents. No allowance will be made to a Bidder because of a lack of such examination or knowledge.
 - 4. The Bid is based upon materials, equipment and systems required by the Bidding Documents without exception and without substitutions.

4. FAMILIAL DISCLOSURE STATEMENT

- A. Each Bid shall be accompanied by the Familial Disclosure Statement in compliance with MCL380.1267. The Bid proposal must be accompanied by a sworn and notarized statement disclosing Familial Relationship that exists between the Bidder or any employee of the Bidder and any member of the Board of Education of the School District, or the Superintendent of the School District. The School District will not consider a Bid Proposal that does not include this sworn and notarized Disclosure Statement.

5. BID SECURITY AND BONDS

- A. Each bid shall be accompanied by a certified check, cashier's check, money order or bid bond made payable to Troy School District in an amount not less than five percent (5%) of the Base Bid as a proposal guarantee. Bid Bond shall be provided by a company licensed to do business in the State of Michigan.
- B. The successful Bidder shall provide a Performance Bond and a Labor and Material Payment Bond, covering the faithful performance of the Contract and payment of all obligations arising there under, each in the amount of one hundred percent (100%) of the contract amount. Bonds shall be provided by a company licensed to do business in the State of Michigan. The cost of such bonds shall be included in the Bid.
- C. The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this paragraph.
- D. Should the Bidder refuse to enter into a Contract or fail to furnish such bonds, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty.
- E. The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either the Contract has been executed and bonds have been furnished or the specified time has elapsed so that the Bid may be withdrawn or all Bids have been rejected.

6. MODIFICATIONS AND WITHDRAWAL OF BIDS

- A. A Bidder may not modify, withdraw or cancel a Bid, for a period of sixty (60) days following the time and date designated for receipt of Bids, and by submitting a Bid each Bidder shall so agree.
- B. A Bidder may withdraw their Bid, either personally or by written request, at any time prior to the scheduled time for receipt of bids. A withdrawn Bid may be resubmitted up to the date and time designated for receipt of Bids.
- C. Prior to the time and date for receipt of Bids, a Bidder may modify a Bid by notice to the party receiving Bids, at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written notice and the signature of the Bidder shall be received, and date and time stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be worded as not to reveal the amount of the original Bid.

7. CONSIDERATION OF BIDS

- A. The Owner reserves the right to reject any or all Bids submitted either in whole or part, to reject a bid not accompanied by the required Bid security or by other data required by the Bidding Documents or to reject a Bid which is any way incomplete or irregular and to waive informality and irregularity in the Bids and in the Bidding.
- B. The Owner reserves the right to accept alternates in any order or combination and to determine the low Bidder on the basis of the sum of the Base Bid and the alternates accepted and to make the awards that the Owner determines are in its best interest. The decision of the Owner is final and not subject to appeal.

- C. The Owner reserves the right to negotiate with any Bidder without rebidding the project in whole or in part.

8. EXECUTION OF AGREEMENT

- A. The successful Bidder will be required to execute AIA Abbreviated Standard Form of Agreement between Owner and Contractor, AIA Document A107-1997 in conjunction with the Supplementary Conditions and additional conditions as defined within Specification Section 00800. The contract documents will be available for review and signatures within seven (7) days of contract award. The owner will issue an owner's Purchase Order for the owner's accounting purposes only.
- B. The Bidder to whom the Contract is awarded shall, within five (5) calendar days after notice of award and receipt of Agreement forms from the Owner, sign and deliver required copies to the Owner.
- C. At or prior to delivery of the signed Agreement, the Bidder to whom the Contract is awarded shall deliver to the Owner those Certificates of Insurance required by the Owner.
- D. The Owner shall approve Bonds and Certificates of Insurance and any required state or local permits before the successful Bidder may proceed with the Work. Failure or refusal to provide Bonds or Certificates of Insurance or required permits in a form satisfactory to the Owner shall subject the successful Bidder to loss of time from the allowable construction period equal to the time of delay in furnishing the required material.
- E. After award of the Contract and prior to the first payment request, the Bidder to whom the Contract is awarded shall deliver to the Owner a schedule of values.

9. INTERPRETATION OF CONTRACT DOCUMENTS PRIOR TO BIDDING

- A. Bidders shall study and compare the Bidding Documents with each other, shall examine the site and local conditions by appointment with Owner and if in doubt as to the true meaning of any part of the Bidding Documents, or finds discrepancies, inconsistencies, ambiguities or errors in or omissions from any part of the Bidding Documents, the Bidder may submit to the Engineer a written request for interpretation thereof. The person submitting the request shall be responsible for its prompt delivery.

Bids Documents Available:	August 15, 2008
Pre-bid Conference and Site Visit:	August 26, 2008, 11:00 am
Deadline for RFI Submissions:	August 28, 2008, 12:00 pm
Deadline for RFI Responses and Addenda:	August 29, 2008, 4:00 pm
Bids Due:	September 2, 2008, 3:00 pm
Bid Opening:	September 2, 2008, 3:01 pm
Post Bid Interviews:	September 5, 2008
Bid Award:	September 16, 2008 Board of Education Meeting

- B. Interpretation, correction or changes to the proposed Contract Documents will be made only by Addendum. Explanations, interpretations, corrections or changes of the Bidding Documents by any other method will not be binding.

10. ADDENDA/RESPONSES TO RFI'S

- A. Addenda and responses to RFI's will be posted on the TSD website and plan houses listed on the Advertisement for Bids.
- B. Copies of Addenda will be made available for inspection wherever Bidding Documents are on file.
- C. Addenda will be issued no later than four (4) days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which postpones the date for receipt of Bids.
- D. Each Bidder shall ascertain prior to submitting his bid that he has received all Addenda issued and shall acknowledge their receipt on the Bid Form.
- E. Each Bidder shall be responsible for compliance with all issued Addenda.

11. SUBSTITUTIONS

- A. No substitutions will be considered prior to receipt of Bids, unless a written request for approval has been received by the Engineer at least ten (10) days prior to the date for receipt of Bids. Such request for substitutions shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, samples and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Engineer's decision of approval or disapproval of a proposed substitution shall be final.
- B. If the Engineer approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum.
- C. No substitutions will be considered after Contract award unless specifically provided for in the Contract Documents.

12. TAXES

- A. For the purposes of this bid, the Troy School District is tax exempt. Do not include Federal, State or local taxes in the Bid. The Owner's federal and state tax exempt number is B38.600.3099. Usage taxes shall be included in the base bid price.

13. PERMITS AND FEES

- A. All Bids shall include costs of all applicable permits and fees.

14. TIME OF COMPLETION

- A. The Bidder, if awarded the Contract, agrees to complete the Work on or before the Contract Completion Date stated in the Bid Form.

15. EQUAL OPPORTUNITY

- A. The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take steps to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.
- B. The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf; state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

16. PREVAILING WAGE LAW

- A. Prevailing wage rates apply to this project.
- B. The wages and fringe benefits to be paid to each class of worker shall not be less than the wage and fringe benefit rates prevailing in the locality in which the work is to be performed, in accordance with Act 166 of the State of Michigan Public Acts of 1965 as amended.

17. POST BID INFORMATION

- A. Bidders to whom Contract award is under consideration shall submit to the Engineer, upon request, a properly executed AIA Document A305, Contractor's Qualification Statement.

END OF SECTION 00200



STATE OF MICHIGAN

JENNIFER M. GRANHOLM
GOVERNOR

DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

REQUIREMENTS OF THE PREVAILING WAGES ON STATE PROJECTS ACT, PUBLIC ACT 166 OF 1965

The Michigan Department of Labor & Economic Growth determines prevailing rates pursuant to the Prevailing Wages on State Projects Act, Public Act 166 of 1965, as amended. The purpose of establishing prevailing rates is to provide minimum rates of pay that must be paid to workers on construction projects for which the state or a school district is the contracting agent and which is financed or financially supported by the state. By law, prevailing rates are compiled from the rates contained in collectively bargained agreements which cover the locations of the state projects. The official prevailing rates provide an hourly rate which includes wage and fringe benefit totals for designated construction mechanic classifications. The overtime rates also include wage and fringe benefit totals. Please pay special attention to the overtime and premium pay requirements. Prevailing wage is satisfied when wages plus fringe benefits paid to a worker are equal to or greater than the required rate.

State of Michigan responsibilities under the law:

- The department establishes the prevailing rate for each classification of construction mechanic **requested by a contracting agent** prior to contracts being let out for bid on a state project.

Contracting agent responsibilities under the law:

- If a contract is not awarded or construction does not start within 90 days of the date of the issuance of rates, a re-determination of rates must be requested by the contracting agent.
- Rates for classifications needed but not provided on the Prevailing Rate Schedule, **must** be obtained **prior** to contracts being let out for bid on a state project.
- The contracting agent, by written notice to the contractor and the sureties of the contractor known to the contracting agent, may terminate the contractor's right to proceed with that part of the contract, for which less than the prevailing rates have been or will be paid, and may proceed to complete the contract by separate agreement with another contractor or otherwise, and the original contractor and his sureties shall be liable to the contracting agent for any excess costs occasioned thereby.

Contractor responsibilities under the law:

- Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing rates prescribed in a contract.
- Every contractor and subcontractor shall keep certified payrolls, as used in the industry, of each and every construction mechanic, and verification of such certified payroll in writing by either a representative or auditor/certified accountant at the end of such a certified payroll. These records should include the occupation and indicate the hours worked on each project for each classification and the actual wages and benefits paid. This record shall be available for reasonable inspection by the contracting agent or the department.
- Each contractor or subcontractor is separately liable for the payment of the prevailing rate to its employees.
- The prime contractor is responsible for advising all subcontractors of the requirement to pay the prevailing rate prior to commencement of work.
- The prime contractor is secondarily liable for payment of prevailing rates that are not paid by a subcontractor.
- A construction mechanic shall only be paid the apprentice rate if registered with the United States Department of Labor, Bureau of Apprenticeship and Training and the rate is included in the contract.

Enforcement:

A person who has information of an alleged prevailing wage violation on a state project may file a complaint with the Wage & Hour Division. The department will investigate and attempt to resolve the complaint informally. During the course of an investigation, if the requested records and posting certification are not made available in compliance with Section 5 of Act 166, the investigation will be concluded and a referral to the Office of Attorney General for civil action will be made. The Office of Attorney General will pursue costs and fees associated with a lawsuit if filing is necessary to obtain records.

A violation of Act 166 may result in the contractor's name being added to the Prevailing Wage Act Violators List published on the division's website, updated monthly. This list includes the names and addresses of contractors and subcontractors the division has found in violation of Act 166 based on complaints from individuals and third parties. The Prevailing Wage Act Violators List is intended to inform contracting agents of contractors that have violated Act 166 for use in determining who should receive state-funded projects.

WAGE & HOUR DIVISION

P.O. BOX 30476 • LANSING, MICHIGAN 48909-7976

www.michigan.gov/wagehour • (517) 335-0400 • FAX (517) 335-0077

ENGINEERS - CLASSES OF EQUIPMENT LIST

UNDERGROUND ENGINEERS	HAZARDOUS WASTE ABATEMENT ENGINEERS
<p>CLASS I Backfiller Tamper, Backhoe, Batch Plant Operator, Clam-Shell, Concrete Paver (2 drums or larger), Conveyor Loader (Euclid type), Crane (crawler, truck type or pile driving), Dozer, Dragline, Elevating Grader, End Loader, Gradall (and similar type machine), Grader, Power Shovel, Roller (asphalt), Scraper (self propelled or tractor drawn), Side Broom Tractor (type D-4 or larger), Slope Paver, Trencher (over 8' digging capacity), Well Drilling Rig, Mechanic, Slip Form Paver, Hydro Excavator.</p> <p>CLASS II Boom Truck (power swing type boom), Crusher, Hoist, Pump (1 or more 6" discharge or larger gas or diesel powered by generator of 300 amps or more, inclusive of generator), Side Boom Tractor (smaller than type D-4 or equivalent), Tractor (pneu-tired, other than backhoe or front end loader), Trencher (8' digging capacity and smaller), Vac Truck.</p> <p>CLASS III Air Compressors (600 cfm or larger), Air Compressors (2 or more less than 600 cfm), Boom Truck (non-swinging, non-powered type boom), Concrete Breaker (self-propelled or truck mounted, includes compressor), Concrete Paver (1 drum, ½ yard or larger), Elevator (other than passenger), Maintenance Man, Mechanic Helper, Pump (2 or more 4" up to 6" discharge, gas or diesel powered, excluding submersible pump), Pumpcrete Machine (and similar equipment), Wagon Drill Machine, Welding Machine or Generator (2 or more 300 amp or larger, gas or diesel powered).</p> <p>CLASS IV Boiler, Concrete Saw (40HP or over), Curing Machine (self-propelled), Farm Tractor (w/attachment), Finishing Machine (concrete), Firemen, Hydraulic Pipe Pushing Machine, Mulching Equipment, Oiler (2 or more up to 4", exclude submersible), Pumps (2 or more up to 4" discharge if used 3 hrs or more a day-gas or diesel powered, excluding submersible pumps), Roller (other than asphalt), Stump Remover, Vibrating Compaction Equipment (6' wide or over), Trencher (service) Sweeper (Wayne type and similar equipment), Water Wagon, Extend-a-Boom Forklift.</p>	<p>CLASS I Backhoe, Batch Plant Operator, Clamshell, Concrete Breaker when attached to hoe, Concrete Cleaning Decontamination Machine Operator, Concrete Pump, Concrete Paver, Crusher, Dozer, Elevating Grader, Endloader, Farm Tractor (90 h.p. and higher), Gradall, Grader, Heavy Equipment Robotics Operator, Hydro Excavator, Loader, Pug Mill, Pumpcrete Machines, Pump Trucks, Roller, Scraper (self-propelled or tractor drawn), Side Boom Tractor, Slip Form Paver, Slope Paver, Trencher, Ultra High Pressure Waterjet Cutting Tool System Operator, Vactors, Vacuum Blasting Machine Operator, Vertical Lifting Hoist, Vibrating Compaction Equipment (self-propelled), and Well Drilling Rig.</p> <p>CLASS II Air Compressor, Concrete Breaker when not attached to hoe, Elevator, End Dumps, Equipment Decontamination Operator, Farm Tractor (less than 90 h.p.), Forklift, Generator, Heater, Mulcher, Pigs (Portable Reagent Storage Tanks), Power Screens, Pumps (water), Stationary Compressed Air Plant, Sweeper, Water Wagon and Welding Machine.</p> <p>Revised: 05/23/08</p>



JENNIFER M. GRANHOLM
GOVERNOR

Michigan Department of Labor & Economic Growth
Wage & Hour Division
PO Box 30476
Lansing, MI 48909-7976
517.335.0400
www.michigan.gov/wagehour



KEITH W. COOLEY
DIRECTOR

Informational Sheet: Prevailing Wages on State Projects
General Information Regarding Fringe Benefits

Certain fringe benefits **may** be credited toward the payment of the Prevailing Wage Rate:

- If a fringe benefit is paid directly to a construction mechanic
- If a fringe benefit contribution or payment is made on behalf of a construction mechanic
- If a fringe benefit, which may be provided to a construction mechanic, is pursuant to a written contract or policy
- If a fringe benefit is paid into a fund, for a construction mechanic

When a fringe benefit is not paid by an hourly rate, the hourly credit will be calculated based on the annual value of the fringe benefit divided by 2080 hours per year (52 weeks @ 40 hours per week).

The following is an example of the types of fringe benefits allowed and how an hourly credit is calculated:

Vacation	40 hours X \$14.00 per hour = \$560/2080 =	\$0.27
Dental insurance	\$31.07 monthly premium X 12 mos. = \$372.84 /2080 =	\$0.18
Vision insurance	\$5.38 monthly premium X 12 mos. = \$64.56/2080 =	\$0.03
Health insurance	\$230.00 monthly premium X 12 mos. = \$2,760.00/2080 =	\$1.33
Life insurance	\$27.04 monthly premium X 12 mos. = \$324.48/2080 =	\$0.16
Tuition	\$500.00 annual cost/2080 =	\$0.24
Bonus	4 quarterly bonus/year x \$250 = \$1000.00/2080 =	\$0.48
401k Employer Contribution	\$2000.00 total annual contribution/2080 =	\$0.96
Total Hourly Credit		\$3.65

Other examples of the types of fringe benefits allowed:

- Sick pay
- Holiday pay
- Accidental Death & Dismemberment insurance premiums

The following are examples of items that **will not** be credited toward the payment of the Prevailing Wage Rate

- Legally required payments, such as:
 - Unemployment Insurance payments
 - Workers' Compensation Insurance payments
 - FICA (Social Security contributions, Medicare contributions)
- Reimbursable expenses, such as:
 - Clothing allowance or reimbursement
 - Uniform allowance or reimbursement
 - Gas allowance or reimbursement
 - Travel time or payment
 - Meals or lodging allowance or reimbursement
 - Per diem allowance or payment
- Other payments to or on behalf of a construction mechanic that are not wages or fringe benefits, such as:
 - Industry advancement funds
 - Financial or material loans



STATE OF MICHIGAN

JENNIFER M. GRANHOLM
GOVERNOR

DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

Michigan Department of Labor & Economic Growth *Wage & Hour Division*
OVERTIME PROVISIONS for MICHIGAN PREVAILING WAGE RATE SCHEDULE

1. Overtime is represented as a nine character code. Each character represents a certain period of time after the first 8 hours Monday thru Friday.

	Monday thru Friday	Saturday	Sunday & Holidays
First 8 Hours		4	8
9th Hour	1	5	
10th Hour	2	6	
Over 10 hours	3	7	

Overtime for Monday thru Friday after 8 hours:

the 1st character is for time worked in the 9th hour (8.1 - 9 hours)

the 2nd character is for time worked in the 10th hour (9.1 - 10 hours)

the 3rd character is for time worked beyond the 10th hour (10.1 and beyond)

Overtime on Saturday:

the 4th character is for time worked in the first 8 hours on Saturday (0 - 8 hours)

the 5th character is for time worked in the 9th hour on Saturday (8.1 - 9 hours)

the 6th character is for time worked in the 10th hour (9.1 - 10 hours)

the 7th character is for time worked beyond the 10th hour (10.01 and beyond)

Overtime on Sundays & Holidays

The 8th character is for time worked on Sunday or on a holiday

The last character indicates if an optional 4-day 10-hour per day workweek can be worked without paying overtime after 8 hours worked.

2. Overtime Indicators Used in the Overtime Provision:

H - means TIME AND ONE-HALF due

X - means TIME AND ONE-HALF due after 40 HOURS worked

D - means DOUBLE PAY due

Y - means YES an optional 4-day 10-hour per day workweek can be worked without paying overtime after 8 hours worked

N - means NO an optional 4-day 10-hour per day workweek *can not* be worked without paying overtime after 8 hours worked

3. EXAMPLES:

HHHHHHHDN - This example shows that the 1½ rate must be used for time worked after 8 hours Monday thru Friday (*characters 1 - 3*); for all hours worked on Saturday, 1½ rate is due (*characters 4 - 7*). Work done on Sundays or holidays must be paid double time (*character 8*). The N (*character 9*) indicates that 4 ten-hour days is not an acceptable workweek at regular pay.

XXXHHHHHDY - This example shows that the 1½ rate must be used for time worked after 40 hours are worked Monday thru Friday (*characters 1-3*); for hours worked on Saturday, 1½ rate is due (*characters 4 - 7*). Work done on Sundays or holidays must be paid double time (*character 8*). The Y (*character 9*) indicates that 4 ten-hour days is an acceptable alternative workweek. (REV 01/15/08)

State of Michigan
Department of Labor and Economic Growth

Official Request
 Lansing, MI 48909-7976

Requestor: TROY SCHOOL DISTRICT
Project Description: SERVICES BUILDING UPS REPLACEMENT
Project Number:

Wage and Hour Division
 6546 Mercantile Way, Suite 5
 PO Box 30476
 917

Telephone: 517-335-0400
 Fax: 517-335-0077
 www.michigan.gov/wagehour

Oakland County
Official 2008 Prevailing Wage Rates for State Funded Projects

Issue Date: 6/19/2008
Contract must be awarded by: 9/17/2008

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<u>Classification</u>			<u>Last</u>	<u>Straight</u>	<u>Time and</u>	<u>Double</u>	<u>Overtime</u>
<u>Name</u>	<u>Description</u>		<u>Updated</u>	<u>Hourly</u>	<u>a Half</u>	<u>Time</u>	<u>Provision</u>
=====							
Asbestos & Lead Abatement Laborer							
Asbestos & Lead Abatement Laborer	MLDC			\$32.65	\$43.39	\$54.13	H H H X X X D Y
			7/31/2007				
Asbestos & Lead Abatement, Hazardous Material Handler							
Asbestos and Lead Abatement, Hazardous Material Handler	AS207			\$32.65	\$44.75	\$56.85	H H H X X X D Y
			11/28/2007				
Boilermaker							
Boilermaker	BO169			\$51.27	\$76.00	\$100.74	H H H H H H D Y
			11/5/2007				
Apprentice Rates:							
1st 6 months				\$38.12	\$56.28	\$74.44	
2nd 6 months				\$39.17	\$57.86	\$76.54	
3rd 6 months				\$40.23	\$59.45	\$78.66	
4th 6 months				\$41.29	\$61.04	\$80.78	
5th 6 months				\$42.33	\$62.60	\$82.86	
6th 6 months				\$44.44	\$65.76	\$87.08	
7th 6 months				\$46.54	\$68.91	\$91.28	
8th 6 months				\$48.65	\$72.08	\$95.50	
Bricklayer							
Bricklayer, stone mason, pointer, cleaner, caulker	BR1			\$48.96	\$73.44	\$97.92	H H D H D D D N
			12/20/2007				
Apprentice Rates:							
First 6 months				\$29.49	\$44.24	\$58.98	
2nd 6 months				\$31.31	\$46.97	\$62.62	
3rd 6 months				\$33.13	\$49.70	\$66.26	
4th 6 months				\$34.95	\$52.43	\$69.90	
5th 6 months				\$36.77	\$55.16	\$73.54	
6th 6 months				\$38.59	\$57.89	\$77.18	
7th 6 months				\$40.41	\$60.62	\$80.82	
8th 6 months				\$42.23	\$63.35	\$84.46	

Official Request #: 917
 Requestor: TROY SCHOOL DISTRICT
 Project Description: SERVICES BUILDING UPS REPLACEMENT
 Project Number:
 County: Oakland

Official Rate Schedule
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Official 2008 Prevailing Wage Rates for State Funded Projects

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					

Carpenter

Carpet and Resilient Floor Layer, (does not include installation of prefabricated formica & parquet flooring which is to be paid carpenter rate)

CA1045 1/9/2008 \$42.24 \$59.86 \$77.47 H H H H D D D D N

Apprentice Rates:

1st 6 months	\$21.10	\$28.15	\$35.19
2nd 6 months	\$24.62	\$33.42	\$42.23
3rd 6 months	\$26.38	\$36.07	\$45.75
4th 6 months	\$28.15	\$38.72	\$49.29
5th 6 months	\$29.91	\$41.36	\$52.81
6th 6 months	\$31.67	\$44.01	\$56.33
7th 6 months	\$33.42	\$46.63	\$59.83
8th 6 months	\$35.19	\$49.28	\$63.37

Carpenter CA687Z1 1/14/2008 \$46.58 \$66.30 \$86.02 H H D H D D D D Y

Apprentice Rates:

1st Year	\$28.84	\$39.69	\$50.54
3rd 6 months	\$30.81	\$42.64	\$54.48
4th 6 months	\$32.78	\$45.60	\$58.42
5th 6 months	\$34.75	\$48.56	\$62.36
6th 6 months	\$36.73	\$51.53	\$66.32
7th 6 months	\$38.70	\$54.49	\$70.26
8th 6 months	\$40.66	\$57.43	\$74.18

Cement Mason

Cement Mason CE514 7/20/2007 \$43.95 \$61.87 \$79.78 H H D H H H D N

Apprentice Rates:

1st 6 months	\$25.64	\$34.60	\$43.56
2nd 6 months	\$27.45	\$37.31	\$47.18
3rd 6 months	\$31.02	\$42.68	\$54.32
4th 6 months	\$34.61	\$48.05	\$61.50
5th 6 months	\$36.40	\$50.74	\$65.08
6th 6 months	\$39.99	\$56.13	\$72.26

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<u>Classification</u>		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					

Drywall

Drywall Taper

PT-22-D

9/1/2006

\$38.45

\$50.90

\$63.35

H H D H D D D D N

Apprentice Rates:

First 3 months

\$26.00

\$32.23

\$38.45

Second 3 months

\$28.49

\$35.96

\$43.43

Second 6 months

\$30.98

\$39.69

\$48.41

Third 6 months

\$33.47

\$43.43

\$53.39

4th 6 months

\$34.71

\$45.29

\$55.87

Electrician

Road Way Electrical Work

EC-17

11/19/2007

\$45.37

\$65.63

\$85.90

H H H H H H D Y

Double time due after 16 hours on any calendar day and all hours Sunday.

Apprentice Rates:

1st 6 months

\$29.17

\$41.34

\$53.50

2nd 6 months

\$31.19

\$44.36

\$57.54

3rd 6 months

\$33.21

\$47.40

\$61.58

4th 6 months

\$35.23

\$50.43

\$65.62

5th 6 months

\$37.25

\$53.46

\$69.66

6th 6 months

\$41.32

\$59.57

\$77.80

Subdivision of county

Holly not included

Inside Wireman

EC-58-IW

1/7/2008

\$53.62

\$71.49

\$89.36

H H H H H H D N

Apprentice Rates:

0-1000 hours

\$32.18

\$39.33

\$46.48

1000-2000 hours

\$33.97

\$42.02

\$50.06

2000-3500 hours

\$35.75

\$44.68

\$53.62

3500-5000 hours

\$37.54

\$47.38

\$57.20

5000-6500 hours

\$41.12

\$52.74

\$64.36

6500-8000 hours

\$44.68

\$58.08

\$71.48

Sound and Communication Installer/Technician

EC-58-SC

1/7/2008

\$32.54

\$44.20

\$55.86

H H H H H H D N

Apprentice Rates:

Period 1

\$20.88

\$26.71

\$32.54

Period 2

\$22.04

\$28.46

\$34.86

Period 3

\$23.21

\$30.21

\$37.20

Period 4

\$24.38

\$31.96

\$39.54

Period 5

\$25.55

\$33.72

\$41.88

Period 6

\$26.71

\$35.46

\$44.20

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					
=====						
Elevator Constructor						
Elevator Constructor	EL 36		\$56.46		\$94.99	D D D D D D D Y
Elevator Constructor		8/7/2007				
Apprentice Rates:						
1st Year Apprentice		\$37.74	\$58.93			
2nd Year Apprentice		\$41.90	\$66.94			
3rd Year Apprentice		\$43.98	\$70.95			
4th Year Apprentice		\$48.14	\$78.96			
Glazier						
Glazier	GL-357		\$43.80	\$58.40		H H H H H H H Y
		5/30/2008				
Apprentice Rates:						
1st 6 months		\$29.20	\$36.50			
2nd 6 months		\$30.66	\$38.69			
3rd 6 months		\$33.58	\$43.07			
4th 6 months		\$35.04	\$45.26			
5th 6 months		\$36.50	\$47.45			
6th 6 months		\$37.96	\$49.64			
7th 6 months		\$39.42	\$51.83			
8th 6 months		\$42.34	\$56.21			
Heat and Frost Insulator						
Spray Insulation	AS25S		\$20.14	\$29.14		H H H H H H H N
		3/5/2007				
Heat and Frost Insulator and Asbestos Worker						
Heat and Frost Insulators and Asbestos Workers	AS25		\$48.20	\$62.86	\$77.52	H H H H H H D Y
		3/5/2007				
Apprentice Rates:						
1st Year		\$29.59	\$37.66	\$45.72		
2nd Year		\$37.60	\$47.13	\$56.66		
3rd Year		\$39.40	\$49.66	\$59.92		
4th Year		\$42.34	\$54.07	\$65.80		
Ironworker						
Fence Erecting	IR-25-F		\$41.03	\$61.26	\$81.49	H H D H H H D Y
		10/4/2007				

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					
Siding, Glazing, Curtain Wall	IR-25-GZ1	3/28/2008	\$39.86	\$59.54	\$79.22	H H D H H H D D Y
Apprentice Rates:						
Level 1		\$24.72	\$36.54	\$48.34		
Level 2		\$26.69	\$39.49	\$52.28		
Level 3		\$28.65	\$42.43	\$56.20		
Level 4		\$30.62	\$45.39	\$60.14		
Level 5		\$32.59	\$48.34	\$64.08		
Level 6		\$34.56	\$51.29	\$68.02		
Pre-engineered Metal Work	IR-25-PE-Z1-Z2	5/8/2008	\$41.69	\$52.37	\$63.04	X X H X X X D Y
Apprentice Rates:						
1st level		\$23.47	\$28.51	\$33.55		
2nd level		\$25.12	\$30.85	\$36.58		
3rd level		\$26.78	\$33.19	\$39.61		
4th level		\$28.44	\$35.55	\$42.66		
5th level		\$30.10	\$37.90	\$45.70		
6th level		\$31.36	\$39.65	\$47.93		
Reinforced Iron Work	IR-25-RF	6/2/2008	\$50.06	\$74.82	\$99.58	H H D H D D D N
Apprentice Rates:						
Level 1		\$30.85	\$45.71	\$60.56		
Level 2		\$33.33	\$49.43	\$65.52		
Level 3		\$35.79	\$53.11	\$70.44		
Level 4		\$38.29	\$56.87	\$75.44		
Level 5		\$40.75	\$60.55	\$80.36		
Level 6		\$43.23	\$64.28	\$85.32		
Rigging Work	IR-25-RIG	6/2/2008	\$55.48	\$82.99	\$110.49	H H H H H H D N
Apprentice Rates:						
Level 1&2		\$31.46	\$46.59	\$61.72		
Level 3		\$34.21	\$50.72	\$67.22		
Level 4		\$36.95	\$54.83	\$72.70		
Level 5		\$39.71	\$58.97	\$78.22		
Level 6		\$42.46	\$63.09	\$83.72		
Decking	IR-25-SD	10/4/2007	\$46.40	\$69.32	\$92.23	H H D H H H D D Y

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Official 2008 Prevailing Wage Rates for State Funded Projects

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					
Structural, ornamental, conveyor, welder and pre-cast	IR-25-STR	6/2/2008	\$55.61	\$83.12	\$110.62	H H D H H H D D Y
Apprentice Rates:						
Levels 1 & 2		\$31.46	\$46.59	\$61.72		
Level 3		\$34.21	\$50.72	\$67.22		
Level 4		\$36.95	\$54.83	\$72.70		
Level 5		\$39.71	\$58.97	\$78.22		
Level 6		\$42.46	\$63.09	\$83.72		
Level 7		\$45.20	\$67.20	\$89.20		
Level 8		\$47.96	\$71.34	\$94.72		
Industrial Door erection & construction	IR-25-STR-D	3/28/2008	\$35.72	\$47.34	\$58.96	H H D H H H D D Y
Laborer						
Construction Laborer, Mason Tender, Carpenter Tender, Drywall Handler, Cement Finisher tender, concrete chute and concrete Bucket Handler, Concrete Laborer, Demolition Laborer	L1076-A-A	6/5/2008	\$38.76	\$54.89	\$71.01	H H D H D D D D Y
Apprentice Rates:						
0-1,000 work hours		\$32.88	\$46.07	\$59.25		
1,001-2,000 work hours		\$34.05	\$47.82	\$61.59		
2,001-3,000 work hours		\$35.23	\$49.60	\$63.95		
3,001-4,000 work hours		\$37.58	\$53.12	\$68.65		
Signal man (on sewer & caisson work); air,electric or gasoline tool operator (including concrete vibrator operator,acetylene torch & air hammer operator); scaffold builder, caisson worker	L1076-A-B	6/5/2008	\$39.02	\$55.28	\$71.53	H H D H D D D D Y
Lansing Burner, Blaster & Powder Man	L1076-A-C	6/5/2008	\$39.51	\$56.01	\$72.51	H H D H D D D D Y
Furnance battery heater tender, burning bar & oxy-acetylene gun, expediter man, top man and/or bottom man (blast furnace work)	L1076-A-D	6/5/2008	\$39.26	\$55.64	\$72.01	H H D H D D D D Y
Cleaner/ sweeper laborer, furniture laborer	L1076-A-E	6/5/2008	\$33.31	\$46.71	\$60.11	H H D H D D D D Y
Demolition Laborer	L1076-D	6/5/2008	\$38.76	\$54.89	\$71.01	H H D H D D D D Y

Official Request #: 917

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Classification	Name	Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
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Plasterer Tender, Plastering Machine Operator	LPT-1		7/3/2007	\$39.00	\$55.42	\$71.83	H H D H D D D N
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Apprentice Rates:

0 - 1,000 hours	\$31.99	\$44.90	\$57.81
1,001 - 2,000 hours	\$33.11	\$46.58	\$60.05
2,001 - 3,000 hours	\$34.24	\$48.28	\$62.31
3,001 - 4,000 hours	\$36.49	\$51.66	\$66.81

Laborer - Hazardous

Class A Laborer - performing work in conjunction with site preparation and other preliminary work prior to actual removal, handling, or containment of hazardous waste substances not requiring use of personal protective equipment required by state or federal regulations; or a laborer performing work in conjunction with the removal, handling, or containment of hazardous waste substances when used of personal protective equipment level "D" is required.	LHAZ-Z2-A		10/11/2007	\$37.62	\$53.35	\$69.07	H H H H H H D Y
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Apprentice Rates:

0-1,000 work hours	\$31.98	\$44.89	\$57.79
1,001-2,000 work hours	\$33.11	\$46.58	\$60.05
2,001-3,000 work hours	\$34.24	\$48.28	\$62.31
3,001-4,000 work hours	\$36.49	\$51.66	\$66.81

Class B Laborer - performing work in conjunction with the removal, handling, or containment of hazardous waste substances when the use of personal protective equipment levels "A", "B" or "C" is required.	LHAZ-Z2-B		10/11/2007	\$38.62	\$54.85	\$71.07	H H H H H H D Y
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Apprentice Rates:

0-1,000 work hours	\$32.74	\$46.03	\$59.31
1,001-2,000 work hours	\$33.91	\$47.78	\$61.65
2,001-3,000 work hours	\$35.09	\$49.56	\$64.01
3,001-4,000 work hours	\$37.44	\$53.08	\$68.71

Laborer Underground - Tunnel, Shaft & Caisson

Class I - Tunnel, shaft and caisson laborer, dump man, shanty man, hog house tender, testing man (on gas), and watchman.	LAUCT-Z1-1		9/6/2007	\$33.54	\$44.30	\$55.05	H H H H H H D Y
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Apprentice Rates:

0-1,000 work hours	\$28.70	\$37.04	\$45.37
1,001-2,000 work hours	\$29.67	\$38.49	\$47.31
2,001-3,000 work hours	\$30.64	\$39.95	\$49.25
3,001-4,000 work hours	\$32.57	\$42.85	\$53.11

Official Request #: 917

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Classification										
Name	Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision				
Class II - Manhole, headwall, catch basin builder, bricklayer tender, mortar man, material mixer, fence erector, and guard rail builder.	LAUCT-Z1-2	9/6/2007	\$33.65	\$44.46	\$55.27	H H H H H H D Y				

Apprentice Rates:

0-1,000 work hours	\$28.79	\$37.17	\$45.55
1,001-2,000 work hours	\$29.76	\$38.74	\$47.71
2,001-3,000 work hours	\$30.73	\$40.09	\$49.43
3,001-4,000 work hours	\$32.68	\$43.01	\$53.33

Class III - Air tool operator (jack hammer man, bush hammer man and grinding man), first bottom man, second bottom man, cage tender, car pusher, carrier man, concrete man, concrete form man, concrete repair man, cement invert laborer, cement finisher, concrete shoveler, conveyor man, floor man, gasoline and electric tool operator, gunnite man, grout operator, welder, heading dinky man, inside lock tender, pea gravel operator, pump man, outside lock tender, scaffold man, top signal man, switch man, track man, tugger man, utility man, vibrator man, winch operator, pipe jacking man, wagon drill and air track operator and concrete saw operator (under 40	LAUCT-Z1-3	9/6/2007	\$33.71	\$44.55	\$55.39	H H H H H H D Y
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Apprentice Rates:

0-1,000 work hours	\$28.83	\$37.23	\$45.63
1,001-2,000 work hours	\$29.81	\$38.71	\$47.59
2,001-3,000 work hours	\$30.78	\$40.16	\$49.53
3,001-4,000 work hours	\$32.73	\$43.09	\$53.43

Class IV - Tunnel, shaft and caisson mucker, bracer man, liner plate man, long haul dinky driver and well point man.	LAUCT-Z1-4	9/6/2007	\$33.89	\$44.82	\$55.75	H H H H H H D Y
--	------------	----------	---------	---------	---------	-----------------

Apprentice Rates:

0-1,000 work hours	\$28.97	\$37.45	\$45.91
1,001-2,000 work hours	\$29.95	\$38.91	\$47.87
2,001-3,000 work hours	\$30.94	\$40.40	\$49.85
3,001-4,000 work hours	\$32.91	\$43.35	\$53.79

Class V - Tunnel, shaft and caisson miner, drill runner, keyboard operator, power knife operator, reinforced steel or mesh man (e.g. wire mesh, steel mats, dowel bars)	LAUCT-Z1-5	9/6/2007	\$34.14	\$45.20	\$56.25	H H H H H H D Y
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Apprentice Rates:

0-1,000 work hours	\$29.16	\$37.73	\$46.29
1,001-2,000 work hours	\$30.15	\$39.21	\$48.27
2,001-3,000 work hours	\$31.15	\$40.71	\$50.27
3,001-4,000 work hours	\$33.14	\$43.70	\$54.25

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					
Class VI - Dynamite man and powder man.	LAUCT-Z1-6	9/6/2007	\$34.47	\$45.69	\$56.91	H H H H H H D Y
Apprentice Rates:						
	0-1,000 work hours	\$29.40	\$38.09	\$46.77		
	1,001-2,000 work hours	\$30.42	\$39.62	\$48.81		
	2,001-3,000 work hours	\$31.43	\$41.13	\$50.83		
	3,001-4,000 work hours	\$33.46	\$44.18	\$54.89		
Class VII - Restoration laborer, seeding, sodding, planting, cutting, mulching and topsoil grading and the restoration of property such as replacing mail boxes, wood chips, planter boxes and flagstones.	LAUCT-Z1-7	9/6/2007	\$27.75	\$35.61	\$43.47	H H H H H H D Y
Apprentice Rates:						
	0-1,000 work hours	\$24.36	\$30.53	\$36.69		
	1,001-2,000 work hours	\$25.04	\$31.55	\$38.05		
	2,001-3,000 work hours	\$25.72	\$32.57	\$39.41		
	3,001-4,000 work hours	\$27.07	\$34.59	\$42.11		
Landscape Laborer						
Landscape Specialist includes air, gas, and diesel equipment operator, lawn sprinkler installer on landscaping work where seeding, sodding, planting, cutting, trimming, backfilling, rough grading or	LLAN-Z1-A	7/3/2007	\$24.38	\$33.81	\$43.24	X X H X X X H D Y
All work pertaining to landscaping where seeding, sodding, planting, cutting, trimming, backfilling, rough grading or maintaining of landscape projects occurs which may include small power tool operator, lawn sprinkler installer helper, material mover, & truck driver.	LLAN-Z1-B	7/3/2007	\$20.16	\$27.48	\$34.80	X X H X X X H D Y
Marble Finisher						
Marble Finisher	TT32-MF	7/25/2007	\$39.57	\$49.90	\$60.23	H H D H D D D D N
Apprentice Rates:						
	Level 1	\$19.30	\$24.91	\$30.52		
	Level 2	\$20.40	\$26.56	\$32.72		
	Level 3	\$24.67	\$31.27	\$37.87		
	Level 4	\$26.01	\$33.28	\$40.55		
	Level 5	\$27.38	\$34.86	\$42.34		
	Level 6	\$28.85	\$36.70	\$44.56		
	Level 7	\$30.39	\$38.30	\$46.21		
	Level 8	\$31.75	\$39.92	\$48.09		

Official Request #: 917

Requestor: TROY SCHOOL DISTRICT

Project Description: SERVICES BUILDING UPS REPLACEMENT

Project Number:

County: Oakland

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Classification	Name	Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
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Marble Mason

Marble Mason	TT32-MM	7/25/2007	\$45.76	\$59.19	\$72.61	H H D H D D D D N
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Apprentice Rates:

Level 1	\$24.86	\$31.89	\$38.93
Level 2	\$27.65	\$35.43	\$43.21
Level 3	\$30.50	\$38.57	\$46.64
Level 4	\$33.00	\$41.96	\$50.92
Level 5	\$35.10	\$44.33	\$53.56
Level 6	\$38.52	\$49.39	\$60.27
Level 7	\$39.37	\$50.53	\$61.69
Level 8	\$40.22	\$51.81	\$63.39

Operating Engineer

Crane with boom & jib or leads 120' or longer	EN-324-A120	6/5/2008	\$50.71	\$67.65	\$84.58	H H D H D D D D Y
Crane with boom & jib or leads 140' or longer	EN-324-A140	6/5/2008	\$51.53	\$68.88	\$86.22	H H D H D D D D Y
Crane with boom & jib or leads 220' or longer	EN-324-A220	6/5/2008	\$51.83	\$69.33	\$86.82	H H D H D D D D Y
Crane with boom & jib or leads 300' or longer	EN-324-A300	6/5/2008	\$53.33	\$71.58	\$89.82	H H D H D D D D Y
Crane with boom & jib or leads 400' or longer	EN-324-A400	6/5/2008	\$54.83	\$73.83	\$92.82	H H D H D D D D Y
Compressor or welding machine	EN-324-CW	6/5/2008	\$39.86	\$51.37	\$62.88	H H D H D D D D Y
Forklift, lull, extend-a-boom forklift	EN-324-FL	6/5/2008	\$47.17	\$62.34	\$77.50	H H D H D D D D Y
Fireman or oiler	EN-324-FO	6/5/2008	\$38.83	\$49.83	\$60.82	H H D H D D D D Y
Regular crane, job mechanic, concrete pump with boom	EN-324-RC	6/5/2008	\$49.85	\$66.36	\$82.86	H H D H D D D D Y

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<u>Classification</u>		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision							
Name	Description												
=====													
Regular engineer, hydro-excavator, remote controlled concrete breaker	EN-324-RE	6/5/2008	\$48.88	\$64.90	\$80.92	H	H	D	H	D	D	D	Y

Apprentice Rates:

Period 1	\$38.92	\$50.14	\$61.35
Period 2	\$40.53	\$52.55	\$64.57
Period 3	\$42.12	\$54.94	\$67.75
Period 4	\$43.72	\$57.34	\$70.95
Period 5	\$45.32	\$59.73	\$74.15
Period 6	\$46.93	\$62.15	\$77.37

Operating Engineer - Marine Construction

Diver/Wet Tender, Engineer (hydraulic dredge)	GLF-1	1/8/2008	\$51.76	\$67.91	\$84.06	X	X	H	H	H	H	D
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Holidays paid at \$100.21 per hour

<u>Subdivision of county</u> all Great Lakes, islands therein, & connecting & tributary waters												
Crane/Backhoe Operator, Mechanic/Welder, Assistant Engineer (hydraulic dredge), Leverman (hydraulic dredge), Diver Tender	GLF-2	1/8/2008	\$50.26	\$65.66	\$81.06	X	X	H	H	H	H	D

Holidays paid \$96.46 per hour

<u>Subdivision of county</u> All Great Lakes, islands therein, & connecting & tributary waters												
Deck Equipment Operator, Machineryman, Maintenance of Crane (over 50 ton capacity) or Backhoe (115,000 lbs. or more), Tug/Launch Operator, Loader, Dozer and like equipment on Barge, Breakwater Wall, Slip/Doc or Scow, Deck Machinery	GLF-3	1/8/2008	\$46.91	\$60.64	\$74.36	X	X	H	H	H	H	D

Holidays paid at \$88.08 per hour

<u>Subdivision of county</u> All Great Lakes, islands therein, & connecting & tributary waters												
Deck Equipment Operator, (Machineryman/Fireman), (4 equipment units or more), Deck Hand, Deck Engineer, & Crane Maintenance 50 ton capacity and under or Backhoe weighing 115,000 lbs or less, Assistant Tug Operator	GLF-4	1/8/2008	\$42.26	\$53.66	\$65.06	X	X	H	H	H	H	D

Holidays paid at \$76.46 per hour

<u>Subdivision of county</u>	All Great Lakes, islands therein, & connecting & tributary waters
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Official Request #: 917
Requestor: TROY SCHOOL DISTRICT
Project Description: SERVICES BUILDING UPS REPLACEMENT

Project Number:
County: Statewide

Official Rate Schedule

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					

Operating Engineer Hazardous Waste Class I

Level A - Fully encapsulating chemical resistant suit w/ pressure demand, full face piece SCBA or pressure demand supplied air respirator w/ escape SCBA. The highest available level of respiratory, skin and eye

EN-324-HWCI-Z1A

4/3/2008

\$47.34 \$63.11 \$78.87 H H H H H H D Y

Apprentice Rates:

1st 6 months	\$37.78	\$48.81	\$59.85
2nd 6 months	\$39.36	\$51.19	\$63.01
3rd 6 months	\$40.94	\$53.56	\$66.17
4th 6 months	\$42.52	\$55.92	\$69.33
5th 6 months	\$44.09	\$58.28	\$72.47
6th 6 months	\$45.67	\$60.66	\$75.63

Level B & C protection. B - Pressure demand, full face SCBA or pressure demand supplied air respirator w/ escape SCBA w/chemical resistant clothing. C - Full face piece, air purifying canister-equipped respirator w/chemical resistant clothing.

EN-324-HWCI-Z1B

4/3/2008

\$46.39 \$61.68 \$76.97 H H H H H H D Y

Apprentice Rates:

1st 6 months	\$37.11	\$47.82	\$58.51
2nd 6 months	\$38.64	\$50.11	\$61.57
3rd 6 months	\$40.17	\$52.40	\$64.63
4th 6 months	\$41.70	\$54.70	\$67.69
5th 6 months	\$43.23	\$57.00	\$70.75
6th 6 months	\$44.76	\$59.29	\$73.81

Level D - Coveralls, safety boots, glasses or chemical splash goggles and hard hats.

EN-324-HWCI-Z1D

3/24/2008

\$45.09 \$59.73 \$74.37 H H H H H H D Y

Apprentice Rates:

1st 6 months	\$36.20	\$46.45	\$56.69
2nd 6 months	\$37.68	\$48.67	\$59.65
3rd 6 months	\$39.14	\$50.86	\$62.57
4th 6 months	\$40.60	\$53.05	\$65.49
5th 6 months	\$42.06	\$55.23	\$68.41
6th 6 months	\$43.53	\$57.44	\$71.35

Official Request #: 917

Requestor: TROY SCHOOL DISTRICT

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Project Number:

County: Oakland

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Classification	Name	Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
	Level D When Capping Landfill Coveralls, safety boots, glasses or chemical splash goggles and hard hats.	EN-324-HWCI-Z1DCL	3/24/2008	\$44.84	\$59.36	\$73.87	H H H H H H D Y
Apprentice Rates:							
	1st 6 months		\$36.03	\$46.19	\$56.35		
	2nd 6 months		\$37.48	\$48.37	\$59.25		
	3rd 6 months		\$38.93	\$50.54	\$62.15		
	4th 6 months		\$40.38	\$52.72	\$65.05		
	5th 6 months		\$41.84	\$54.91	\$67.97		
	6th 6 months		\$43.29	\$57.08	\$70.87		
Operating Engineer Hazardous Waste Class II							
	Level A - Fully encapsulating chemical resistant suit w/ pressure demand, full face piece SCBA or pressure demand supplied air respirator w/ escape SCBA. The highest available level of respiratory, skin and eye	EN-324-HWCII-Z1A	4/3/2008	\$43.11	\$56.76	\$70.41	H H H H H H D Y
	Level B & C protection. B - Pressure demand, full face SCBA or pressure demand supplied air respirator w/ escape SCBA w/chemical resistant clothing. C - Full face piece, air purifying canister-equipped respirator w/chemical resistant clothing.	EN-324-HWCII-Z1B	3/24/2008	\$42.16	\$55.34	\$68.51	H H H H H H D Y
	Level D - Coveralls, safety boots, glasses or chemical splash goggles and hard hats.	EN-324-HWCII-Z1D	3/24/2008	\$40.86	\$53.39	\$65.91	H H H H H H D Y
	Level D When Capping Landfill Coveralls, safety boots, glasses or chemical splash goggles and hard hats.	EN-324-HWCII-Z1DCL	3/25/2008	\$40.61	\$53.01	\$65.41	H H H H H H D Y
Operating Engineer Hazardous Waste Crane w/ Boom & Jib leads 140' or longer							
	Level A - Fully encapsulating chemical resistant suit w/ pressure demand, full face piece SCBA or pressure demand supplied air respirator w/ escape SCBA. The highest available level of respiratory, skin and eye	EN-324-HW140-Z1A	4/3/2008	\$49.99	\$67.08	\$84.17	H H H H H H D Y
	Level B & C protection. B - Pressure demand, full face SCBA or pressure demand supplied air respirator w/ escape SCBA w/chemical resistant clothing. C - Full face piece, air purifying canister-equipped respirator w/chemical resistant clothing.	EN-324-HW140-Z1B	3/24/2008	\$49.04	\$65.66	\$82.27	H H H H H H D Y
	Level D Coveralls, safety boots, glasses or chemical splash goggles and hard hats.	EN-324-HW140-Z1D	3/24/2008	\$47.74	\$63.71	\$79.67	H H H H H H D Y

Official Request #: 917

Requestor: TROY SCHOOL DISTRICT

Project Description: SERVICES BUILDING UPS REPLACEMENT

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County: Oakland

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					
=====						
Level D When Capping Landfill Coveralls, safety boots, glasses or chemical splash goggles and hard hats.	EN-324-HW140-Z1DCL 3/25/2008	\$47.49	\$63.33	\$79.17	H H H H H H D Y	
Operating Engineer Hazardous Waste Crane w/ Boom & Jib leads 220" or longer						
Level A - Fully encapsulating chemical resistant suit w/ pressure demand, full face piece SCBA or pressure demand supplied air respirator w/ escape SCBA. The highest available level of respiratory, skin and eye	EN-324-HW220-Z1A 4/3/2008	\$50.29	\$67.53	\$84.77	H H H H H H D Y	
Level B & C protection. B - Pressure demand, full face SCBA or pressure demand supplied air respirator w/ escape SCBA w/chemical resistant clothing. C - Full face piece, air purifying canister-equipped respirator w/chemical resistant clothing.	EN-324-HW220-Z1B 3/24/2008	\$49.34	\$66.11	\$82.87	H H H H H H D Y	
Level D Coveralls, safety boots, glasses or chemical splash goggles and hard hats.	EN-324-HW220-Z1D 3/24/2008	\$48.04	\$64.16	\$80.27	H H H H H H D Y	
Level D When Capping Landfill Coveralls, safety boots, glasses or chemical splash goggles and hard hats.	EN-324-HW220-Z1DCL 3/25/2008	\$47.79	\$63.78	\$79.77	H H H H H H D Y	
Operating Engineer Hazardous Waste Regular Crane, Job Mechanic, Dragline Operator, Boom Truck Operator, Power Shovel Operator and Concrete Pump with boom						
Level D When Capping Landfill Coveralls, safety boots, glasses or chemical splash goggles and hard hats.	EN-324-HWRC-Z1DCL 3/25/2008	\$45.19	\$59.88	\$74.57	H H H H H H D Y	
Operating Engineer Hazardous Waste Regular Crane, Job Mechanic, Dragline Operator, Boom Truck Operator, Power Shovel Operator and Concrete Pump with Boom Operator						
Level D - Coveralls, safety boots, glasses or chemical splash goggles and hard hats.	EN-324-HWRC-Z1D 5/23/2008	\$46.06	\$61.19	\$76.31	H H H H H H D Y	
Operating Engineer Hazardous Waste Regular Crane, Job Mechanic, Dragline Operator, Boom Truck Operator, Power Shovel Operator and Concrete Pump with booms						
Level B & C protection. B - Pressure demand, full face SCBA or pressure demand supplied air respirator w/ escape SCBA w/chemical resistant clothing. C - Full face piece, air purifying canister-equipped respirator w/chemical resistant clothing.	EN-324-HWRC-Z1B 3/24/2008	\$47.36	\$63.14	\$78.91	H H H H H H D Y	

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					
=====						
Operating Engineer Hazardous Waste Regular Crane, Job Mechanic, Dragline Operator, Boom Truck Operator, Power Shovel Operators and Concrete Pump with booms						
Level A - Fully encapsulating chemical resistant suit w/ pressure demand, full face piece SCBA or pressure demand supplied air respirator w/ escape SCBA. The highest available level of respiratory, skin and eye	EN-324-HWRC-Z1A	4/3/2008	\$48.31	\$64.56	\$80.81	H H H H H H D Y
Operating Engineer Steel Work						
Forklift, 1 Drum Hoist	EN-324-ef	6/6/2008	\$52.96	\$70.75	\$88.53	H H D H H H D D Y
Crane w/ 120' boom or longer	EN-324-SW120	6/6/2008	\$55.01	\$73.82	\$92.63	H H D H H H D D Y
Crane w/ 120' boom or longer w/ Oiler	EN-324-SW120-O	6/6/2008	\$56.01	\$75.32	\$94.63	H H D H H H D D Y
Crane w/ 140' boom or longer	EN-324-SW140	6/6/2008	\$56.19	\$75.59	\$94.99	H H D H H H D D Y
Crane w/ 140' boom or longer W/ Oiler	EN-324-SW140-O	6/6/2008	\$57.19	\$77.09	\$96.99	H H D H H H D D Y
Boom & Jib 220' or longer	EN-324-SW220	6/6/2008	\$56.46	\$76.00	\$95.53	H H D H H H D D Y
Crane w/ 220' boom or longer w/ Oiler	EN-324-SW220-O	6/6/2008	\$57.46	\$77.50	\$97.53	H H D H H H D D Y
Boom & Jib 300' or longer	EN-324-SW300	6/6/2008	\$57.96	\$78.25	\$98.53	H H D H H H D D Y
Crane w/ 300' boom or longer w/ Oiler	EN-324-SW300-O	6/6/2008	\$58.96	\$79.75	\$100.53	H H D H H H D D Y
Boom & Jib 400' or longer	EN-324-SW400	6/6/2008	\$59.46	\$80.50	\$101.53	H H D H H H D D Y
Crane w/ 400' boom or longer w/ Oiler	EN-324-SW400-O	6/6/2008	\$60.46	\$82.00	\$103.53	H H D H H H D D Y

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Classification Name Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Crane Operator, Job Mechanic, 3 Drum Hoist & Excavator	EN-324-SWCO 6/6/2008	\$54.65	\$73.28	\$91.91	H H D H H H D D Y
Apprentice Rates:					
0-999 hours		\$42.03	\$54.90	\$67.77	
1,000-1,999 hours		\$43.87	\$57.66	\$71.45	
2,000-2,999 hours		\$45.71	\$60.42	\$75.13	
3,000-3,999 hours		\$47.54	\$63.17	\$78.79	
4,000-4,999 hours		\$49.38	\$65.93	\$82.47	
5,000 hours		\$51.22	\$68.69	\$86.15	
Crane w/ Oiler	EN-324-SWCO-O 6/6/2008	\$55.65	\$74.78	\$93.91	H H D H H H D D Y
Compressor or Welder Operator	EN-324-SWCW 6/6/2008	\$47.20	\$62.11	\$77.01	H H D H H H D D Y
Hoisting Operator, 2 Drum Hoist, & Rubber Tire Backhoe	EN-324-SWHO 6/6/2008	\$54.01	\$72.32	\$90.63	H H D H H H D D Y
Oiler	EN-324-SWO 6/6/2008	\$45.79	\$59.99	\$74.19	H H D H H H D D Y
Tower Crane & Derrick where work is 50' or more above first level	EN-324-SWTD50 6/6/2008	\$55.74	\$74.92	\$94.09	H H D H H H D D Y
Tower Crane & Derrick 50' or more w/ Oiler where work station is 50' or more above first level	EN-324-SWTD50-O 6/6/2008	\$56.74	\$76.42	\$96.09	H H D H H H D D Y
Operating Engineer Underground					
Class I Equipment	EN-324A1-UC1 10/8/2007	\$44.84	\$59.33	\$73.82	H H H H H H H D Y
Apprentice Rates:					
0-999 hours		\$36.05	\$46.20	\$56.34	
1,000-1,999 hours		\$37.50	\$48.37	\$59.24	
2,000-2,999 hours		\$38.94	\$50.53	\$62.12	
3,000-3,999 hours		\$40.39	\$52.71	\$65.02	
4,000-4,999 hours		\$41.84	\$54.88	\$67.92	
5,000-5,999 hours		\$43.29	\$57.06	\$70.82	
Class II Equipment	EN-324A1-UC2 10/8/2007	\$40.11	\$52.24	\$64.36	H H H H H H H D Y
Class III Equipment	EN-324A1-UC3 10/8/2007	\$39.38	\$51.14	\$62.90	H H H H H H H D Y
Class IV Equipment	EN-324A1-UC4 10/8/2007	\$38.81	\$50.29	\$61.76	H H H H H H H D Y

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Name	Description					
Master Mechanic	EN-324A1-UMM	10/8/2007	\$45.09	\$59.71	\$74.32	H H H H H H D Y

Painter

Painter (8 hours of repaint work performed on Sunday shall be paid time & one half rate)	PT-22-P	5/26/2006	\$38.01	\$50.24	\$62.47	H H D H D D D D N
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Apprentice Rates:

First 6 months	\$25.78	\$31.89	\$38.01
Second 6 months	\$29.45	\$37.40	\$45.35
Third 6 months	\$30.67	\$39.23	\$47.79
Fourth 6 months	\$31.89	\$41.06	\$50.23
Fifth 6 months	\$33.12	\$42.91	\$52.69
Final 6 months	\$34.34	\$44.73	\$55.13

Sandblasting & spraywork performed, on highway bridges, overpasses, tanks or steel, OR spraywork & sandblasting done with a scaffold height of 40' above the floor level	PT-22-S	6/1/2006	\$38.81	\$51.44	\$64.07	H H D H D D D D N
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Pipefitter

Pipefitter	PF-636	6/1/2007	\$55.06	\$74.14	\$89.96	H H D H D D D D N
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Apprentice Rates:

1st & 2nd periods	\$26.28	\$34.63	\$41.63
3rd period	\$28.28	\$37.63	\$45.63
4th period	\$29.53	\$39.51	\$48.13
5th period	\$30.78	\$41.38	\$50.63
6th period	\$32.03	\$43.25	\$53.13
7th period	\$33.28	\$45.13	\$55.63
8th period	\$34.28	\$46.63	\$57.63
9th period	\$35.28	\$48.13	\$59.63
10th period	\$36.71	\$50.27	\$62.49

Plasterer

Plasterer	BR1P	12/19/2007	\$42.89	\$64.34	\$85.78	H H H H H H D N
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Apprentice Rates:

1st 6 months	\$21.97	\$32.96	\$43.94
2nd 6 months	\$25.46	\$38.19	\$50.92
3rd 6 months	\$28.95	\$43.42	\$57.90
4th 6 months	\$32.43	\$48.65	\$64.86
5th 6 months	\$35.92	\$53.88	\$71.84
6th 6 months	\$39.40	\$59.10	\$78.80

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Contract must be awarded by: 9/17/2008

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					
Plasterer	PL67	6/4/2007	\$42.87	\$58.16	\$73.45	H H H X D D D N
Apprentice Rates:						
	1st 6 months	\$24.52	\$30.63	\$36.75		
	2nd 6 months	\$27.58	\$35.23	\$42.87		
	3rd 6 months	\$30.64	\$39.81	\$48.99		
	4th 6 months	\$33.70	\$44.41	\$55.11		
	5th 6 months	\$36.75	\$48.98	\$61.21		
	6th 6 months	\$39.81	\$53.57	\$67.33		
Plumber	PL-98	6/20/2007	\$53.68	\$71.45	\$87.21	H H D H D D D Y
Apprentice Rates:						
	Period 1	\$17.11	\$23.41	\$29.71		
	Period 2	\$17.11	\$23.41	\$29.71		
	Period 3	\$26.78	\$35.13	\$43.47		
	Period 4	\$27.41	\$36.07	\$44.73		
	Period 5	\$28.57	\$37.81	\$47.05		
	Period 6	\$29.72	\$39.53	\$49.35		
	Period 7	\$30.87	\$41.26	\$51.65		
	Period 8	\$32.04	\$43.01	\$53.99		
	Period 9	\$33.19	\$44.74	\$56.29		
	Period 10	\$34.35	\$46.48	\$58.61		
Roofer	RO-149-WOM	9/4/2007	\$46.81	\$60.92	\$75.02	H H D H H H D N
Commercial Roofer						
Straight time is not to exceed ten (10) hours per day or forty (40) hours per week.						
Apprentice Rates:						
	Apprentice 1	\$30.97	\$39.16	\$47.34		
	Apprentice 2	\$35.15	\$43.42	\$51.70		
	Apprentice 3	\$36.57	\$45.56	\$54.54		
	Apprentice 4	\$37.60	\$47.10	\$56.60		
	Apprentice 5	\$38.82	\$48.93	\$59.04		
	Apprentice 6	\$40.22	\$51.03	\$61.84		

Official Request #: 917

Requestor: TROY SCHOOL DISTRICT

Project Description: SERVICES BUILDING UPS REPLACEMENT

Project Number:

County: Oakland

Official Rate Schedule

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Official 2008 Prevailing Wage Rates for State Funded Projects

Issue Date: 6/19/2008

Contract must be awarded by: 9/17/2008

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Classification			Last	Straight	Time and	Double	Overtime
Name	Description		Updated	Hourly	a Half	Time	Provision
=====							
Sheet Metal Worker							
Sheet Metal Worker		SHM-80		\$55.37	\$73.66	\$91.95	H H D H D D D D Y
			10/2/2007				
	Apprentice Rates:						
	First Year		\$36.96	\$46.34	\$55.71		
	Second Year		\$38.37	\$48.45	\$58.53		
	Third Year		\$39.80	\$50.60	\$61.39		
	Fourth Year		\$42.65	\$54.87	\$67.09		
	Fifth Year		\$45.52	\$59.18	\$72.83		
Siding & Decking		SHM-80-SD		\$37.10	\$49.16	\$61.22	H H H H H H D Y
			10/1/2007				
Sprinkler Fitter							
Sprinkler Fitter		SP 704		\$55.92	\$75.26	\$94.60	H H D H D D D D Y
			12/5/2007				
	Apprentice Rates:						
	1st Period		\$22.82	\$30.55	\$38.29		
	2nd Period		\$34.65	\$43.36	\$52.06		
	3rd Period		\$36.58	\$46.25	\$55.92		
	4th Period		\$38.51	\$49.14	\$59.78		
	5th Period		\$40.45	\$52.06	\$63.66		
	6th Period		\$42.38	\$54.95	\$67.52		
	7th Period		\$44.32	\$57.86	\$71.40		
	8th Period		\$46.25	\$60.76	\$75.26		
	9th Period		\$48.18	\$63.65	\$79.12		
	10th Period		\$50.12	\$66.56	\$83.00		
Terrazzo							
Terrazzo Finisher		TT32-TRF		\$39.97	\$50.50	\$61.03	H H D H D D D D N
			7/25/2007				
	Apprentice Rates:						
	Level 1		\$20.29	\$26.40	\$32.50		
	Level 2		\$21.00	\$27.46	\$33.92		
	Level 3		\$24.60	\$31.17	\$37.73		
	Level 4		\$25.94	\$33.17	\$40.41		
	Level 5		\$27.31	\$34.76	\$42.20		
	Level 6		\$28.78	\$36.40	\$44.02		
	Level 7		\$30.32	\$38.32	\$46.32		
	Level 8		\$31.68	\$39.94	\$48.20		

Official Request #: 917

Requestor: TROY SCHOOL DISTRICT

Project Description: SERVICES BUILDING UPS REPLACEMENT

Project Number:

County: Oakland

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Official 2008 Prevailing Wage Rates for State Funded Projects

Issue Date: 6/19/2008

Contract must be awarded by: 9/17/2008

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
----------------	--	--------------	-----------------	-----------------	-------------	--------------------

Terrazzo Worker	TT32-TRW	7/25/2007	\$45.29	\$58.48	\$71.67	H H D H D D D D N
-----------------	----------	-----------	---------	---------	---------	-------------------

Apprentice Rates:

Level 1	\$24.76	\$31.75	\$38.73
Level 2	\$27.55	\$35.28	\$43.01
Level 3	\$30.40	\$38.42	\$46.44
Level 4	\$32.90	\$41.81	\$50.72
Level 5	\$35.00	\$44.31	\$53.61
Level 6	\$38.34	\$49.13	\$59.91
Level 7	\$39.44	\$50.63	\$61.83
Level 8	\$40.29	\$51.91	\$63.53

Tile

Tile Finisher	TT32-TF	7/25/2007	\$39.59	\$49.93	\$60.27	H H D H D D D D N
---------------	---------	-----------	---------	---------	---------	-------------------

Apprentice Rates:

Level 1	\$19.20	\$24.76	\$30.32
Level 2	\$20.30	\$26.41	\$32.52
Level 3	\$24.57	\$31.12	\$37.67
Level 4	\$25.91	\$33.13	\$40.35
Level 5	\$27.28	\$34.71	\$42.14
Level 6	\$28.75	\$36.56	\$44.36
Level 7	\$30.29	\$38.15	\$46.01
Level 8	\$31.65	\$39.77	\$47.89

Tile Layer	TT32-TL	7/25/2007	\$45.19	\$58.33	\$71.47	H H D H D D D D N
------------	---------	-----------	---------	---------	---------	-------------------

Apprentice Rates:

Level 1	\$24.76	\$31.75	\$38.73
Level 2	\$27.55	\$35.28	\$43.01
Level 3	\$30.40	\$38.42	\$46.44
Level 4	\$32.90	\$41.81	\$50.72
Level 5	\$34.95	\$44.10	\$53.26
Level 6	\$38.29	\$49.05	\$59.81
Level 7	\$38.89	\$49.81	\$60.73
Level 8	\$39.74	\$51.09	\$62.43

Truck Driver

on all trucks of 8 cubic yard capacity or less	TM-RB1	7/24/2007	\$34.76	\$36.44		H H H H H H H Y
of all trucks of 8 cubic yard capacity or over	TM-RB1A	7/24/2007	\$34.86	\$36.59		H H H H H H H Y
on euclid type equipment	TM-RB1B	7/24/2007	\$35.01	\$36.81		H H H H H H H Y

Official Request #: 917

Requestor: TROY SCHOOL DISTRICT

Project Description: SERVICES BUILDING UPS REPLACEMENT

Project Number:

County: Oakland

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Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Official 2008 Prevailing Wage Rates for State Funded Projects

Issue Date: 6/19/2008

Contract must be awarded by: 9/17/2008

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Classification									
Name	Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision			
=====									
Underground Laborer Open Cut, Class I									
Construction Laborer		LAUC-Z1-1	\$33.39	\$44.07	\$54.75	H H H H H H D Y			
		9/6/2007							
	Apprentice Rates:								
	0-1,000 work hours	\$28.59	\$36.87	\$45.15					
	1,001-2,000 work hours	\$29.55	\$38.31	\$47.07					
	2,001-3,000 work hours	\$30.51	\$39.75	\$48.99					
	3,001-4,000 work hours	\$32.43	\$42.63	\$52.83					
Underground Laborer Open Cut, Class II									
Mortar and material mixer, concrete form man, signal man, well point man, manhole, headwall and catch basin builder, guard rail builders, headwall, seawall, breakwall, dock builder and fence erector.		LAUC-Z1-2	\$33.50	\$44.24	\$54.97	H H H H H H D Y			
		9/6/2007							
	Apprentice Rates:								
	0-1,000 work hours	\$28.68	\$37.01	\$45.33					
	1,001-2,000 work hours	\$29.64	\$38.45	\$47.25					
	2,001-3,000 work hours	\$30.60	\$39.89	\$49.17					
	3,001-4,000 work hours	\$32.54	\$42.80	\$53.05					
Underground Laborer Open Cut, Class III									
Air, gasoline and electric tool operator, vibrator operator, drillers, pump man, tar kettle operator, bracers, rodger, reinforced steel or mesh man (e.g. wire mesh, steel mats, dowel bars, etc.), cement finisher, welder, pipe jacking and boring man, wagon drill and air track operator and concrete saw operator (under 40 h.p.), windlass and tugger man, and directional boring man.		LAUC-Z1-3	\$33.55	\$44.31	\$55.07	H H H H H H D Y			
		9/6/2007							
	Apprentice Rates:								
	0-1,000 work hours	\$28.71	\$37.05	\$45.39					
	1,001-2,000 work hours	\$29.68	\$38.51	\$47.33					
	2,001-3,000 work hours	\$30.65	\$39.97	\$49.27					
	3,001-4,000 work hours	\$32.58	\$42.86	\$53.13					
Underground Laborer Open Cut, Class IV									
Trench or excavating grade man.		LAUC-Z1-4	\$33.63	\$44.43	\$55.23	H H H H H H D Y			
		9/6/2007							
	Apprentice Rates:								
	0-1,000 work hours	\$28.77	\$37.15	\$45.51					
	1,001-2,000 work hours	\$29.74	\$38.60	\$47.45					
	2,001-3,000 work hours	\$30.72	\$40.07	\$49.41					
	3,001-4,000 work hours	\$32.66	\$42.98	\$53.29					

Official Request #: 917

Requestor: TROY SCHOOL DISTRICT

Project Description: SERVICES BUILDING UPS REPLACEMENT

Project Number:

County: Oakland

Official Rate Schedule

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Official 2008 Prevailing Wage Rates for State Funded Projects

Issue Date: 6/19/2008

Contract must be awarded by: 9/17/2008

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Classification		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					
=====						
Underground Laborer Open Cut, Class V						
Pipe Layer		LAUC-Z1-5	\$33.69	\$44.52	\$55.35	H H H H H H D Y
		9/6/2007				
	Apprentice Rates:					
	0-1,000 work hours	\$28.82	\$37.22	\$45.61		
	1,001-2,000 work hours	\$29.79	\$38.67	\$47.55		
	2,001-3,000 work hours	\$30.77	\$40.15	\$49.51		
	3,001-4,000 work hours	\$32.72	\$43.07	\$53.41		
Underground Laborer Open Cut, Class VI						
Grouting man, top man assistant, audio visual television		LAUC-Z1-6	\$31.14	\$40.70	\$50.25	H H H H H H D Y
operations and all other operations in connection with		9/6/2007				
closed circuit television inspection, pipe cleaning and pipe						
relining work and the installation and repair of water						
service pipe and appurtenances.						
	Apprentice Rates:					
	0-1,000 work hours	\$26.90	\$34.34	\$41.77		
	1,001-2,000 work hours	\$27.75	\$35.61	\$43.47		
	2,001-3,000 work hours	\$28.60	\$36.89	\$45.17		
	3,001-4,000 work hours	\$30.29	\$39.43	\$48.55		
Underground Laborer Open Cut, Class VII						
Restoration laborer, seeding, sodding, planting, cutting,		LAUC-Z1-7	\$27.76	\$35.63	\$43.49	H H H H H H D Y
mulching and topsoil grading and the restoration of		9/6/2007				
property such as replacing mail boxes, wood chips, planter						
boxes, flagstones etc.						
	Apprentice Rates:					
	0-1,000 work hours	\$24.37	\$30.55	\$36.71		
	1,001-2,000 work hours	\$25.05	\$31.57	\$38.07		
	2,001-3,000 work hours	\$25.73	\$32.59	\$39.43		
	3,001-4,000 work hours	\$27.08	\$34.61	\$42.13		

Official Request #: 917

Requestor: TROY SCHOOL DISTRICT

Project Description: SERVICES BUILDING UPS REPLACEMENT

Project Number:

County: Oakland

Official Rate Schedule

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Troy School District
Services Building
UPS Replacement
TSD Bid No. 9546
Troy, Michigan

IDS Project No. 03234-2007

SECTION 00410 - BID FORM

OWNER: Troy School District
4400 Livernois
Troy, Michigan 48098

PROJECT: Troy School District
Services Building
UPS Replacement
TSD Bid No. 9546
Troy, Michigan

ARCHITECT: Integrated Design Solutions, LLC
Architecture, Engineering, Interiors & Technology
888 W. Big Beaver Road, Suite 200
Troy, Michigan 48084
(248) 823-2100
(248) 823-2200 fax

NAME OF BIDDER: _____

ADDRESS: _____

TELEPHONE: _____

BID

Pursuant to and in compliance with your Advertisement for Bids Instructions to Bidders and other documents relating thereto, the undersigned proposes and agrees to furnish equipment, materials, and labor and perform all work necessary to complete the Services Building, UPS Replacement, TSD Bid No. 9546 Project in accordance with the Drawings and Specifications prepared by Integrated Design Solutions, LLC dated August 15, 2008, and agrees to accept payment as herein provided.

BASE BID – Technical Section 16000 (Electrical Work)

Lump sum bid for all work specified and shown on the Drawings as indicated for base bid.

Dollars (\$_____).

NOTE:

The amount shall be shown in both words and figures. In case of a discrepancy, the amount shown in words shall govern.

BASE BID – Technical Section 16795 (Technology Work)

Lump sum bid for all work specified and shown on the Drawings as indicated for base bid.

Dollars (\$_____).

NOTE:

The amount shall be shown in both words and figures. In case of a discrepancy, the amount shown in words shall govern.

MANDATORY ALTERNATES

The foregoing Base Bids may be increased or decreased by the amounts herein quoted for Alternates. The following alternate prices shall include all charges for labor, material, and equipment, bonds, overhead and profit, general conditions, supervision, insurance, taxes, and incidental expenses.

Electrical Mandatory Alternate No. 1: Provide a fixed 40kVA UPS unit, 3 #3, 1 #8 Grd. – 1 1/2" C. feeder and 80A breaker, in lieu of a scalable 40kVA/80kVA UPS unit, feeder and breaker shown on drawings.

Add/Deduct _____

Dollars (\$_____).

VOLUNTARY ALTERNATES

Voluntary Alternate No. 1:

Add/Deduct _____

Dollars (\$_____).

Voluntary Alternate No. 2:

Add/Deduct _____

Dollars (\$_____).

TAXES

For the purposes of this bid, the Troy School District is tax exempt. Do not include Federal, State or local taxes in the Bid. The Owner's federal and state tax-exempt number is B38.600.3099. Usage taxes shall be included in the base bid price.

BID SECURITY

Accompanying this Bid is a certified check, cashier's check, money order or bid bond (cross out those not applicable) made payable to Troy School District in the amount of five percent (5%), of Base Bid, which shall be retained by the Owner as liquidated damages, if the undersigned fails to execute the contract within ten (10) days of award of the Contract.

ADDENDA

The undersigned acknowledges the receipt of the following addenda:

Addendum No. _____	Dated _____	Addendum No. _____	Dated _____
Addendum No. _____	Dated _____	Addendum No. _____	Dated _____
Addendum No. _____	Dated _____	Addendum No. _____	Dated _____

TIME OF COMPLETION

The undersigned agrees to complete the Project, including AE punchlists, by November 3, 2008.

WITHDRAWAL OF BIDS

The undersigned agrees that his Bid shall not be withdrawn for a period of sixty (60) days after the date set for receipt of Bids.

NON-COLLUSION

The undersigned certifies that the bid has not been prepared in collusion with any other bidder and that the prices, discounts, terms and conditions thereof have not been directly or indirectly communicated by or on behalf of the Bidder to any such person other than the recipient of such bid, and will not be communicated to any such person prior to the official opening of said bid. The undersigned fully understands that no premiums, rebates, or gratuities are permitted either with, prior to or after signing the Contract. This certification may be treated as if it were a sworn statement made under oath, and is made subject to the provisions of 18 U. S. C., 1001, relating to the making of false statements.

SIGNATURE AND LEGAL STATUS OF BIDDER

Signed and sealed this _____ day of _____, 20____.

(Individual, Partnership, Corporation)

State of Incorporation

Affix Corporate Seal

By:

(Authorized Signature of Bidder)

(Print or Type Name of Bidder)

Title

Business Address

Instructions: Submit one (1) original and two (2) copies to the Owner and retain one (1) copy for the Bidder's records. Clearly label each copy submitted as either "original" or "copy".

END OF BID FORM

SECTION 00450

FAMILIAL DISCLOSURE STATEMENT

The undersigned, the owner or authorized officer of _____ (the "Bidder"), pursuant to the familial disclosure requirement provided in the _____ (the "School District") advertisement for construction bids, hereby represent and warrant, except as provided below, that no familial relationships exist between the owner(s) or any employee of _____ and any member of the Board of Education of the School District or the Superintendent of the School District.

List any Familial Relationships:

BIDDER:

By: _____

Its: _____

STATE OF MICHIGAN)
)ss.
COUNTY OF _____)

This instrument was acknowledged before me on the ____ day of _____, 2008, by
_____.

, Notary Public

_____ County, Michigan

My Commission Expires: _____

Acting in the County of: _____

END OF SECTION

AIA® Document A107™ – 1997

Abbreviated Standard Form of Agreement Between Owner and Contractor for Construction Projects of Limited Scope where the basis of payment is a STIPULATED SUM

AGREEMENT made as of the _____ day of _____ in the year _____
(In words, indicate day, month and year)

BETWEEN the Owner:
(Name, address and other information)

and the Contractor:
(Name, address and other information)

the Project is:
(Name and location)

| 00000-00000 Blank Forms

the Architect is:
(Name, address and other information)

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This Document includes abbreviated General Conditions and should not be used with other general conditions.

This document has been approved and endorsed by The Associated General Contractors of America.

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User Notes:

(278939223)

ARTICLE 1 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 2.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

(Insert the date of commencement, if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

§ 2.2 The Contract Time shall be measured from the date of commencement.

§ 2.3 The Contractor shall achieve Substantial Completion of the entire Work not later than days from the date of commencement, or as follows:

(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. Unless stated elsewhere in the Contract Documents, insert any requirements for earlier Substantial Completion of certain portions of the Work.)

, subject to adjustments of this Contract Time as provided in the Contract Documents

(Insert provisions, if any, for liquidated damages relating to failure to complete on time or for bonus payments for early completion of the Work.)

ARTICLE 3 CONTRACT SUM

§ 3.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be (\$), subject to additions and deletions as provided in the Contract Documents.

§ 3.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

(State the numbers or other identification of accepted alternates. If decisions on other alternates are to be made by the Owner subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

§ 3.3 Unit prices, if any, are as follows:

Description	Units	Price (\$ 0.00)
-------------	-------	-----------------

ARTICLE 4 PAYMENTS

§ 4.1 PROGRESS PAYMENTS

§ 4.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents. The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

Init.

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User Notes:

(278939223)

§ 4.1.2 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment to the Contractor not later than the day of the same month. If an Application for Payment is received by the Architect after the date fixed above, payment shall be made by the Owner not later than () days after the Architect receives the Application for Payment.

§ 4.1.3 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

per annum

(Usury laws and requirements under the Federal Truth in Lending Act, similar state and local consumer credit laws and other regulations at the Owner's and Contractor's principal places of business, the location of the Project and elsewhere may affect the validity of this provision. Legal advice should be obtained with respect to deletions or modifications, and also regarding requirements such as written disclosures or waivers.)

§ 4.2 FINAL PAYMENT

§ 4.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when:

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 17.2, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

§ 4.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follow:

ARTICLE 5 ENUMERATION OF CONTRACT DOCUMENTS

§ 5.1 The Contract Documents are listed in Article 6 and, except for Modifications issued after execution of this Agreement, are enumerated as follows:

§ 5.1.1 The Agreement is this executed 1997 edition of the Abbreviated Standard Form of Agreement Between Owner and Contractor, AIA Document A107-1997.

§ 5.1.2 The Supplementary and other Conditions of the Contract are those contained in the Project Manual dated , and are as follows:

Document	Title	Pages
----------	-------	-------

§ 5.1.3 The Specifications are those contained in the Project Manual dated as in Section 5.1.2, and are as follows:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

Title of Specifications exhibit:

(Table deleted)

§ 5.1.4 The Drawings are as follows, and are dated unless a different date is shown below:

(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

Title of Drawings exhibit:

(Table deleted)

§ 5.1.5 The Addenda, if any, are as follows:

Number	Date	Pages
--------	------	-------

Init.

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 5.

§ 5.1.6 Other documents, if any, forming part of the Contract Documents are as follows:
(List any additional documents which are intended to form part of the Contract Documents.)

GENERAL CONDITIONS

ARTICLE 6 GENERAL PROVISIONS

§ 6.1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement with Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 6.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Architect and Contractor, (2) between the Owner and a Subcontractor or sub-subcontractor, (3) between the Owner and Architect or (4) between any persons or entities other than the Owner and Contractor.

§ 6.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 6.4 EXECUTION OF THE CONTRACT

Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 6.5 OWNERSHIP AND USE OF ARCHITECT'S DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants are Instruments of Service through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect or the Architect's consultants, and unless otherwise indicated the Architect and the Architect's consultants shall be deemed the authors of them and will retain all common law, statutory and other reserved rights, in addition to the copyrights. All copies of them, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants. The Contractor, Subcontractors, sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other

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documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' copyrights or other reserved rights.

ARTICLE 7 OWNER

§ 7.1 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 7.1.1 The Owner shall furnish and pay for surveys and a legal description of the site.

§ 7.1.2 The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 7.1.3 Except for permits and fees which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for other necessary approvals, easements, assessments and charges required for the construction, use or occupancy of permanent structures or permanent changes in existing facilities.

§ 7.2 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents, or persistently fails to carry out the Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order is eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

§ 7.3 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or persistently fails or neglects to carry out the Work in accordance with the Contract Documents, or fails to perform a provision of the Contract, the Owner, after 10 days' written notice to the Contractor and without prejudice to any other remedy the Owner may have, may make good such deficiencies and may deduct the reasonable cost thereof, including Owner's expenses and compensation for the Architect's services made necessary thereby, from the payment then or thereafter due the Contractor.

ARTICLE 8 CONTRACTOR

§ 8.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 8.1.1 Since the Contract Documents are complementary, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 7.1.1, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions or inconsistencies in the Contract Documents; however, any errors, omissions or inconsistencies discovered by the Contractor shall be reported promptly to the Architect as a request for information in such form as the Architect may require.

§ 8.1.2 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents.

§ 8.2 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 8.2.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures, and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall be fully and solely responsible for the jobsite safety thereof unless the Contractor gives timely written notice to the Owner and Architect that such means, methods, techniques, sequences or procedures may not be safe.

§ 8.2.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

§ 8.3 LABOR AND MATERIALS

§ 8.3.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 8.3.2 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

§ 8.3.3 The Contractor shall deliver, handle, store and install materials in accordance with manufacturers' instructions.

§ 8.3.4 The Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order.

§ 8.4 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation or normal wear and tear and normal usage.

§ 8.5 TAXES

The Contractor shall pay sales, consumer, use and other similar taxes which are legally enacted when bids are received or negotiations concluded.

§ 8.6 PERMITS, FEES AND NOTICES

§ 8.6.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work.

§ 8.6.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities applicable to performance of the Work. The Contractor shall promptly notify the Architect and Owner if the Drawings and Specifications are observed by the Contractor to be at variance therewith. If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 8.7 SUBMITTALS

§ 8.7.1 The Contractor shall review for compliance with the Contract Documents, approve in writing and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness. The Work shall be in accordance with approved submittals.

§ 8.7.2 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents.

§ 8.8 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

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§ 8.9 CUTTING AND PATCHING

The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

§ 8.10 CLEANING UP

The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus material.

§ 8.11 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees; shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect, unless the Contractor has reason to believe that there is an infringement of patent or copyright and fails to promptly furnish such information to the Architect.

§ 8.12 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 8.13 INDEMNIFICATION

§ 8.13.1 To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with Section 16.3, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 8.13.

§ 8.13.2 In claims against any person or entity indemnified under this Section 8.13 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 8.13.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 9 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

§ 9.1 The Architect will provide administration of the Contract and will be an Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Section 17.2.

§ 9.2 The Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the Work, and (3) to determine in general if the Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will neither have control over or charge of, nor be responsible for, the construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 8.2.1.

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§ 9.3 The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 9.4 Based on the Architect's evaluations of the Work and of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 9.5 The Architect will have authority to reject Work that does not conform to the Contract Documents.

§ 9.6 The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 9.7 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect will make initial decisions on all claims, disputes and other matters in question between the Owner and Contractor but will not be liable for results of any interpretations or decisions so rendered in good faith.

§ 9.8 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 9.9 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 9.10 CLAIMS AND DISPUTES

§ 9.10.1 Claims, disputes and other matters in question arising out of or relating to this Contract, including those alleging an error or omission by the Architect but excluding those arising under Section 15.2, shall be referred initially to the Architect for decision. Such matters, except those relating to aesthetic effect and except those waived as provided for in Section 9.11 and Sections 14.5.3 and 14.5.4, shall, after initial decision by the Architect or 30 days after submission of the matter to the Architect, be subject to mediation as a condition precedent to arbitration or the institution of legal or equitable proceedings by either party.

§ 9.10.2 If a claim, dispute or other matter in question relates to or is the subject of a mechanic's lien, the party asserting such matter may proceed in accordance with applicable law to comply with the lien notice or filing deadlines prior to resolution of the matter by the Architect, by mediation or by arbitration.

§ 9.10.3 The parties shall endeavor to resolve their disputes by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to this Agreement and with the American Arbitration Association. The request may be made concurrently with the filing of a demand for arbitration but, in such event, mediation shall proceed in advance of arbitration or legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order.

§ 9.10.4 Claims, disputes and other matters in question arising out of or relating to the Contract that are not resolved by mediation, except matters relating to aesthetic effect and except those waived as provided for in Section 9.11 and Sections 14.5.3 and 14.5.4, shall be decided by arbitration which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect. The demand for arbitration shall be filed in writing with the other party to this Agreement and with the American Arbitration Association and shall be made within a reasonable time after the dispute has arisen. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof. Except by written consent of the person or entity sought to be joined, no arbitration arising out of or relating to the Contract Documents shall include, by consolidation, joinder or in any other manner, any person or entity not a party to the Agreement under which such arbitration arises, unless

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it is shown at the time the demand for arbitration is filed that (1) such person or entity is substantially involved in a common question of fact or law, (2) the presence of such person or entity is required if complete relief is to be accorded in the arbitration, (3) the interest or responsibility of such person or entity in the matter is not insubstantial, and (4) such person or entity is not the Architect or any of the Architect's employees or consultants. The agreement herein among the parties to the Agreement and any other written agreement to arbitrate referred to herein shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 9.11 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor and Owner waive claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 19. Nothing contained in this Section 9.11 shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

ARTICLE 10 SUBCONTRACTORS

§ 10.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site.

§ 10.2 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of the Subcontractors for each of the principal portions of the Work. The Contractor shall not contract with any Subcontractor to whom the Owner or Architect has made reasonable and timely objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 10.3 Contracts between the Contractor and Subcontractors shall (1) require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by the Contract Documents, assumes toward the Owner and Architect, and (2) allow the Subcontractor the benefit of all rights, remedies and redress afforded to the Contractor by these Contract Documents.

ARTICLE 11 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 11.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under conditions of the contract identical or substantially similar to these, including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such claim as provided in Section 9.10.

§ 11.2 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's activities with theirs as required by the Contract Documents.

§ 11.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work or defective construction of a separate contractor.

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ARTICLE 12 CHANGES IN THE WORK

§ 12.1 The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly. Such changes in the Work shall be authorized by written Change Order signed by the Owner, Contractor and Architect, or by written Construction Change Directive signed by the Owner and Architect.

§ 12.2 The cost or credit to the Owner from a change in the Work shall be determined by mutual agreement of the parties or, in the case of a Construction Change Directive, by the Contractor's cost of labor, material, equipment, and reasonable overhead and profit.

§ 12.3 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

§ 12.4 If concealed or unknown physical conditions are encountered at the site that differ materially from those indicated in the Contract Documents or from those conditions ordinarily found to exist, the Contract Sum and Contract Time shall be equitably adjusted.

ARTICLE 13 TIME

§ 13.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 13.2 The date of Substantial Completion is the date certified by the Architect in accordance with Section 14.4.2.

§ 13.3 If the Contractor is delayed at any time in the commencement or progress of the Work by changes ordered in the Work, by labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions not reasonably anticipatable, unavoidable casualties or any causes beyond the Contractor's control, or by other causes which the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine, subject to the provisions of Section 9.10.

ARTICLE 14 PAYMENTS AND COMPLETION

§ 14.1 APPLICATIONS FOR PAYMENT

§ 14.1.1 Payments shall be made as provided in Article 4 of this Agreement. Applications for Payment shall be in a form satisfactory to the Architect.

§ 14.1.2 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or other encumbrances adverse to the Owner's interests.

§ 14.2 CERTIFICATES FOR PAYMENT

§ 14.2.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 14.2.3.

§ 14.2.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluations of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance

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of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 14.2.3 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 14.2.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 14.2.1. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 8.2.2, because of:

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or another contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 persistent failure to carry out the Work in accordance with the Contract Documents.

§ 14.2.4 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 14.3 PAYMENTS TO THE CONTRACTOR

§ 14.3.1 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to sub-subcontractors in similar manner.

§ 14.3.2 Neither the Owner nor Architect shall have an obligation to pay or see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 14.3.3 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 14.4 SUBSTANTIAL COMPLETION

§ 14.4.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 14.4.2 When the Architect determines that the Work or designated portion thereof is substantially complete, the Architect will issue a Certificate of Substantial Completion which shall establish the date of Substantial Completion, establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work

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and insurance, and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. Upon the issuance of the Certificate of Substantial Completion, the Architect will submit it to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

§ 14.5 FINAL COMPLETION AND FINAL PAYMENT

§ 14.5.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions stated in Section 14.5.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 14.5.2 Final payment shall not become due until the Contractor has delivered to the Owner a complete release of all liens arising out of this Contract or receipts in full covering all labor, materials and equipment for which a lien could be filed, or a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including costs and reasonable attorneys' fees.

§ 14.5.3 The making of final payment shall constitute a waiver of claims by the Owner except those arising from:

- .1 liens, claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

§ 14.5.4 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 15 PROTECTION OF PERSONS AND PROPERTY

§ 15.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein; and
- .3 other property at the site or adjacent thereto.

The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons and property and their protection from damage, injury or loss. The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, a Subcontractor, a sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 15.1.2 and 15.1.3, except for damage or loss attributable to acts or omissions of the Owner or Architect or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 8.13.

§ 15.2 HAZARDOUS MATERIALS

§ 15.2.1 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner

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and Contractor. The Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shutdown, delay and start-up, which adjustments shall be accomplished as provided in Article 12 of this Agreement.

§ 15.2.2 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 15.2.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), and provided that such damage, loss or expense is not due to the sole negligence of a party seeking indemnity.

§ 15.2.3 If, without negligence on the part of the Contractor, the Contractor is held liable for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

ARTICLE 16 INSURANCE

§ 16.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located insurance for protection from claims under workers' compensation acts and other employee benefit acts which are applicable, claims for damages because of bodily injury, including death, and claims for damages, other than to the Work itself, to property which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by the Contractor or by a Subcontractor or anyone directly or indirectly employed by any of them. This insurance shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater, and shall include contractual liability insurance applicable to the Contractor's obligations. Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. Each policy shall contain a provision that the policy will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner.

§ 16.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 16.3 PROJECT MANAGEMENT PROTECTIVE LIABILITY INSURANCE

§ 16.3.1 Optionally, the Owner may require the Contractor to purchase and maintain Project Management Protective Liability insurance from the Contractor's usual sources as primary coverage for the Owner's, Contractor's and Architect's vicarious liability for construction operations under the Contract. Unless otherwise required by the Contract Documents, the Owner shall reimburse the Contractor by increasing the Contract Sum to pay the cost of purchasing and maintaining such optional insurance coverage, and the Contractor shall not be responsible for purchasing any other liability insurance on behalf of the Owner. The minimum limits of liability purchased with such coverage shall be equal to the aggregate of the limits required for Contractor's Liability insurance under Section 16.1.

§ 16.3.2 To the extent damages are covered by Project Management Protective Liability insurance, the Owner, Contractor and Architect waive all rights against each other for damages, except such rights as they may have to the proceeds of such insurance. The policy shall provide for such waivers of subrogation by endorsement or otherwise.

§ 16.3.3 The Owner shall not require the Contractor to include the Owner, Architect or other persons or entities as additional insureds on the Contractor's Liability insurance under Section 16.1.

§ 16.4 PROPERTY INSURANCE

§ 16.4.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance on an "all-risk" policy form, including builder's risk, in the amount of the initial Contract Sum, plus the value of subsequent modifications and cost of materials supplied and installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who

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are beneficiaries of such insurance, until final payment has been made as provided in Section 14.5 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 16.4 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and sub-subcontractors in the Project.

§ 16.4.2 The Owner shall file a copy of each policy with the Contractor before an exposure to loss may occur. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 16.5 WAIVERS OF SUBROGATION

§ 16.5.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 11, if any, and any of their subcontractors, sub-subcontractors, agents and employees for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to Section 16.4 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 11, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 16.5.2 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their sub-subcontractors in similar manner.

ARTICLE 17 CORRECTION OF WORK

§ 17.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 17.2 In addition to the Contractor's obligations under Section 8.4, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 14.4.2, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty.

§ 17.3 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 7.3.

§ 17.4 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work.

§ 17.5 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Article 17.

ARTICLE 18 MISCELLANEOUS PROVISIONS

§ 18.1 ASSIGNMENT OF CONTRACT

Neither party to the Contract shall assign the Contract without written consent of the other.

§ 18.2 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located.

§ 18.3 TESTS AND INSPECTIONS

Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

§ 18.4 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

As between Owner and Contractor, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued:

- .1 not later than the date of Substantial Completion for acts or failures to act occurring prior to the relevant date of Substantial Completion;
- .2 not later than the date of issuance of the final Certificate for Payment for acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to the issuance of the final Certificate for Payment; and
- .3 not later than the date of the relevant act or failure to act by the Contractor for acts or failures to act occurring after the date of the final Certificate for Payment.

ARTICLE 19 TERMINATION OF THE CONTRACT

§ 19.1 TERMINATION BY THE CONTRACTOR

If the Architect fails to recommend payment for a period of 30 days through no fault of the Contractor, or if the Owner fails to make payment thereon for a period of 30 days, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead, profit and damages applicable to the Project.

§ 19.2 TERMINATION BY THE OWNER

§ 19.2.1 The Owner may terminate the Contract if the Contractor:

- .1 persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 19.2.2 When any of the above reasons exists, the Owner, upon certification by the Architect that sufficient cause exists to justify such action, may, without prejudice to any other remedy the Owner may have and after giving the Contractor seven days' written notice, terminate the Contract and take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 19.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 19.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

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§ 19.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

ARTICLE 20 OTHER CONDITIONS OR PROVISIONS

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

CONTRACTOR (Signature)

(Printed name and title)

(Printed name and title)

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SECTION 00800

SUPPLEMENTARY CONDITIONS AND ADDITIONAL CONDITIONS

PROJECT: Troy School District
Services Building
UPS Replacement
TSD Bid No. 9546
Troy, Michigan

OWNER: Troy School District
4400 Livernois
Troy, MI 48098

ARCHITECT: Integrated Design Solutions, LLC
888 W. Big Beaver, Suite 200
Troy, MI 48084
(248) 823-2100
(248) 823-2200 (Fax)

THE FOLLOWING SUPPLEMENTS MODIFY THE "GENERAL CONDITIONS" INCLUDED IN THE "ABBREVIATED STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION PROJECTS OF LIMITED SCOPE", AIA DOCUMENT A107, 1997 EDITION. WHERE A PORTION OF THE GENERAL CONDITIONS IS MODIFIED OR DELETED BY THESE SUPPLEMENTARY CONDITIONS, THE UNALTERED PORTIONS OF THE GENERAL CONDITIONS SHALL REMAIN IN EFFECT.

EXPLANATION OF NUMBERING: Article 20 shall constitute revisions and additions to and follow the same format of the General Conditions.

ARTICLE 20

OTHER CONDITIONS OR PROVISIONS

20.1 Add new subparagraph 6.6 as follows:

"6.6 The Contractor will be furnished free of charge six (6) copies of Drawings and Project Manuals for execution of the Work."

20.2 Delete subparagraph 12.2 and add the following in its place:

"12.2 The cost or credit to the Owner from a change in the work shall be determined by mutual agreement, by an acceptable estimate and lump sum proposal by the Contractor or by actual cost of all labor and materials and a percentage or fixed fee for all other changes, such as overhead, profit, insurance, taxes and bonds. On any change which involves a net credit to the Owner, no allowance for overhead and profit shall be figured.

12.2.1 If none of the foregoing methods is agreed upon, the Contractor, upon receipt of an order as hereinbefore stated, shall proceed with the work. In such case the Contractor shall keep and present in such form as the Owner may direct, a correct account of the cost, together with vouchers. In any case, the Owner shall certify to the amount including the specified allowance for overhead and profit, due the Contractor.

12.2.2 The allowable fee for added work by Contractor's own forces shall not exceed 15% of additional cost and his fee on work performed by Subcontractors shall not exceed 7-1/2% of

additional cost. Quotations by Subcontractors at all times shall be subject to these same limitations."

- 20.3 Modifications to subparagraph 14.1.1
To the end of this subparagraph add the following:

"The form of Application for Payment shall be a notarized AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet."

- 20.4 Add new subparagraph 14.1.2 as follows:

"14.1.2 Until final completion, the Owner will pay ninety (90) percent of the amount due the Contractor on account of progress payments. Upon final completion, the Architect will certify payment in full."

- 20.5 Modifications to subparagraph 16.1.
To the end of this subparagraph add the following:

"16.1.1 The insurance by Subparagraph 16.1 shall be written for not less than the following limits, or greater if required by law:

1. Worker's Compensation:

- | | | |
|----|--|--|
| a. | State: | Statutory |
| b. | Applicable Federal
(e.g. Longshoremen's): | Statutory |
| c. | Employer's Liability: | \$1,000,000.00 per Accident
\$1,000,000.00 Disease, Policy Limit
\$1,000,000.00 Disease, Each Employee |

2. Comprehensive or Commercial General Liability (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage);

a. Bodily Injury:

\$1,000,000.00	Each Occurrence
\$1,000,000.00	Aggregate

b. Property Damage:

\$1,000,000.00	Each Occurrence
\$1,000,000.00	Aggregate

c. Products and Completed Operations to be maintained for one (1) year after final payment:

\$1,000,000.00	Aggregate
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d. Broad Form Property Damage Coverage shall include Completed Operations.

3. Contractual Liability:
 - a. Bodily Injury:

\$1,000,000.00	Each Occurrence
\$1,000,000.00	Aggregate
 - b. Property Damage:

\$1,000,000.00	Each Occurrence
\$1,000,000.00	Aggregate
4. Personal Injury, with Employment Exclusion deleted:

\$1,000,000.00	Aggregate
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5. Business Auto Liability (including owned, non-owned and hired vehicles):
 - a. Bodily Injury:

\$1,000,000.00	Each Person
\$1,000,000.00	Each Occurrence
 - b. Property Damage:

\$1,000,000.00	Each Occurrence
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6. Umbrella Excess Liability
 (Bodily Injury and Property Damage
 Combined)

	\$1,000,000.00
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"16.1.2" Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:

1. Premises Operations (including X, C, and U coverages as applicable).
2. Independent Contractor's Protective.
3. Products and Completed Operations.
4. Personal Injury Liability with Employment Exclusion deleted.
5. Owned, non-owned and hired motor vehicles.
6. Broad Form Property Damage including Completed Operations.

16.1.3 If the General Liability coverages are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2.

- 20.6 Delete paragraph 16.3 and subparagraphs 16.3.1, 16.3.2 and 16.3.3 in their entirety.
- 20.7 Delete paragraph 16.4 and subparagraphs 16.4.1 and 16.4.2 in their entirety.

20.8 Modifications to Article 19.

Add the following subparagraphs to the end of Article 19.

"19.3" Termination by the Owner for Convenience.

"19.3.1 The Owner may, at any time, terminate the contract for the Owner's convenience and without cause.

"19.3.2 Upon receipt of written note from the Owner of such termination for the Owner's convenience, the Contractor shall:

1. Cease operations as directed by the Owner in the notice;
2. Take actions necessary, or that the Owner may direct, for the protection and preservation of the work; and
3. Except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing Subcontracts and purchase orders and enter into no further Subcontracts and purchase orders.

19.3.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment from the Owner on the same basis provided in Subparagraph 20.2."

20.9 BONDS

20.9.1 The Contractor shall furnish a Performance Bond and a Labor and Material Payment Bond covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds shall be obtained from a company licensed to do business in the State of Michigan and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to 100 percent of the Contract Sum.

20.9.2 The Contractor shall deliver the required bonds to the Owner not later than three days following the date the Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

20.10 EQUAL OPPORTUNITY

20.10. The Contractor shall maintain policies of employment as follows:

20.10.1. The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

20.10.2. The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

END OF SECTION 00800

SECTION 07841 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:
 - 1. Floors.
 - 2. Walls and partitions.
 - 3. Construction enclosing compartmentalized areas.
- B. Related Sections include the following:
 - 1. Division 16 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
 - 1. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
 - 2. Fire-resistance-rated floor assemblies.
- B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
- C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - 1. Penetrations located in construction containing fire-protection-rated openings.
 - 2. Penetrating items larger than 4-inch- diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

- D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- E. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of through-penetration firestop system product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL ITS or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
 - 1) UL in "Fire Resistance Directory."
 - 2) ITS in "Directory of Listed Products."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by firestop system manufacturers or when substrates are wet.
- B. Ventilate firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hilti Construction Chemicals, Inc.
 - 2. Nelson Firestop Products.
 - 3. RectorSeal Corporation (The).
 - 4. Specified Technologies Inc.
 - 5. 3M Fire Protection Products.
 - 6. Tremco.

2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.3 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials indicated by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- H. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

- I. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
- J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- K. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 07841

SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1 Sections.

1. Design requirements.
2. Performance requirements.
3. Substitutions.
4. Permits and fees.
5. Examination of drawings and premises.
6. Submittals.
7. Project record documents.
8. Operation and maintenance manuals and equipment.
9. Quality assurance.
10. Delivery, storage and handling.
11. Warranty.

- B. This Section includes basic requirements for materials and installations for electrical work, including but not limited to:

1. Sealing of openings.
2. Sleeves.
3. Expansion fittings.
4. Nameplates and directories.
5. Electrical demolition work.
6. Cutting and patching.
7. Equipment foundations and supports.
8. Phasing.
9. Field Quality Control.

1.3 REFERENCES

- A. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing Materials
3. BICSI - Building Industry Consulting Service International
4. FCC - Federal Communication Commission
5. ICEA - Insulated Cable Engineers Association

6. IEEE - Institute of Electrical and Electronics Engineers
7. NEC - National Electrical Code
8. NETA - International Electrical Testing Association
9. NEMA - National Electrical Manufacturer's Association
10. NFPA - National Fire Protection Association
11. UL - Underwriters' Laboratories, Inc.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements: Furnish all labor, materials, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 16 Sections and as indicated on Drawings.
 1. The Electrical Drawings indicate the general design and extent of the electrical system. Comply to the Drawings as closely as actual construction of the building and the work of other Trades permit.
- B. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.
 1. All equipment of the same or similar systems shall be by the same manufacturer.
- C. Substitutions: Base Bid must be in accordance with materials or products specified. Any exceptions to this must be approved in writing by the Architect/Engineer ten (10) days or more prior to bidding.
 1. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the Bid, but will not affect the awarding of the Contract.
- D. Permits and Fees: Obtain all permits, licenses, inspections and test required. Upon completion of the Work, obtain and send certificates of inspections and approvals to the Architect/Engineer.
 1. Pay all fees and expenses for permits, licenses, tests and inspections.
- E. Examination of Drawings and Premises: Before submitting Bids, examine the site, architectural, mechanical and other trades' drawings and specifications.
 1. Notify Architect/Engineer should any discrepancies occur between them and the electrical work.
 2. No additional charges will be allowed because of failure to make this examination, or to include all materials and labor required for the Work.
 3. Before submitting Bids, examine the premises to determine existing conditions for performing the Work. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.
 4. The Architectural Drawings take precedence in all matters pertaining to the building structure, Mechanical drawings in all matters pertaining to Mechanical trades and Electrical drawings in all matters pertaining to Electrical trades installation. However, where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer who shall determine the course of action to be taken.

1.5 SUBMITTALS

- A. The following is in addition to the requirements for submittals in Division 1.
- B. Material List: Submit a complete list of all materials, equipment, and their manufacturers, for approval by the Architect/Engineer within 15 days after award of contract and prior to submittal of shop drawings.
- C. Provide equipment submittals in the form of letters of intent, product data catalog sheets or shop drawings as hereinafter specified for all materials provided on the project.
- D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 - 1. Provide a space approximately 4" x 5" on the label or beside the title block on shop drawings to record the Contractor's review and approval markings and the action taken.
 - 2. Include the following information on the label for processing and recording action taken.
 - Project Name
 - Date
 - Name and address of Architect/Engineer
 - Name and address of Contractor
 - Name and address of Subcontractor
 - Name and address of Supplier
 - Name of Manufacturer
 - Number and title of appropriate Specification Section
 - Drawing number, identification mark, fixture type, panelboard number, specification section number, and detail references, or as noted on the electrical drawings.
- E. Equipment submittals shall be reviewed by the Electrical Contractor for completeness and accuracy and prior to submitting to the Architect/Engineer for review. Submittals shall be dated and signed by the Electrical Contractor.
- F. Partial submittals for equipment shall not be permitted. Where partial submittals are transmitted to the Architect/Engineer, they will be returned "Rejected".
- G. Where the equipment submittals consist of manufacturer's standard detail drawing or schedules and contain data for a variety of similar equipment, indicate the data pertinent to the equipment furnished for this project only. Standard detail drawings and schedules not clearly indicating which data is associated with this Project shall be returned "Rejected".
- H. Where accessories and/or options are specified and do not appear as part of manufacturer's standard detail drawings, state each accessory that is to be provided with the equipment on the standard detail drawings.
- I. Letter of Intent shall state that the product is exactly as specified with no exceptions, and that the product is being manufactured by one of the specified manufacturers. The Letter of Intent shall include the specification section number, the product description, the name of the selected manufacturer and the catalog number of the product. The aforementioned information shall be typed on the Electrical Contractor's letterhead and submitted with one (1) product data sheet for each product itemized in the Letter of Intent for record.

- J. Shop Drawings: Prepare layout shop drawings drawn to scale and submit one (1) transparency copy and two (2) prints of each to the Architect/Engineer for review, together with required number of additional copies as required by the General Conditions. After the shop drawings are reviewed, the transparency copy will be stamped and returned for printing and distribution. Refer to Division 1 for submittals and quantities.
1. Layout shop drawings shall show building floor plans to scale and shall include lighting and power distribution systems, all details of electrical construction, routing of conduits, wiring, circuiting and related information necessary for the installation and future maintenance of the electrical wiring systems.
- K. No apparatus or equipment shall be shipped from stock or fabricated until equipment submittals for them have been reviewed and approved by the Architect/Engineer. By the review of shop drawings, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Electrical Trades of full responsibility for the proper and correct execution of the work required.
- L. Submittals shall be provided on all major electrical systems and/or equipment, including the following:

REMARKS LEGEND

In addition to the previously specified, provide the following where indicated:

- | | |
|---------------------------------------|--|
| 1. Factory Test Report | 8. Points List |
| 2. Field Testing Report | 9. Sequence of Operation |
| 3. Record Drawings | 10. Certificate of Inspection |
| 4. Mock-Up | 11. Installer Certificate & Master Label |
| 5. Material & Equip. List/Certificate | 12. Fire Marshal Approval |
| 6. Operation & Maintenance Manuals | 13. Tools/Spare Parts |
| 7. Construction Schedule | 14. _____ |

Section Number	Section Title	Shop Dwgs.	Product Data	Letter of Intent	Samples	Warranty	Remarks
16010	General Requirements					X	6, 7, 10
	Layout Shop Drawings	X					3, 5, 13
	Materials List			X			5
16025	Electrical Systems			X			
16060	Grounding						
	Grounding Cable			X			
	Grounding Connections/fittings			X			
16080	Electrical Testing						
	Testing Firm			X			
	Tests on 600 Volt Cables						2
	Tests on Control Devices						2
	Tests on Grounding						2

16120	Conductors and Cables (0-600V)						
	Cable			X			1
	Splicing Connectors			X			
	Termination Lugs			X			
16130	Raceways and Boxes						
	EMT Conduit and Fittings			X			
	RGS Conduit and Fittings			X			
	Flexible Steel Conduit and Fittings			X			
	Liquid-Tite Flexible Steel Conduit and Fittings			X			
	Outlet Boxes			X			
	Pull Boxes			X			
16190	Supporting Devices			X			
16195	Electrical Identification			X			
16264	Uninterruptible Power Supply	X	X				

1.6 PROJECT RECORD DOCUMENTS

- A. Project Record Documents: Revise layout shop drawings as required during construction to indicate the as-built condition.
- At the completion of the Project, resubmit to the Owner's Representative the revised sepias and one set of prints indicating "as-built" conditions for Owner's record. The Drawings shall contain all title block information as originally issued by the Architect/Engineer with the addition of the electrical contractor's company name, address, telephone number, company's project number, date of issuance by the electrical contractor, and issued for "as-built" conditions in title.
 - Furnish and deliver to the Owner's Representative a manual of all shop drawings and product data upon substantial completion. The manual shall consist of a standard hard cardboard, vinyl covered, 3-ring binder, letterhead size, 8-1/2" x 11". Shop drawings shall be folded and punched. All items and pages shall be numbered with typewritten index inserted at front of manual.
 - Submit final project record documents as described in Division 1.

1.7 OPERATION AND MAINTENANCE MANUALS AND EQUIPMENT

- A. Operation and Maintenance Manuals: The manuals shall contain operating instructions, service instructions, parts lists, etc., which are shipped with electrical equipment. On completion of the work, transmit these items to the Architect/Engineer, for the Owner's use. If this information is not shipped with the equipment, obtain from the manufacturer.
- B. Maintenance Materials: Retain all portable and detachable portions of the installation such as keys, tools, manuals, etc., until the completion of the work and then transmit them to the Owner and obtain itemized receipt. This receipt shall be attached to the "Final Application" for payment.

- C. Furnish three (3) sets of bound operation and maintenance manuals to the Architect/Engineer. Each set shall include:

1. One (1) copy of all shop drawings.
2. Operation and maintenance instructions and manuals.
3. One (1) copy of all electrical testing.
4. As-built drawings.

1.8 QUALITY ASSURANCE

- A. Regulatory Requirements:

1. Ordinances and Codes: Perform all work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of the National Board of Fire Underwriters, the National Electric Code, and the latest accepted practices of IEEE and NEMA.
 - a. Notify the Architect/Engineer before submitting his proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations. After entering into Contract, make all changes required to conform to above ordinances, rules and regulations without additional expense to the Owner.
 - b. Barrier-Free Regulations: All materials and installations shall comply with the requirements of the State of Michigan Handicapped Barrier-Free Regulations and with the Americans With Disabilities Act (ADA).

- B. Field Measurements:

1. Drawings are not intended to be scaled for roughing-in or to serve as shop drawings. Take all field measurements required for fitting the installation to the building.

- C. Sequencing and Scheduling: Sequence and schedule work so as to avoid interference with the work of other Trades. Be responsible for removing and relocating any work which in the opinion of the Owner's Representatives causes interference.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Storage and Protection: Provide adequate storage space for all electrical equipment, conduit and materials delivered to the job site under a weather protected enclosure. Location of the space will be designated by the Owner's Field Representative. Equipment set in place in unprotected areas must be provided with temporary protection.

1. Be responsible for the care and protection of electrical equipment until it has been fully tested and accepted.
2. Protect materials with permanent factory finish from damage by covering.
3. Protect conduit openings with temporary plugs or caps.

1.10 WARRANTY

- A. Warranty: Provide a one year parts and labor warranty for all equipment and installation. Comply with requirements of the General Conditions.

PART 2 - PRODUCTS

2.1 SEALING OF OPENINGS

- A. Seal openings around electrical materials (Conduit, raceways, busways, panels, etc.) where floors, fire rated walls and smoke barriers are penetrated. (Fiberglass is not acceptable.) Fire and/or smoke barriers shall be UL Listed fire and smoke stop fittings and shall have fire rating equal to or greater than the penetrated barrier. Refer to Section 07841 "Through Penetration Firestop Systems".

2.2 SLEEVES

- A. Provide conduit sleeves where conduits pass through concrete floors, walls, beams and ceilings.
- B. Sleeves shall be galvanized rigid steel conduit. Do not use aluminum conduit. Where specific sizes are not indicated on the Drawings, sleeves shall be sized to provide one-half (1/2) inch clearance around the outside surface of the item for which they were installed. They shall be cut flush with wall surfaces, and shall extend one inch, or as directed through floor. Sleeves shall be packed with approved non-combustible packing material and sealed with sealant to prevent passage of air, liquid or fumes from one area to another. The filler and sealant materials used shall be rated at least equal in fire resistance to the construction material being penetrated. Floor sleeves shall be sealed between floor and sleeve with concrete grout.

2.3 EXPANSION FITTINGS

- A. Provide expansion fittings in all conduits and bus duct runs that cross building expansion joints, both in concrete slabs and where exposed.

2.4 NAMEPLATES AND DIRECTORIES

- A. Identify switchgear, unit substations, motor controls, panelboards, safety switches, etc., with manufacturers' nameplate, shop order, where applicable on composite assemblies, and designations used on the Drawings. Nameplates shall be laminated phenolic plastic, beveled edged white with engraved black letters. Except where impractical, letters and numerals shall be a minimum of 1/4 inch high. Nameplates shall be mechanically secured. Pressure sensitive nameplates are not acceptable. Panel directories shall be typed, showing equipment served and location for each breaker or switch with a clear plastic protective cover. Provide new typed, updated panel directories at all existing panels affected by the scope of the project. Ring out all existing branch circuits as required to update the existing panel directories.

PART 3 - EXECUTION

3.1 ELECTRICAL DEMOLITION WORK

- A. General: Perform electrical demolition work in a systematic manner. Use such methods as outlined below to complete Work indicated on the Drawings.
- B. Obtain approval from the Owner prior to interrupting existing services. All service interruptions shall be at a time suitable to the Owner. Where the Owner approves service interruptions at times resulting in premium time work to this Contractor, this Contractor shall include the premium time in his Base Bid.

- C. The associated conduit, wire, junction boxes, supports, etc., of demolished equipment shall be removed from the utilization equipment back to the source panel and the associated circuit breaker or fused switch shall be relabeled as "spare", unless otherwise noted. All associated wiring shall be removed back to the "sources" as noted below:
 - 1. Power: Remove conduit and wire back to the panel. When the circuit continues on to the other existing loads remove conduit and wire back to the first junction box.
 - 2. Conduit in walls to remain: Abandon in place. Install blank coverplates.
 - 3. Conduit accessible above ceilings and/or other location: Remove conduit.
- D. Ring out circuits prior to deactivating feeders and branch circuits to insure maintaining electrical power in adjacent unrenovated area. Where removal of conduit and wire affects "downstream" circuits, refeed downstream circuits.
- E. Conduit in floor slabs shall be cut 1/2 inch below the floor and patched.
- F. Where applicable, existing in-place conduit may be reused for new work providing that the installation is in accordance requirements for new work found in Section 16000.
- G. Where equipment or fixtures are removed, outlets shall be properly blanked-off, and conduits capped. After alterations are completed, the entire installation shall present a "finished" look, as approved by the Architect/Engineer. The original function of the present electrical work to be modified shall not be changed unless required by the specific revisions to the system as specified or as indicated.
- H. Materials salvaged from this work shall not be reused except where reuse is specifically indicated.
- I. Existing fixtures and electrical equipment removed, not reused and not specifically indicated to be turned over to the Owner, shall be legally and properly disposed of off Owner's property.
- J. Existing fixtures and electrical equipment specifically indicated to be turned over to the Owner shall be disconnected, removed and turned over to the Owner in an undamaged condition to an on sight storage area as directed by the Owner.

3.2 CUTTING AND PATCHING

- A. Refer to Division 1 for requirements for cutting, patching and refinishing work necessary for the installation of Electrical Work.
- B. Direct miscellaneous cutting and patching of the existing building construction for the installation of the Electrical Work.
- C. The cutting of holes through the existing building construction shall only be done by the use of abrasive saws and rotary coring machines. The use of hammer and drill points will not be permitted. The openings shall not be cut larger than necessary for the installation of the electrical work. Openings shall then be grouted in. Where existing piping, etc. is removed, the unused openings shall be grouted in.
- D. The drilling or punching of structural members, such as holes through beams or columns, shall not be done without the specific permission of the Architect/Engineer.

- E. Cutting of holes through floors and walls shall be done only at such locations as may be directed by the Architect/Engineer.
- F. Cooperate with the other Contractors so that all cutting and repairing in any given area will be done simultaneously.
- G. Electrical work which may interfere with changes in piping, ducts or other mechanical equipment, as well as conduits and outlets that may be uncovered by the cutting of new openings in present building, shall be removed at the direction of the Architect/Engineer.

3.3 EQUIPMENT FOUNDATIONS AND SUPPORTS

- A. Furnish foundations and supports for electrical equipment and materials as required by codes, as listed hereinafter and shown or noted on the Drawings.
- B. Provide necessary inserts, rod, structural steel frames, brackets, platforms, etc., for equipment suspended from ceilings or walls, such as conduits, transformers, panels, etc.
- C. Inserts for equipment support shall be lead shield anchors for small work and expansion shields for large work. Wooden plugs will not be allowed. Do not use metal roof decking and cellular floors for supporting equipment.
- D. Provide and install concrete bases 4" above finished floor, with leveling channels, where noted, for floor-mounted equipment such as transformers, switchboards, distribution panels, motor control centers, etc.

3.4 PHASING

- A. Identify general power and lighting feeder and branch circuits with a visual color code as an integral part of the outer jacket or as a printed color coding the entire length of the insulation in accordance with the NEC.

3.5 FIELD QUALITY CONTROL

- A. Testing Ducts and Conduits: Ducts and conduits which are installed underground or concealed in concrete floor slab, foundations, etc., shall be cleared of foreign material and obstructions after installation and before conductor or pullwires are draw-in, by wire brushing, swabbing and employing an iron or hardwood mandrel which is 1/4" smaller in diameter than the internal diameter of the duct or conduit. Pulling wires shall be left in empty conduits.
- B. Tests and Inspection:
 - 1. When the systems are completed, operate equipment as directed by Architect/Engineer. Replace all faulty equipment. Make necessary adjustments before final acceptance.
 - 2. Tests shall include but not be limited to panels, lighting fixtures, receptacles, fire alarm system, generator transfer, sound systems, emergency lighting, branch circuits, etc.
 - 3. Perform all tests required by State, City, County and/or other agencies having jurisdiction.
 - 4. Provide all materials, equipment, etc., and labor required for tests.

C. Cleaning:

1. Keep premises free from accumulation of waste materials and rubbish. At completion of work remove all rubbish from and about the building and leave the electrical systems clean and ready for use.
2. Final clean-up shall include washing of fixture lenses, switchboards, transformers, motor control centers, distribution panels, lighting panels, etc., to remove shipping and/or construction dust and debris. Fixture reflectors and/or lenses with water marks or cleaning streaks will not be accepted.

D. Painting:

1. In general, no painting is required by Electrical Trades other than touch-up of factory-finished electrical equipment.
2. All factory finished electrical equipment shall be cleaned at completion of the job. Equipment showing rust or mars shall be thoroughly cleaned and sanded, prime coated and touched up with enamel of color to match original finish.

END OF SECTION 16010

SECTION 16025 – ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. Description of Systems:
 - 1. Utility Primary Voltage to Site: 13.2 KV, 3 phase, 4 wire, 60 hertz, neutral solidly grounded at the source.
 - 2. Primary Distribution System: 13.2 KV, 3 phase, 4 wire, 60 hertz, neutral solidly grounded.
 - 3. Power Systems: 480/277 volts, 3 phase, 4 wire, 60 hertz, neutral solidly grounded at the source.
 - 4. Lighting Systems: 480/277 volts, 3 phase, 4 wire, 60 hertz, solidly grounded neutral.
 - 5. Small Power System: 208/120 volts, 3 phase, 4 wire, 60 hertz, solidly grounded neutral.
 - 6. Emergency Power Systems: 480/277 volt, 3 phase, 4 wire, neutral solidly grounded.

1.3 WORK SPECIFIED IN DIVISION 16 SECTIONS

- A. Furnish all labor, materials, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 16 Sections.
- B. The principal items of electrical work to be furnished and installed shall include but not necessarily be limited to the following items:
 - 1. Replace 480-208/120 Volt, 3 phase, 4 wire, uninterruptible power system (UPS) for existing communications equipment connected to the existing emergency generator power system.
 - 2. Testing of power cables and electrical equipment.
 - 3. All items incidental to and/or required to complete the installation.

PART 2 - PRODUCTS

See specific sections for requirements.

PART 3 - EXECUTION

See specific sections for requirements.

END OF SECTION 16025

SECTION 16060 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Grounding Conductors:
 - a. For General Use Above and Below Grade: Bare.
 - b. In Ducts in Duct Banks: Insulated.
 - c. In Conduit with Phase Conductors: Insulated.
 - 2. Grounding Connections:
 - a. In Earth or Inaccessible Locations: Exothermic welded type.
 - b. To Structural Steel Used for Main Building Framing: Exothermic welded type.
 - c. To Non-Permanently Fixed Equipment: Lugs bolted to the equipment.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Ground electrical system neutrals and non-current carrying parts of electrical equipment per the minimum requirements of the National Electrical Code, except where additional requirements are indicated or specified.

1.4 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Submit letter of intent for each item. Coordinate the items, as they relate to the work, prior to submittal. Items shall include:
 - 1. Ground cables
 - 2. Grounding connections and fittings

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

- A. Bare Grounding Conductors: stranded annealed copper.
- B. Insulated Grounding Conductors: stranded annealed copper insulated with a heat and moisture resistant polyvinyl chloride compound and meeting UL Requirements for Type THWN or XHHW, 75 degC, rated 600 volts, color-coded green. Refer to Section 16120 for manufacturers.

2.2 GROUNDING CONNECTIONS

- A. Exothermic Welding Connection Materials.
 - 1. Manufacturer: Provide the following:
 - a. Cadweld
- B. Copper Compression Grounding
 - 1. Manufacturer: Provide products of one of the following:
 - a. Anderson
 - b. Burndy
 - c. IlSCO
 - d. Panduit
 - e. Penn Union
 - f. Thomas & Betts
- C. Grounding Fittings for Bonding a Ground Conductor to Its Own Conduit.
 - 1. Manufacturer: Provide products of one of the following:
 - a. Appleton Type GIB
 - b. Burndy Type NE
 - c. Penn Union Type BD
 - d. O-Z Type GB
 - e. Thomas & Betts Type TIG or 3800 Series

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install conductors of size required by the NEC. except that where sizes are otherwise indicated, provide these sizes.
- B. Thoroughly clean all bonding surfaces of non-conducting materials. Where bolted connections are used, treat surfaces with a corrosion-inhibiting compound.

- C. Where insulated conductors are used, thoroughly tape all exposed splices and connections. Encapsulate below grade splices and connections so that bare conductors are not in contact with earth.
- D. Where metallic conduit is used for mechanical protection of a ground conductor, bond conductor to the conduit at each end.
- E. For electrical system neutral grounding, do not use conductor sizes smaller than No. 8 AWG.
- F. Ground the enclosures of all heavy duty equipment, such as switchboards, transformers, motor control centers, motors above 50 horsepower, with a separate grounding conductor connected to the nearest ground conductor or ground bus comprising a part of the electrical system grounding.
- G. Where non-metallic conduit is used, install a ground conductor in the conduit with the circuit conductors. The ground conductor shall be a separate conductor. Size the ground conductors per NEC requirements except where noted otherwise.
- H. Provide an equipment grounding conductor, within the raceway along with phase conductors, for all feeders and branch circuits.
- I. Provide an equipment grounding conductor within all flexible conduits.
- J. The metallic enclosures and exposed noncurrent-carrying metal parts of all electrical equipment shall be grounded by connection with an equipment grounding conductor. This includes boxes, panels, lighting fixtures, ballasts and poles, receptacles, etc.

END OF SECTION 16060

SECTION 16080 - ELECTRICAL TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.2 SUMMARY

- A. General Scope:

- 1. Engage the services of a recognized independent testing firm for the purpose of performing inspections and tests as herein specified. Where this contractor has the qualifications and capabilities of providing these services, it shall be so stated prior to award of contract.
- 2. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
- 3. It is the intent of these tests to assure that all electrical equipment, both contractor and owner supplied, is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.
- 4. The tests and inspections shall determine suitability for energization.

- B. Applicable Codes, Standards and References

- 1. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.
 - a. American National Standards Institute - ANSI
 - 1) ANSI C2: National Electrical Safety Code
 - 2) ANSI Z244-1: American National Standard for Personnel Protection
 - b. American Society for Testing and Materials - ASTM
 - c. Association of Edison Illuminating Companies - AEIC
 - d. Electrical Apparatus Service Association - EASA
 - e. Institute of Electrical and Electronic Engineers - IEEE
 - f. Insulated Cable Engineers Association - ICEA
 - g. International Electrical Testing Association - NETA
 - h. National Electrical Manufacturer's Association - NEMA
 - i. National Electrical Code - NEC
 - j. National Fire Protection Association - NFPA
 - 1) ANSI/NFPA 70B: Electrical Equipment Maintenance
 - 2) NFPA 70E: Electrical Safety Requirements for Employee Workplaces
 - 3) ANSI/NFPA 70: National Electrical Code
 - 4) ANSI/NFPA 78: Lightning Protection Code
 - 5) ANSI/NFPA 101: Life Safety Code

- k. Occupational Safety and Health Administration - OSHA
 - 1) OSHA Part 1910; Subpart S, 1910.308
 - 2) OSHA Part 1926; Subpart V, 1926.950 through 1926.960
 - l. Underwriters Laboratories, Inc. - UL
 - m. State and Local Codes and Ordinances
2. All inspections and tests shall utilize the following references:
- a. Project Design Specifications.
 - b. Project Design Drawings.
 - c. Project Short Circuit and Coordination Study.
 - d. Project Arc Flash Hazard Study.
 - e. Manufacturer's instruction manuals applicable to each particular apparatus.
- C. Qualifications of Testing Agency:
- 1. The testing firm shall be a corporately independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.
 - 2. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
 - 3. The testing firm shall have been engaged in such practices for a minimum of five years.
 - 4. The testing firm shall meet Federal OSHA criteria for accreditation of testing laboratories, Title 29, Parts 2907, 1910, and 1936. Full membership in the InterNational Electrical Testing Association constitutes proof of such criteria.
 - 5. The lead, on site, technical person shall be currently certified by the InterNational Electrical Testing Association (NETA) in Electrical Power Distribution System Testing.
 - 6. Testing firm shall utilize only full-time technicians who are regularly employed by the firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians and/or linemen may assist, but may not perform testing and/or inspection services.
 - 7. The testing firm shall submit proof of the above qualifications with bid documents when requested.
 - 8. The testing firm shall be an independent organization as defined by OSHA Title 29, Part 1936 and the InterNational Electrical Testing Association.
 - 9. All instruments used by the testing firm to evaluate electrical performance shall meet NETA's Specifications for Test Instruments.
 - 10. The terms used herewithin such as Test Agency, Test Contractor, Testing Laboratory, or Contractor Test Company, shall be construed to mean testing firm.
- D. Division of Responsibility:
- 1. The Electrical Contractor shall perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.
 - 2. The Electrical Contractor shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements.

3. The Electrical Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
 4. The testing firm shall notify the engineer prior to commencement of any testing.
 5. Any system, material or workmanship which is found defective on the basis of acceptance tests shall be reported.
 6. The testing firm shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.
- E. Electrical Tests: Furnish all labor, materials, test equipment, and technical supervision to perform and record the electrical tests as specified, and perform and record all electrical tests as required, including tests on:
1. Tests on Cables, Low Voltage (600V Maximum)
 2. Grounding Systems
 3. Emergency Systems, Uninterruptible Power Systems
- F. Preliminary Inspections and Tests: Visual inspections of electrical equipment, wire checks of factory wiring and any other preliminary work required to prevent delays during performance of electrical acceptance tests.
- G. Electrical Acceptance Tests: Those inspections and tests required to show that the workmanship, methods, inspections, and materials used in erection and installation of the electrical equipment conforms to accepted engineering practices, IEEE Standards, IPCEA-NEMA Standards, the National Electrical Code, manufacturers instructions, and Division 16 Sections, and to determine that the equipment involved may be energized for operational tests.
- H. Operating Tests: Those tests performed on all electrical equipment installed under Division 16 Sections, and under other Sections, to show that the electrical equipment will perform the functions for which it was designed.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Refer to Section 16025, "Electrical Systems".
- B. Operating tests on mechanical and electrical equipment installed under other Sections to prove capability of such equipment to perform as specified in the Section covering specific equipment.
- C. Repair or replacement of equipment installed under other Sections and not meeting acceptance tests specified in this Section and therefore not acceptable.

1.4 PERFORMANCE REQUIREMENTS

- A. Final acceptance of electrical equipment will not only depend on equipment integrity as determined by the electrical acceptance test, but will also depend on complete operational tests, whether performed under this or other Sections.

1.5 SUBMITTALS

- A. Test Reports:
 1. The test report shall include the following:
 - a. Project Name: Obtain from project manual.

- b. A/E Firm: Integrated Design Solutions, LLC
 - c. A/E Address: 888 W. Big Beaver, Suite 200, Troy, MI 48084
 - d. A/E Project Number: Obtain from project manual.
 - e. Name of testing organization.
 - f. Address of testing organization.
 - g. Name of individual performing tests.
 - h. Description of tests.
 - i. Test data.
 - j. Analysis and recommendations.
 - k. Description of equipment tested and its number/name.
 - l. Humidity, temperature, and other conditions that may affect the results of the tests and/or calibrations.
 - m. Date of inspections, tests, maintenance, and/or calibrations.
 - n. Identification of the testing technician.
 - o. Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
 - p. Indication of expected results when calibrations are to be performed.
 - q. Indication of "as-found" and "as-left" results, as applicable.
 - r. Sufficient spaces to allow all results and comments to be indicated.
2. Submit test reports, including complete data on actual readings taken and corrected values, to the Architect/Engineer for approval after each test period. Have all test reports signed by the authorized witnesses present at tests prior to submission. Do not energize any equipment or material for operating tests until test data has been approved.
- B. Submit five (5) copies of final approved test reports to the Owner at the completion of the work under this Section.

1.6 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
- 1. Do not perform megger tests during times of high relative humidity.
 - 2. Do not perform tests on outdoor equipment during inclement weather. Do not perform tests on direct burial bare ground conductors or on ground rods within a 48 hour period following rainfall.
- B. Safety Precautions:
- 1. All parties involved shall be cognizant of applicable safety procedures. This document does not include any procedures, including specific safety procedures. It shall be understood and clear that an overwhelming majority of the tests and inspections recommended in these specifications are potentially hazardous. Individuals performing these tests shall be trained and capable of conducting these tests in a safe manner and with complete knowledge of the hazards involved. Safety practices shall include, but are not limited to, the following requirements:
 - a. All applicable provisions of the Occupational Safety and health Act, particularly OSHA 29CFR 1910.
 - b. Accident Prevention Manual for Industrial Operations, National Safety Council.
 - c. Applicable state and local safety operating procedures.
 - d. Owner's safety practices.

- e. ANSI/NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.
 - 2. A safety lead person shall be identified prior to commencement of work.
 - 3. A safety briefing shall be conducted prior to the commencement of work.
 - 4. All tests shall be performed with the apparatus de-energized and grounded except where otherwise specifically required to be ungrounded or energized for certain tests.
 - 5. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety.
 - 6. During cable tests, station a person at each point where cable has exposed connections. Supply each person with a two-way communication device.
- C. Suitability of Test Equipment:
- 1. All test equipment shall meet the calibration requirements found in these specifications and shall be in good mechanical and electrical condition.
 - 2. Field test metering used to check power system meter calibration shall be more accurate than the instrument being tested.
 - 3. Accuracy of metering in test equipment shall be appropriate for the test being performed.
 - 4. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and the tested equipment.
- D. Test Instrument Calibration:
- 1. The testing organization shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated.
 - 2. The firm providing calibration service shall maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.
 - 3. the accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
 - 4. Instruments shall be calibrated in accordance with the following frequency schedule:
 - a. Field instruments: Analog, 6 months maximum. Digital, 12 months maximum.
 - b. Laboratory instruments: 12 months maximum.
 - c. Leased specialty equipment: 12 months maximum.
 - 5. Dated calibration labels shall be visible on all test equipment.
 - 6. Records, which show date and results of instruments calibrated or tested, must be kept up to date.
 - 7. Calibrating standard shall be of better accuracy than that of the instrument tested.

1.7 SEQUENCE AND SCHEDULING

- A. Schedule sequence of tests so that equipment can be energized immediately after completion of the applicable tests and approval of test reports. Notify the Architect/Engineer of time of test at least 96 hours prior to testing.
- B. Notify vendors and manufacturers of electrical equipment of the time of tests and extend reasonable cooperation to them or their representatives to permit them to witness tests should they so request. Obtain list of manufacturers of Owner furnished equipment from the Architect/Engineer.

1.8 INDEPENDENT TESTING FIRMS

- A. Dymax Services, Inc.
23460 Industrial Park Drive
Farmington Hills, MI 48335
(248) 477-6066
- B. Power Plus Engineering, Inc.
46575 Magellan Drive
Novi, MI 48377
(248) 344-0200

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform preliminary inspections and tests immediately prior to performing acceptance tests. Fuses and fusing devices, such as cable limiters, shall be omitted from cable tests and tests involving cables.

3.2 MEGGER TESTS

- A. Megger readings specified are the minimum readings desired at an ambient temperature of 60 degF (15.56 degC) and at a low relative humidity. When megger readings are taken at other than 60 degF, convert readings to equivalent values at 60 degF.
- B. When megger readings fall below the specified minimum values at 60 degF, devise some means of applying heat for the purpose of drying out the equipment subject to the approval of the Architect/Engineer. If drying is to be done by applying an electric potential to a piece of equipment, do not exceed the continuous voltage or current ratings of the equipment being dried, either directly or by induction.

3.3 CONTINUITY TESTS

- A. Perform continuity tests with a DC type device using a bell or buzzer. Do not use phones for continuity test; use phones only for communication.

3.4 CABLES, LOW-VOLTAGE (600V MAXIMUM)

- A. General:
 - 1. Provide visual and mechanical inspection of all cables.
 - 2. Provide a continuity test for all feeders and subfeeders.
 - 3. Provide a megger test for all cables serving loads 200 amperes and above.
 - 4. Provide uniform resistance testing of all parallel conductors.
 - 5. Verify that phase identification was provided and its accuracy for each power feeder and subfeeder cable.
 - 6. Verify identification of all lighting circuits and 120 volt circuits on the panel directories.
 - 7. Test and verify thorough operational tests that all lighting and 120 volt circuits perform all the functions for which they were designed.

B. Visual and Mechanical Inspection:

1. Inspect and compare cable data including size and quantity of cables with drawings and specifications. Report differences in test report and include on contractor's "as-built" drawings.
2. Inspect exposed sections of cables for physical damage.
3. Inspect bolted electrical connections for high resistance using one of the following methods:
 - a. Use of low-resistance ohmmeter.
 - b. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 - c. Perform thermographic survey.
4. Inspect compression-applied connectors for correct cable match and indentation.
5. Inspect for correct phase identification and phase arrangements.
6. Inspect jacket and insulation condition.

C. Electrical Tests:

1. Perform resistance measurements through bolted connections with low-resistance ohmmeter.
2. Megger Test: Perform insulation-resistance test for each conductor with respect to ground conductors. Test duration shall be one minute. Applied potential shall be as follows:
 - a. 500 volts DC for 300 volt rated cable.
 - b. 1000 volts DC for 600 volt rated cable. Minimum permissible insulation-resistance.
 - c. Tested value shall be 50 megohm for isolated cables and 5 megohms for non-isolated cables.
3. Perform continuity tests to insure correct cable connection.
4. Verify uniform resistance of parallel conductors.

D. Connections: Isolate power cables to be megger tested by opening switches or breakers at each end of cable prior to testing where such disconnecting means exists. Where cables are direct connected without a disconnecting means, do not disconnect cables; test as connected.

E. Acceptance: Cable must pass all inspections and tests.

F. Records:

1. Include the following information in test report on each 480 volt power cable:
 - a. Complete cable identification and description of isolation means.
 - b. Megger readings, including converted values.
 - c. Approximate average cable temperature.

3.5 TESTS ON GROUNDING

- A. General: Inspect ground conductors and connections for conformance with design specifications and for satisfactory workmanship. Test resistance to earth of each ground rod and each ground grid. Test ground paths for equipment and structural steel grounding.

B. Connections:

1. Include ground bus on equipment, grid connection, and associated intermediate copper ground conductors in tests on ground paths for electrical equipment.
2. Include structural steel connection, grid connection and intermediate conductor in tests on ground paths for structural steel.

C. Tests On Each Ground Grid: Test each isolated ground grid as specified for individual ground rods, except the maximum acceptable resistance to earth is five ohms. In tests on total ground systems, the maximum acceptable resistance to earth is two ohms.

D. Tests On Ground Paths: Test ground paths for electrical equipment and structural steel for continuity by applying a low voltage DC source of current, capable of furnishing up to 100 amperes. The ground path for electrical equipment using structural steel must conduct 100 amperes. Resistance as calculated from the current and voltage must not exceed 0.010 ohms.

E. Acceptance: Grounding materials and connections must pass all inspections and must meet all specified maximum and minimum values.

F. Records: Make complete records of all tests. Include resistance values obtained, calculations of same, and methods of test and calculation.

3.6 TESTS ON SPECIAL SERVICE SYSTEMS

- A. Perform operating tests on all special service systems to prove that all design functions are satisfactorily performed.

END OF SECTION 16080

SECTION 16120 - CONDUCTORS AND CABLES (0-600V)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wire and cable systems as required, and all material and equipment, including wire cable, connectors and lugs, fittings, and wire and cable identification, as indicated or specified.

1.3 PERFORMANCE REQUIREMENTS

- A. Furnish wire and cable on which standard factory tests established by ASTM, ANSI, IPCEA and NEMA have been performed.

1.4 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Letter of Intent: Submit letter of intent for each type and size of wire and cable, connectors and lugs. Identify material, construction data, insulation thickness, and jacket thickness. Submit color coding schemes for branch circuit wiring. Submit cable identifications.
- C. Samples: Submit samples on request of the Architect-Engineer.
- D. Submit test data for wire and cable upon request of the Architect-Engineer. Do not install wire and cable for which test data has been requested until test data is approved.

1.5 REGULATORY REQUIREMENTS

- A. Wire and Cable: Listed by Underwriters' Laboratories as meeting National Electrical Code requirements and be so labeled.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver all wire and cable to the site on reels or in coils, plainly marked for complete identification, including the wire or cable size, the number of conductors, type of wire or cable, length, weight, thickness and character of the insulation and the name of the manufacturer. Furnish 600 volt wires and cables on coils and reels carrying original date perforated inspection labels of the Underwriters' Laboratories showing the number of feet and type of wire contained.

PART 2 - PRODUCTS

2.1 WIRE AND CABLE (ALUMINUM WIRE WILL NOT BE ACCEPTABLE)

- A. General Requirements: Furnish wire and cable per standard specifications established for such material and construction by ASTM, ANSI, IPCEA and NEMA, where applicable. Furnish copper conductors, not less than No. 12 AWG, except control conductors which may be No. 14 AWG. Furnish conductor sizes as indicated. Furnish stranded conductors for sizes No. 10 AWG and smaller, and stranded conductors for sizes No. 8 AWG and larger.

1. Manufacturer: Provide products of one of the following:

- a. American Insulated Wire Corp.
- b. Cablec Corp.
- c. Okonite
- d. Pirelli Cable Corp.
- e. Southwire.
- f. Triangle.

- B. Wire for General Interior and Exterior Use, Sizes No. 10 AWG and Smaller: Single conductor, annealed copper, NEC Type THW rated 75 degC, 600 volts; NEC Type THHN-THWN rated 90 degC in dry locations and 75 degC in wet locations, 600 volts.
- C. Wire for General Interior and Exterior Use, Sizes No. 8 AWG Through No. 4/0 AWG: Single conductor, annealed copper, NEC Type THW rated 75 degC, 600 volts; NEC Type THHN-THWN rated 90 degC in dry locations and 75 degC in wet locations, 600 volts.
- D. Wire for In Underground Duct or Conduit: Single or multi-conductor, as indicated on the Drawings, NEC Type USE rated 75 degC, 600 volts.

2.2 CONNECTORS FOR SPLICING COPPER CONDUCTORS

- A. Connectors for Straight Splicing Conductors Up To and Including No. 8 AWG: Solderless compression type.

1. Manufacturer: Provide one of the following:

- a. Burndy "Hylink"
- b. Panduit
- c. Thomas & Betts "Sta-Kon"

- B. Connectors for Pigtail Splicing Conductors Up To and Including No. 8 AWG: Solderless type; with a metallic insert connector within a plastic insulating cover having a temperature rating of 105 degC, 600 volts.
 - 1. Manufacturer: Provide one of the following:
 - a. Buchanan
 - b. Ideal
 - c. Scotchlok
- C. Connectors for Straight Splicing Conductors No. 6 AWG and Larger: Solderless compression 2-way type.
 - 1. Manufacturer: Provide one of the following:
 - a. Burndy Type YS-L
 - b. Thomas & Betts 54500 Series
- D. Connectors for 3-Way Splicing Conductors No. 6 AWG and Larger: Solderless compression type.
 - 1. Manufacturer: Provide one of the following:
 - a. Burndy YS-T
 - b. Thomas & Betts 54700 Series

2.3 LUGS FOR TERMINATING COPPER CONDUCTORS

- A. Lugs for Terminating Power Conductors Up To and Including No. 8 AWG: Solderless type, manufacturer's standard, unless otherwise specified.
- B. Lugs for Terminating Power Conductors No. 6 AWG and Larger: Solderless compression type, one hole for No. 6 AWG through No. 4/0 AWG inclusive, and two hole for larger sizes.
 - 1. Manufacturer: Provide one of the following:
 - a. Burndy Type YA-L
 - b. Thomas & Betts Series 54000
- C. Lugs for Terminating Control and Switchboard Wiring: Solderless compression type with tinned ring tongue.
 - 1. Manufacturer: Provide one of the following:
 - a. Burndy "Hylug"
 - b. Thomas & Betts "Sta-Kon"

2.4 TERMINAL BLOCKS

- A. Terminal Blocks for Use in Control Wiring of Control Panels and Terminal Cabinets: Molded barrier type rated 30 amperes, 600 volts, with washer head binding screws and white marking strip.
 - 1. Manufacturer: Provide one of the following:
 - a. Cutler-Hammer, Inc., Bulletin 10987
 - b. General Electric EB-5
 - c. Marathon 2000 Series

2.5 WIRE LABELS

- A. Wire Labels for Identification of Conductors.
 - 1. Manufacturer: Provide products of one of the following:
 - a. Brady
 - b. Westline

2.6 INSULATING TAPE

- A. General Use Tape:
 - 1. Manufacturer: Provide one of the following:
 - a. Okonite Type CLF Catalog Series 602-20
 - b. Scotch 33 Plus
- B. High Temperature Area Tape:
 - 1. Manufacturer: Provide products of one of the following:
 - a. Plymouth/Bishop Insulating Products "77 Plyglas"
 - b. Scotch 27

2.7 MISCELLANEOUS

- A. Lubricating Compound:
 - 1. Manufacturer: Provide products of one of the following:
 - a. American Polywater Corp.
 - b. Ideal 77 Yellow or Wire Lube

PART 3 - EXECUTION

3.1 GENERAL

- A. Install wiring in raceway systems, as indicated and as specified. Install wiring only in completed raceway systems and when systems are protected from the weather. Install conductors continuous, without splices, between equipments, where possible. Where splices are required, make up splices in boxes; do not use fittings for same.
- B. Install phase and neutral conductors of each branch or feeder circuit in a single conduit except where paralleling circuits are indicated. Install paralleling circuits of identical makeup and length as the paralleled circuit, and terminate conductors at the same location, mechanically and electrically, at both ends, to ensure equal division of the total current between conductors.
- C. Continuously lubricate all cables of the larger sizes at the pull-in point of conduit systems with an approved compound compatible with conductor insulation or jacket.
- D. Install conductors in such a manner that the bending radius of any wire or cable is not less than the minimum recommended by IPCEA and/or the manufacturer. Do not exceed manufacturer's recommended values for maximum pulling tension applied to any wire or cable.
- E. Connect all power wiring to equipment such that phasing shall be A-B-C-N left to right, top to bottom and front to back, where possible, and permanently identify phasing on the structure or housing adjacent to bus. Phase identification A-B-C is equivalent to transformer phase identification X1-X2-X3 and H1-H2-H3.

3.2 COLOR CODING AND CONDUCTOR IDENTIFICATION

- A. Provide single conductor cables having black insulation for power feeders and subfeeders. Do not color-code these circuits. Identify individual feeder and subfeeder conductors as to phase connection A, B, C by means of wire labels at each splice and termination.
- B. Identify individual phase conductors of branch power and lighting circuits as to phase and system voltage by means of color coding in conformance with Section 210-5 of the NEC. Develop a unique color scheme for each different voltage system. Match existing schemes where such exist. Submit color schemes for approval of the Architect-Engineer prior to implementation. Provide conductor color coding by means of colored insulating materials or by means of colored wire labels attached to individual conductors in all outlet, pull or junction boxes and at all terminations.
- C. Identify each control circuit wire at each termination by means of wire labels. Provide identification as indicated. Mark the white marking strip of all control terminal blocks with the same identification as the connecting wire in permanent black ink.

3.3 IN UNDERGROUND DUCT SYSTEMS

- A. Brush and swab the duct line before pulling cable. When installing cables of large sizes, use flexible cable feeders of an appropriate size to lead the cable from the reel into the duct mouth. In manholes and handholes, install power cables exposed on cable racks and control and special system wiring in rigid steel conduit systems. In passing cables through manholes and handholes, take care to avoid crossovers so that each cable is accessible when placed on racks, and where feasible, install each cable in the duct in the same relative position throughout the underground system, unless otherwise required or indicated. Install cables so that spare ducts are accessible for use in the future.

3.4 SPLICES AND TERMINATIONS

- A. Splice and terminate conductors with connectors and lugs as specified for the specific size and type of conductor. Indent all compression type connectors and lugs with tools as recommended by the connector or lug manufacturer.
- B. Thoroughly clean wire ends before connectors or lugs are applied. Install the connector or lug immediately after wire brushing the conductor.
- C. Insulate all bare surfaces of conductors with a minimum of four layers (half lap in two directions) of electrical insulating tape. On larger splices and terminals, build up connection with electrical insulating putty before applying tape, to eliminate both sharp edges and voids.

3.5 CABLE IDENTIFICATION

- A. Designate source and load, or feeder or cable identification on tags. Submit identification for the approval of the Architect-Engineer.

END OF SECTION 16120

SECTION 16130 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. Raceway systems as required, and all equipment and material, including conduit, fittings, boxes, wireways, and cable trays, as indicated or specified.

1.3 SUBMITTALS

- A. Letter of Intent: Submit letter of intent for each item. Coordinate the items, as they relate to the work, prior to submittal. Items shall include:
 - 1. Conduit and fittings
 - 2. Boxes

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Work in hazardous areas in accordance with Article 500 of the National Electrical Code.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit, Elbows, and Couplings: Zinc-coated hot dip galvanized threaded steel per ANSI C80.1 "Specification for Rigid Steel Conduit, Zinc-Coated" and UL6. Each length of conduit shall be threaded on both ends.
 - 1. Manufacturer: Provide products of one of the following:
 - a. Allied
 - b. ETP
 - c. Pittsburgh
 - d. Republic
 - e. Triangle

- B. Electrical Metallic Tubing: Zinc-coated steel per ANSI C80.3-1977 "Specification for Electrical Metallic Tubing, Zinc-Coated".

1. Manufacturer: Provide products of one of the following:

- a. Allied
- b. ETP
- c. Republic
- d. Triangle

- C. Flexible Steel Conduit: Per UL-1, "Flexible Steel Conduit".

1. Manufacturer: Provide products of one of the following:

- a. Allied
- b. ETP
- c. Triangle

- D. Liquid-Tight Flexible Steel Conduit: Per UL-1, "Flexible Steel Conduit", with a PVC jacket.

1. Manufacturer: Provide products of one of the following:

- a. "Sealtite"
- b. Electriflex

2.2 CONDUIT FITTINGS

- A. Fittings for Rigid Steel Conduit: Cast or malleable iron bodies, cadmium or zinc-plated, with taper threads, screw attached cover plates, and gaskets when located in areas requiring gaskets as specified in Part 3.

1. Manufacturer: Provide products of one of the following:

- a. Appleton Form 35
- b. Crouse-Hinds Form 8
- c. ETP
- d. Pyle-National Form R

- B. Expansion Fittings for Rigid Steel Conduit: Cast or malleable iron bodies, with threaded end caps for receiving fixed and movable conduits, metallic pressure packing and copper bonding jumper assembly, and providing for a minimum of 2 inches movement of the conduit in either direction.

1. Manufacturer: Provide products of one of the following:

- a. Appleton Type XJ
- b. Crouse-Hinds Type XJ
- c. O-Z Type AX

- C. Couplings and Connectors for EMT: Zinc-plated steel, set screw type.
1. Manufacturer: Provide products of one of the following:
 - a. Appleton
 - b. ETP
 - c. Midwest
 - d. Steel City
 - e. Thomas & Betts
- D. Conduit Unions, On Continuous Run:
1. Manufacturer: Provide products of one of the following:
 - a. Erickson
- E. Fittings for Flexible Steel Conduit: Malleable iron or steel, zinc or cadmium plated, securing the conduit by clamping action around the periphery of the conduit. Do not furnish fittings that anchor the conduit by means of set screws.
1. Manufacturer: Provide products of one of the following:
 - a. Appleton
 - b. ETP
 - c. Steel City
- F. Fittings for Liquid-Tight Flexible Steel Conduit: Designed to maintain the liquid-tight feature of the installation.
1. Manufacturer: Provide products of one of the following:
 - a. Appleton ST Series
 - b. ETP
 - c. Thomas & Betts 5331 to 5360
- G. Locknuts for Rigid Steel Conduit: Malleable iron or steel, zinc or cadmium plated.
- H. Bushings for 1 Inch and Smaller Rigid Steel Conduits: Insulating plastic type of non-burnable thermosetting phenolic, conforming to Underwriters' Laboratories requirements. Do not furnish non-rigid plastic bushings.
- I. Bushings for 1-1/4 Inch and Larger Rigid Steel Conduits: Malleable iron or steel, zinc or cadmium plated, with insulating insert of thermosetting plastic as specified for smaller conduit bushings, molded and locked into the bushing ring.

2.3 OUTLET BOXES

- A. Sheet Steel Boxes: Galvanized or sherardized stock not less than No. 14 gage, with knockout openings, single or multiple gang, with extensions, adapters, plaster rings, tile covers, fixture studs and cover plates. Furnish accessories with same gage and finish as specified for boxes, except where special finishes are specified for covers and device plates in Section 16121. Provide sizes per NEC requirements for wiring space, except where minimum sizes are specified under Part 3.

1. Manufacturer: Provide products of one of the following:

- a. Appleton
- b. RACO
- c. Steel City

- B. Cast or Malleable Iron Boxes: Galvanized or cadmium plated, single or multiple gang, with taper threaded hubs, adapters and cover plates. Furnish cast metal, galvanized or cadmium plated accessories, except where special device plates are specified in Section 16121. Furnish gaskets when located in areas requiring gaskets as specified in Part 3. Provide sizes per NEC requirements for wiring space, except where minimum sizes are specified under Part 3.

1. Manufacturer: Provide products of one of the following:

- a. Appleton
- b. Crouse-Hinds
- c. Pyle-National
- d. Russelstoll

2.4 PULL AND JUNCTION BOXES

- A. Boxes Less than 5 Inches by 5 Inches: Conform to requirements specified for Outlet Boxes.
- B. Sheet Metal Boxes: Code gage, full seam welded with bent-in flanges seam welded at corner joints, screw fastened cover of same gage as box. Fasten cover with brass machine screws. Galvanize box and cover after fabrication. Provide sizes conforming to NEC requirements for wiring space, except where boxes of larger size are indicated. Furnish gaskets when located in areas requiring gaskets as specified in Part 3.
- C. Cast or Malleable Iron Boxes: Code gage, with threaded hubs or conduit bosses for field drilling and tapping, screw fastened cover of same gage as box. Fasten cover with brass machine screws. Galvanize box and cover after fabrication. Provide sizes conforming to NEC requirements for wiring space, except where boxes of larger size are indicated. Furnish gaskets when located in areas requiring gaskets as specified in Part 3.

1. Manufacturer: Provide products of one of the following:

- a. Hoffman
- b. O-Z

2.5 MISCELLANEOUS

A. Trapeze Hangers

1. Manufacturer: Provide products of one of the following:

- a. Kindorf
- b. Powerstrut
- c. Unistrut

B. Shielding Paint

1. Manufacturer: Provide products of one of the following:

- a. Thomas & Betts "KopR-Shield"

C. Sealant: Single component, non-sage urethane:

1. Manufacturer: Provide products of one of the following:

- a. Sika Corp. "Sikaflex 1a"
- b. Pecora Corp. "Dynatrol 1"
- c. Sonneborn "Sonolastic NP-1"
- d. Tremco "Dymonic"

PART 3 - EXECUTION

3.1 CONDUIT SYSTEMS

- A. Install rigid steel conduit for all main feeders which include feeders to switchboards, panelboards, distribution panels, transformers, and motor control centers. Install rigid steel conduit for all conduits 2" in diameter or larger. Where conduits are routed exposed in "unfinished" or "open" areas, rigid steel conduits shall be installed up to 10'-0" above finished floor. Unless otherwise specified or indicated, the use of electric metallic tubing is permitted for branch circuits above suspended ceilings, in concealed wall cavities in offices or similarly "finished areas", or in unfinished areas 10'-0" above finished floor.
- B. Install flexible conduit in lieu of rigid conduit or EMT for service to individual recessed fixtures, 1/2 inch minimum size, and for final connection to equipment subject to vibration or movement. Use liquidtight type of flexible conduit in lieu of non-jacketed flexible conduit in damp or wet locations and for final connections to all motors and transformers.
- C. Install conduit systems as indicated, as required by the NEC, and as specified. Install conduit sizes as indicated. Where conduit sizes are not indicated, install sizes per NEC requirements, except do not use conduit sizes smaller than 3/4 inch unless otherwise specified.
- D. Install conduit concealed in office and similar finished areas, and exposed in all other areas unless otherwise indicated or specified. Do not run conduit in or under concrete floors in contact with earth in utility areas unless specifically indicated.
- E. Install exposed conduit runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Keep conduit at least six inches away from parallel runs of high

temperature surfaces, such as steam or hot water pipes and do not run conduit directly under cold water lines.

- F. Group conduit for common support, where indicated and elsewhere as directed by the Architect-Engineer.
- G. Do not install crushed or deformed conduits and avoid trapped runs in damp or wet locations. Take care to prevent the entrance of water and the lodging of concrete, plaster, dirt or trash in conduit, boxes, fittings and equipment during the course of construction. Free conduit of obstructions or replace the conduits. Where conduit joints occur in concrete slabs, or in damp or wet locations, make joints watertight by applying an approved compound on the entire thread area before assembling. Draw up all conduit joints as tightly as possible. Cap exposed empty conduits which do not terminate in outlets, panels, cabinets, etc. with standard galvanized plumbers pipe caps. Plug empty conduits which terminate flush with floors or walls with flush coupling and brass plug.
- H. Install conduit sleeves for all exposed conduits and cables passing through walls, ceilings or floors, and fill the void between sleeve and conduit with sealant flush with the end of the sleeve to seal the opening.
 - 1. For conduit sleeves passing through fire rated walls, floors or ceilings, comply with requirements of Section 07841 "Through-Penetration Firestop Systems".
- I. Make changes in direction of runs with symmetrical bends, fittings or pull boxes. Do not use bends around outside corners; use fittings for same. Install elbows, bends and offsets having a minimum radius of curvature of 24 inches for 2 inch and 2-1/2 inch conduit, and 36 inches for 3 inch and larger conduit. Except where conduit runs are shown in exact detail, install pull points at not greater than 200 foot intervals in straight runs. Where bends are included between pull points, reduce this maximum permissible 200 foot separation between pull points by 50 feet for each 90 degree bend and 25 feet for each 45 degree bend. Figure deductions for all other angle bends on a similar basis. When bends are made in the field, make bends with an approved hickey or conduit bending machine. Make bends in 1-1/4 inch and larger conduits with standard conduit ells where possible.
- J. Provide conduit nipples with two independent sets of threads. Do not use running threads on any part of the conduit system. Where conditions require joining two fixed conduits into a continuous run, use a conduit union, in place of running threads and coupling.
- K. Install expansion fittings in exposed conduit runs of greater than 100 feet in length, crossing building expansion joints, and elsewhere as indicated.
- L. Install double locknuts and bushings on all rigid conduit terminations into threadless openings. Increase length of conduit threads at terminations sufficiently to permit the bushing to be fully seated against the end of the conduit.

- M. Use one hole malleable iron galvanized pipe straps for support of single conduits, or clevis type hangers. Support groups of conduit on trapeze hangers. Use threaded rod or pipe for hanger support. Do not use perforated strap or wire for conduit or hanger support. Use beam clamps or malleable iron or wrought steel with hook rods to grip the beam flange for conduit or hanger support; do not use C-clamp type fittings. Support exposed conduit at least every 8 feet if smaller than 2 inch, and every 10 feet if 2 inch and larger unless otherwise noted.
- N. All wiring shall be installed in raceways. The use of MC cable, AC cable, or BX cable shall not be permitted.
- O. All conduit systems and circuits shall be provided with an equipment grounding conductor.

3.2 OUTLET, SWITCH, JUNCTION AND PULL BOXES

- A. Outlet Boxes for Use with Rigid Steel Conduit in Non-Hazardous Areas: Sheet steel for flush or concealed work in dry locations; cast or malleable iron in exposed, damp or wet locations. Do not use sheet steel outlet boxes in utility areas.
- B. Outlet Boxes for Use with Electrical Metallic Tubing: Sheet steel for flush or concealed work; cast or malleable iron for exposed locations.
- C. Flush Mounted Boxes: For single outlets, use boxes not less than 4 inches square and 2-1/8 inches deep. For multiple outlets, use gang type boxes not less than 2-1/4 inches deep. Furnish plaster rings not less than 1-1/8 inches deep. For ceiling outlets in concrete slabs, use boxes not less than 3 inches deep.
- D. Gaskets: Provide cover gaskets for boxes in damp or wet locations and in utility areas.
- E. Pull and Junction Boxes for Use with Each Type of Conduit: As specified for outlet boxes for each conduit type under above paragraphs.
- F. Install boxes in the wiring or raceway systems as required for pulling of wires, making connections, and mounting of devices and fixtures.
- G. Install extension rings, adapters, raised covers and plaster rings on flush mounted boxes as required. Equip flush mounted boxes in masonry block or tile walls with tile covers.
- H. Locate outlets in offices and other finished areas with due regard for the finish and interior architectural treatment so that outlets are centered with respect to panels, joints or moldings, and so that plaster rings, frames and tile covers are properly located with respect to the finished surface.
- I. Support boxes independent of conduit and secure rigidly in place. Install boxes used for fixture support such that they are capable of carrying 100 pounds.
- J. In concrete, anchor boxes securely to reinforcing steel and to forms to prevent shifting when concrete is placed.
- K. Above suspended ceilings, support boxes independent of the ceiling; fasten boxes to the ceiling support system by bar hanger or other approved support.

END OF SECTION 16130

SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. This section includes straps, clamps, steel channel, and fastening hardware for supporting electrical work.

1.3 REFERENCES

- A. NECA - National Electrical Contractors Association.
- B. ANSI/NFPA 70 - National Electrical Code.

1.4 SECTION INCLUDES

- A. Conduit and equipment supports.
- B. Anchors and fasteners.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: all material provided shall have a protective zinc coating either Electro-Plated (ASTM B633 SCl or SC3), Pre-Galvanized (ASTM A525 coating designation G90) or Hot-Dip Galvanized after fabrication (ASTM A123). The minimum thickness of zinc coating shall be 0.2 mil (5 micrometers).
- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- C. All structural supports and channels shall be manufactured from ASTM A570 grade 33 steel. The minimum gauge of steel shall #16.
- D. The contractor shall replace all supports and channels that sag, twist, and or show signs of not providing proper structural support, to the equipment, it is intended for, as determined by the Owner and Engineer. All costs associated with replacing supports and steel channels shall be incurred by the contractor.

E. Anchors and Fasteners:

1. Concrete Structural Elements: Use expansion anchors, powder actuated anchors and preset inserts.
2. Steel Structural Elements: Use beam clamps and steel ramset fasteners.
3. Concrete Surfaces: Use expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use hollow wall fasteners.
5. Solid Masonry Walls: Use expansion anchors.
6. Sheet Metal: Use sheet metal screws.
7. Wood Elements: Use wood screws.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation."
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- E. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- F. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.
- G. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION 16190

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. Identification is required for the following principal items of equipment and systems (not an inclusive list):
 - 1. Disconnecting means.
 - 2. Ungrounded conductors.
 - 3. Service disconnecting means.
 - 4. Wiring device terminals.
 - 5. High leg.
 - 6. Panelboard circuits.
 - 7. Flexible cords.
 - 8. Fire protective signal circuits.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Provide identification on all electrical equipment installed, including transformers, switchgear, switchboard, control centers, panelboards, circuit breakers, starters, switches, push-button stations, contactors, and terminal cabinets.
- B. Nameplates shall be laminated phenolic plastic, beveled edged white with engraved black letters. Except where impractical, letters and numerals shall be a minimum of 1/4 inch high. Nameplates shall be mechanically secured. Pressure sensitive nameplates are not acceptable. Panel directories shall be neatly typed, showing equipment served and location for each breaker or switch with a clear plastic protective cover. Update all panel directories in existing panelboards affected by the work of this project by providing new typed directories in these panels.
- C. The room names and number indicated on the construction documents are for reference only. Panelboard directories shall be completed using the Owner's final approved room numbering scheme.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Marking: The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product may be identified shall be placed on all electric equipment. Other markings shall be provided indicating voltage, current, wattage, or other ratings as applicable. The marking shall be sufficient durability to withstand the environment involved.

- B. Identification of the following specific equipment and systems should be addressed:
1. Disconnecting means for motors, appliances, service feeders, and branch circuits.
 2. Grounded conductors: identified by a continuous white or natural gray outer finish along its entire length.
 3. Terminals.
 - a. Terminals to which the grounded conductor is to be connected shall be white in color.
- C. Identify and/or color code:
1. Ungrounded conductors where more than one nominal voltage system exists in a building.
 2. Grounded conductor of branch circuit wiring identified by a continuous white or gray color.
 3. Equipment grounding conductor identified by a continuous green color or continuous green color with one or more yellow stripes.
 4. Higher voltage to ground phase conductor identified by an outer finish that is orange in color or tagging.
 5. Intrinsically safe circuits.
 6. Fire protective circuits.
 7. Emergency and egress lighting circuits.

END OF SECTION 16195

SECTION 16264 – UNINTERRUPTIBLE POWER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty three-phase, solid-state, scalable (field-upgradable) uninterruptible power system (UPS). The UPS shall provide high-quality AC power for sensitive electronic equipment loads.

1.3 STANDARDS

- A. The UPS shall be designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.
 - 1. CSA 22.2, No. 107.1
 - 2. FCC Part 15, Class A
 - 3. IEC 61000-4-5
 - 4. ISO 9001
 - 5. National Electrical Code (NFPA-70)
 - 6. NEMA PE-1
 - 7. UL Standard 1778
 - 8. ISTA_1H
- B. The UPS shall be UL and cUL listed per UL Standard 1778.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements - UPS Module
 - 1. Voltage. Input/Output Voltage Specifications of the UPS shall be:
 - a. Rectifier Input: 480 volts, three-phase, 3-wire-plus-ground
 - b. Output: 480 volts, three-phase, 3-wire-plus-ground
 - 2. Output Load Capacity. Specified output load capacity of the UPS shall be 40 kVA at 0.9 lagging power factor.
 - 3. Scalable Output Capacity: UPS rated output capacity will be scalable. Unit shall have a starting capacity of 40kVA and scale to 60kVA and 80kVA.

B. Design Requirements - Battery

1. Battery Cells: Sealed, lead-acid, valve-regulated.
2. Reserve Time: 13 minutes (minimum) at 40 kVA, 0.9 power factor, with ambient temperature of 77°F (25°C). Unit shall provide terminal for connection of external batteries.
3. Recharge Time: to 95% capacity within ten (10) times discharge time.

C. Modes of Operation

1. The UPS shall be designed to operate as an on-line, double-conversion, reverse-transfer system in the following modes:
 - a. Normal - The critical AC load is continuously supplied by the UPS inverter. The rectifier/charger derives power from a utility AC source and supplies DC power to the inverter while simultaneously float-charging the reserve battery.
 - b. Emergency - Upon failure of utility AC power, the critical AC load is supplied by the inverter, which obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.
 - c. Recharge - Upon restoration of utility AC power after a utility AC power outage, the rectifier/charger shall automatically restart, gradually ramp up output voltage and assume the inverter and battery recharge loads.
 - d. Bypass - If the UPS must be taken out of service for maintenance or repair or if the inverter overload capacity is exceeded, the static transfer switch shall perform a reverse transfer of the load from the inverter to the bypass source with no interruption in power to the critical AC load.

D. Performance Requirements

1. AC Input to UPS
 - a. Voltage Configuration for Standard Units: 480V, three-phase, three-wire plus ground
 - b. Voltage Range: +15%, -20% of nominal without derating
 - c. Frequency: 57-66 Hz
 - d. Power Factor: >0.99 at nominal input voltage and full-rated UPS output load
 - e. >0.98 at nominal input voltage and half-rated UPS output load
 - f. Inrush Current: 600% of full load current maximum
 - g. Current Limit: 140% of nominal AC input current maximum
 - h. Current Distortion: <3% reflected THD maximum at full load
 - i. Surge Protection: Sustains input surges without damage per criteria listed in IEC 1000-4-5

2. AC Output, UPS Inverter
 - a. Voltage Configuration: three-phase, 3-wire plus ground
 - b. Voltage Regulation:
 - 1) $\pm 1\%$ three-phase RMS average for a balanced three-phase load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature and load power factor
 - 2) $\pm 2\%$ three-phase RMS average for a 100% unbalanced load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature and load power factor
 - c. Frequency: Nominal frequency $\pm 0.05\%$.
 - d. Frequency Slew Rate: Selectable from 0.1 Hz/sec to 3.0 Hz/sec maximum
 - e. Phase Displacement:
 - 1) ± 0.5 degree for balanced load
 - 2) ± 1.0 degrees for 100% unbalanced load
 - f. Bypass Line Sync Range:
 - 1) ± 2.0 Hz, field-selectable ± 0.5 to 5.0 Hz
 - g. Voltage Distortion:
 - 1) 1% total harmonic distortion (THD) for linear loads
 - 2) $< 5\%$ THD for 100% nonlinear loads (3:1 crest factor) without kVA/kW derating
 - h. Load Power Factor Range: 0.7 lagging to 1.0 leading without derating
 - i. Output Power Rating: Rated kVA at 0.9 lagging power factor
 - j. Overload Capability:
 - 1) 110% for 1 hour
 - 2) 125% for 10 minutes
 - 3) 150% for 1 minute
 - k. Voltage Transient Response:
 - 1) 100% load step $\pm 5.0\%$
 - 2) Loss or return of AC input power $\pm 1.0\%$
 - l. Transient Recovery Time: to within 2% of output voltage within one cycle
 - m. Voltage Unbalance: 100% unbalanced load, $\pm 2\%$

1.5 ENVIRONMENTAL CONDITIONS

- A. The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:
 1. Operating Ambient Temperature
 - a. UPS Module: 32°F to 104°F (0°C to 40°C)
 - b. Battery: 77°F $\pm 9^\circ$ F (25°C $\pm 5^\circ$ C)

2. Storage/Transport Ambient Temperature
 - a. UPS Module: -13°F to 158°F (-25°C to 70°C)
 - b. Battery: -4°F to 92°F (-20°C to 33°C)
3. Relative Humidity: 0 to 95%, non-condensing
4. Altitude
 - a. Operating: to 6562 ft. (2000m) above Mean Sea Level without derating. Derated from 6562 ft. (2000m) to 9843 ft. (3000m) for higher altitude applications.
 - b. Storage/Transport: to 40,000 ft. (12,200m) above Mean Sea Level.
5. Audible Noise
 - a. Less than 63dB for 120kVA and 61dB for 80kVA typical (fan at low speed)
 - b. Less than 69dB for 120kVA and 67dB for 80kVA at worse case (fan at high speed)

1.6 SUBMITTALS

A. Proposal Submittals

Submittals with the proposal shall include:

1. System configuration with single-line diagrams
2. Functional relationship of equipment including weights, dimensions and heat dissipation
3. Descriptions of equipment to be furnished, including deviations from these specifications
4. Size and weight of shipping units to be handled by installing contractor
5. Detailed layouts of customer power and control connections
6. Detailed installation drawings including all terminal locations

- B. UPS Delivery Submittals: Submittals upon UPS delivery shall include a complete set of submittal drawings and one (1) set of instruction manuals that shall include a functional description of the equipment with block diagrams, safety precautions, instructions, step-by-step operating procedures and routine maintenance guidelines, including illustrations.

1.7 WARRANTY

- A. UPS Module: The UPS manufacturer shall warrant the UPS module against defects in materials and workmanship for 12 months after initial startup or 18 months after ship date, whichever period expires first.
- B. Battery: The battery manufacturer's standard warranty shall be passed through to the end user.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A minimum of 20 years' experience in the design, manufacture and testing of solid-state UPS systems is required. The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001:2000 certified.
- B. Factory Testing: Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification.

PART 2 - PRODUCTS

2.1 FABRICATION

A. Materials

1. All materials of the UPS shall be new, of current manufacture, high grade and free from all defects and shall not have been in prior service except as required during factory testing.
2. The maximum working voltage, current and di/dt of all solid-state power components and electronic devices shall not exceed 75% of the ratings established by their manufacturer. The operating temperature of solid-state component sub-assembly shall not be greater than 75% of their ratings. Electrolytic capacitors shall be computer grade and be operated at no more than 95% of their voltage rating at the maximum rectifier charging voltage.

B. Wiring

1. Wiring practices, materials and coding shall be in accordance with the requirements of the National Electrical Code (NFPA 70). All bolted connections of busbars, lugs and cables shall be in accordance with requirements of the National Electrical Code and other applicable standards. All electrical power connections are to be torqued to the required value and marked with a visual indicator.
2. Provision shall be made for power cables to enter or leave from the top or bottom of the UPS cabinet.

C. Construction and Mounting

1. The UPS unit, comprised of an input circuit breaker, rectifier/charger, inverter, static transfer switch and maintenance bypass switch, shall be housed in a single free-standing NEMA type 1 enclosure. Cabinet doors/covers shall require a tool for gaining access. Casters and stops shall be provided for ease of installation. Front access only shall be required for expedient servicing and adjustments. The UPS cabinet shall be structurally adequate and have provisions for hoisting, jacking and forklift handling.
2. The UPS cabinet shall be cleaned, primed and painted with the manufacturer's standard color. The UPS shall be constructed of replaceable subassemblies. Printed circuit assemblies shall be plug connections. Like assemblies and like components shall be interchangeable.

D. Cooling

1. Cooling of the UPS shall be by forced air using a redundant fan configuration. Fan power shall be provided by the UPS.
2. The thermal design, along with all thermal and ambient sensors, shall be coordinated with the protective devices before excessive component or internal cabinet temperatures are exceeded.

- E. Grounding: The UPS chassis shall have an equipment ground terminal. Provisions for local bonding shall be provided.

2.2 COMPONENTS

A. Rectifier/Charger

1. General: The term 'rectifier/charger' shall denote the solid-state equipment and controls necessary to convert incoming AC power to regulated DC power for input to the inverter and for battery charging. The rectifier/charger shall be a solid-state IGBT type with constant voltage/current limiting control circuitry.
2. AC Input Current Limiting: The rectifier/charger unit shall be provided with AC input current limiting whereby the maximum input current shall be limited to 140% of the full input current rating. The rectifier/charger shall operate at a reduced current limit mode whenever the critical load is powered from the UPS static bypass circuit such that the maximum UPS input current will not exceed 125% of full load input current. In addition, the rectifier/charger shall have a battery current limit, adjustable from 0 to 25% of the full load input current.
3. DC Filter: The rectifier/charger shall have a filter to minimize ripple voltage into the battery. Under no conditions shall ripple voltage into the battery exceed 1% RMS. The filter shall be adequate to ensure that the DC output of the rectifier/charger will meet the input requirements of the inverter. The inverter shall be able to operate from the rectifier/charger with the battery disconnected.
4. Automatic Rectifier Restart: Upon restoration of utility AC power, after a utility AC power outage and prior to a UPS automatic end-of-discharge shutdown, the rectifier/charger shall automatically restart, walk-in and gradually assume the inverter and battery recharge loads.
5. Battery Recharge: In addition to supplying power for the inverter load, the rectifier/charger shall be capable of producing battery charging current sufficient to replace 95% of the battery discharge power within ten (10) times the discharge time. After the battery is recharged, the rectifier/charger shall maintain the battery at full charge until the next emergency operation.
6. Overvoltage Protection: There shall be DC overvoltage protection so that if the DC voltage rises to the preset limit, the UPS will shut down automatically and initiate an uninterrupted load transfer to the static bypass line.

B. Inverter

1. General: The term 'inverter' shall denote the solid-state equipment and controls to convert DC power from the rectifier/charger or battery to regulated AC power for supporting the critical load. The inverter shall use Insulated Gate Bipolar Transistors (IGBTs) in a phase-controlled, pulse-width-modulated (PWM) design capable of providing the specified AC output.
2. Overload Capability: The inverter shall be capable of supplying current and voltage for overloads exceeding 100%. The inverter is to provide 150% of full load for 1 minute, 125% of full load for 10 minutes and 110% of full load for 1 hour. A status indicator and audible alarm shall indicate overload operation. The UPS shall transfer the load to bypass when overload capacity is exceeded.
3. Fault Clearing and Current Limit: The inverter shall be capable of supplying an overload current of 150% of its full-load rating for one minute. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The critical load will be transferred to the static bypass automatically and uninterrupted. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective fuses.
4. Step Load Response

5. Voltage Distortion: For linear loads, the output voltage total harmonic distortion (THD) shall not be greater than 1%. For 100% rated load of 3:1 crest factor nonlinear loads, the output voltage total harmonic distortion shall not be greater than 4%. The output rating is not to be derated in kVA nor kW due to the 100% nonlinear load with 3:1 crest factor.
6. Phase Balance: Electronic controls shall be provided to regulate each phase so that an unbalanced loading will not cause the output voltage to go outside the specified voltage unbalance or phase displacement. With 100% load on one phase (and 0% load on the other two phases) or 100% load on two phases (and 0% load on the other phase), the voltage balance is to be within 2% and the phase displacement is to be 120 degrees within ± 1 degree.
7. Inverter Shutdown: For rapid removal of the inverter from the critical load, the inverter control electronics shall instantaneously turn off the inverter transistors. Simultaneously, the static transfer switch shall be turned on to maintain continuous power to the critical load.
8. Inverter DC Protection: The inverter shall be protected by the following disconnect levels:
 - a. DC Overvoltage Shutdown
 - b. DC Undervoltage Warning (Low Battery Reserve)—pre-warning time is adjustable
 - c. DC Undervoltage Shutdown (End of Discharge)
9. Output Frequency: The output frequency of the inverter shall be controlled by a high-speed DSP microcontroller capable of holding the inverter output frequency to within $\pm 0.05\%$ during steady state and transient conditions. Total deviation from the rated frequency, including short time fluctuations and drift, shall not exceed 0.05%.

C. Display And Controls

1. Monitoring and Control
 - a. The UPS shall be provided with a microprocessor-based unit status display and controls section designed for convenient and reliable user operation. A graphical liquid crystal display (LCD) shall be used to show a single-line diagram of the UPS and shall be provided as part of the monitoring and controls sections of the UPS. All operator controls and monitors shall be located on the front of the UPS cabinet. Monitoring functions such as metering, status and alarms shall be displayed on the graphical LCD.
 - b. Additional features of the monitoring system shall include:
 - 1) Menu-driven display with pushbutton navigation
 - 2) Real-time clock (time and date)
 - 3) Alarm history with time and date stamp
 - 4) Memory with battery backup
2. Metering
 - a. The following parameters shall be displayed:
 - 1) Input AC voltage line-to-line
 - 2) Input AC current for each phase
 - 3) Input frequency
 - 4) Battery voltage
 - 5) Battery charge/discharge current
 - 6) Output AC voltage line-to-line
 - 7) Output AC current for each phase
 - 8) Output frequency
 - 9) Apparent power
 - 10) Active power
 - 11) Battery time left during battery operation

3. Alarm Messages

a. The following alarm messages shall be displayed:

1. Mains Voltage Abnormal
2. Mains Undervoltage
3. Mains Freq. Abnormal
4. Mains Phase Reversed
5. Charger Fault
6. Battery Reversed
7. No Battery
8. Control Power 1 Fail
9. Parallel Comm. Fail
10. Bypass Unable To Track
11. Bypass Abnormal
12. Inverter Asynchronous
13. Fan Fault
14. Control Power 2 Fail
15. Unit Over Load
16. System Over Load
17. Bypass Phase Reversed
18. Transfer Time-Out
19. Load Sharing Fault
20. Parallel Connect Fault
21. Bypass Over Current
22. Output Ground Fault

4. Status Messages

a. The following UPS status messages shall be displayed:

- 1) Rectifier (Off / Soft Start / Main Input On / Battery Input On)
- 2) Input Supply (Normal Mode / Battery Mode / All Off)
- 3) Battery Self Test (True / False)
- 4) Input Disconnect (Open / Closed)
- 5) Epo (True / False)
- 6) Charger (On / Off)
- 7) Output Disconnect (Open / Closed)
- 8) Maint. Disconnect (Open / Closed)
- 9) Bypass Disconnect (Open / Closed)
- 10) Inverter (Off / Soft Start / On)
- 11) Bypass (Normal / Unable To Trace / Abnormal)
- 12) Output Supply (All Off / Bypass Mode / Inverter Mode / Output Disable)
- 13) Inverter On (Enable / Disable)

5. Controls: UPS startup, shutdown and maintenance bypass operations shall be accomplished through pushbutton controls on the front panel. Menu-driven user prompts shall be provided to guide the operator through system operation without the use of additional manuals. Pushbuttons shall be provided to display the status of the UPS and to test and reset visual and audible alarms. A mimic screen shall be available on the LCD to depict a single-line diagram of the UPS with switch positions and power flow.
6. On-Line Battery Test: The UPS shall be provided with a menu-driven On-Line Battery Test feature. The test shall ensure the capability of the battery to supply power to the inverter while the load is supplied power in the normal mode.

D. Static Transfer Switch

1. General

- a. A static transfer switch and bypass circuit shall be provided as an integral part of the UPS. The static switch shall be a naturally commutated high-speed static (SCR-type) device rated to conduct full load current continuously. The switch shall have an overload rating to clear a 20-ampere load branch circuit breaker.
- b. The static transfer switch control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarm conditions. This control circuit shall provide an uninterrupted transfer of the load to an alternate bypass source without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS or to bypass the UPS for maintenance.

2. Uninterrupted Transfer

- a. The transfer control logic shall automatically turn on the static transfer switch, transferring the critical AC load to the bypass source, after the transfer logic senses any of the following conditions:
 - 1) Inverter overload capacity exceeded
 - 2) Critical AC load overvoltage or undervoltage
 - 3) UPS fault condition
- b. The transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if any of the following conditions are present:
 - 1) Bypass frequency out of limits
 - 2) Bypass out-of-synchronization range with inverter output

3. Uninterrupted Retransfer

- a. Retransfer of the critical AC load from the bypass source to the inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic shall inhibit an automatic retransfer of the critical load to the inverter if one of the following conditions exists:
 - 1) Bypass out of synchronization range with inverter output
 - 2) Inverter/bypass voltage difference exceeding preset limits
 - 3) Overload condition exists in excess of inverter full load rating
 - 4) UPS fault condition present

E. Maintenance Bypass Switch

- 1. General: A manually operated maintenance bypass switch shall be incorporated into the UPS cabinet to directly connect the critical load to the bypass AC input power source, bypassing the rectifier/charger, inverter and static transfer switch.
- 2. Isolation: All energized terminals shall be shielded to ensure that maintenance personnel do not inadvertently come in contact with energized parts or terminals. A means to de-energize the static switch shall be provided when the UPS is in the maintenance bypass mode of operation.

F. Battery Power Pack

- 1. The battery power pack shall include sealed, lead-acid, valve-regulated battery cells housed in a separate cabinet that matches the UPS cabinet styling to form an integral system lineup. Battery cells shall be mounted on slide-out trays for ease of maintenance. A battery disconnect circuit breaker shall be included for isolation of the battery pack from the UPS module. The UPS shall be automatically disconnected from the battery when the battery reaches the minimum discharge voltage level. Casters and leveling feet shall also be provided with the battery power pack cabinet

for ease of installation. When the application calls for the battery cabinet to be bolted to the UPS cabinet, an interconnecting cable kit will be available, pre-cut and pre-lugged.

G. Accessories

1. Network Interface Card (NIC) shall provide communication outputs to indicate a change of status of the UPS. Outputs shall be provided for:
 - a. SNMP
 - b. HTML - Web page
 - c. Network management systems

H. Manufacturer: Provide one of the following:

1. Liebert NX
2. Or approved equal by APC.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. The following inspections and test procedures shall be performed by factory-trained field service personnel during the UPS startup.
1. Visual Inspection
 - a. Inspect equipment for signs of damage.
 - b. Verify installation per drawings.
 - c. Inspect cabinets for foreign objects.
 - d. Verify neutral and ground conductors are properly sized and configured.
 - e. Inspect battery cases.
 - f. Inspect battery for proper polarity.
 - g. Verify all printed circuit boards are configured properly.
 2. Mechanical Inspection
 - a. Check all control wiring connections for tightness.
 - b. Check all power wiring connections for tightness.
 - c. Check all terminal screws, nuts and/or spade lugs for tightness.
 3. Electrical Inspection
 - a. Check all fuses for continuity.
 - b. Confirm input voltage and phase rotation is correct.
 - c. Assure connection and voltage of the battery string(s).

3.2 MANUFACTURER'S FIELD SERVICE

- A. Service Personnel
1. The UPS manufacturer shall directly employ a nationwide service organization consisting of factory-trained field service personnel dedicated to the startup, maintenance and repair of UPS and power equipment. The organization shall consist of regional and local offices.
 2. The manufacturer shall provide a fully automated national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours/day, 7 days/week, 365 days/year. If emergency service is required, response time shall be 20 minutes or less.

3. An automated procedure shall be in place to ensure that the manufacturer is dedicating the appropriate technical support resources to match escalating customer needs.
- B. Replacement Parts Stocking
1. Parts shall be available through an extensive network to ensure round-the-clock parts availability throughout the country.
 2. Recommended spare parts shall be fully stocked by local field service personnel with backup available from national parts center and the manufacturing location. The national parts center Customer Support Parts Coordinators shall be on-call 24 hours/day, 7 days/week, 365 days/year for immediate parts availability. Parts from the national parts center shall be shipped within 4 hours on the next available flight out and delivered to the customer's site within 24 hours.
- C. UPS Training
1. Provide operator training sessions for eight (8) hours minimum at the jobsite building as determined by the Owner.
 2. Maintenance training courses for customer employees shall be available by the UPS manufacturer. The training is in addition to the basic operator training conducted as a part of the system startup.
- D. Maintenance Contracts: A complete offering of preventive and full-service maintenance contracts for both the UPS system and battery system shall be available. An extended warranty and preventive maintenance package shall be available. Warranty and preventive maintenance service shall be performed by factory-trained service personnel.

END OF SECTION 16264

SECTION 16265 – POWER CONDITIONING CENTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. These specifications describe requirements for a complete power conditioning and distribution center, supplying power to sensitive electronic loads. The specified center shall provide isolation, distribution, control and monitoring of AC power. It shall include all equipment to properly interface the AC power source to the intended load.

1.3 STANDARDS

- A. The specified system shall be designed, manufactured, tested and installed in compliance with:
 - 1. American National Standards Institute (ANSI)
 - 2. Canadian Standards Association (CSA)
 - 3. Federal Information Processing Standards Publication 94 (FIPS Pub 94)
 - 4. Institute of Electrical and Electronics Engineers (IEEE)
 - 5. ISO 9001
 - 6. National Electrical Code (NEC - NFPA 70)
 - 7. National Electrical Manufacturers Association (NEMA)
 - 8. National Fire Protection Association (NFPA 75)
 - 9. Underwriters Laboratories (UL)
- B. The Power Conditioning Center (PCC) shall be UL listed as a complete system under UL 60950 Standard for Information Technology Equipment.
- C. The specified center shall comply with latest FCC Part 15 EMI emission limits for Class A computing devices and the emission and immunity limits of EN50081-2/EN550022 Class A and EN50082-2.
- D. The PCC shall safely withstand without misoperation or damage:
 - 1. Transient voltage surges on the AC power input as defined by ANSI/IEEE C62.41 for Category B3 locations (high surge exposure industrial and commercial facilities),
 - 2. Electrostatic discharges (ESD) up to 10 kV at any point on the exterior of the unit and
 - 3. Electromagnetic fields from portable transmitters within 3 feet of the unit.

1.4 SYSTEM DESCRIPTION

- A. Electrical Requirements
 - 1. Output capacity shall be 80 kW/80 kVA (minimum).
 - 2. Input voltage shall be 480 volts AC, 60 Hz, three-phase, three-wire-plus-ground.
 - 3. Output voltage shall be 208/120 volts AC, three-phase, four-wire-plus-ground, wye configuration.
- B. Environmental Requirements
 - 1. Storage temperature range: -55 to +85°C (-67 to +185°F).
 - 2. Operating temperature range: 0 to 40°C (+32 to 104°F).
 - 3. Relative humidity: 0% to 95% without condensing.

4. Operating altitude: Up to 6,600 ft. above Mean Sea Level. Derated for higher altitude applications.
5. Storage/transport: Up to 40,000 ft. above Mean Sea Level.
6. Audible noise: Under normal operation noise level shall not exceed than the ANSI C89 standard for transformers.

1.5 DOCUMENTATION

- A. Drawings
 1. Submittal drawings shall include:
 - a. One-line wiring diagrams
 - b. Outline drawings including weight, dimensions, heat dissipation and recommended service clearances
 - c. Location and detailed layout of customer power and control connections
 - d. Outline drawings of options if supplied
- B. Equipment Manual : The manufacturer shall furnish an installation, operation and maintenance manual with installation, startup, operation and maintenance instructions for the specified system.
- C. Spare Parts: A list of recommended spare parts shall be supplied at the customer's request.
- D. User's List: An in-service user's list shall be furnished upon request.

1.6 WARRANTY

- A. The manufacturer shall provide a one-year warranty against defects in material and workmanship for 12 months after initial startup or 18 months after ship date, whichever occurs first. (Refer to the Warranty Statement for details.)

1.7 QUALITY ASSURANCE

- A. The specified center shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, "Hi-Pot" Test (two times rated voltage plus 1000 volts, per UL requirements) and Metering Calibration Tests. The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

PART 2 - PRODUCT

2.1 COMPONENTS

- A. Frame Construction and Enclosure
 1. The frame shall be constructed of galvanized steel and pop riveted to provide a strong substructure. The enclosure shall be mounted on four (4) heavy-duty swivel casters for portability and ease of installation and shall be provided with four permanent leveling jacks for final installation. The unit shall have easily removable output cable trays on the top and bottom to allow matching the size and number of cable/conduit openings to the site requirements. A minimum of 42 cable/conduit openings shall be provided for each output panelboard. All service shall be capable of being performed with access to the front, rear and top. Retrofitting additional power distribution cables shall require access to the rear of the unit only. A tool shall be required to remove the exterior panels, which access the hazardous voltage area of the unit.

2. The unit shall have lockable, removable, hinged front and rear doors that are 16-gauge perforated sheet metal construction to maximize ventilation. A two-point latch with key lock is provided for security. Doors shall provide access to the main input circuit breaker and to all output circuit breakers. Doors and side panels are finished in powder-coat black.
 3. The unit shall be naturally convection-cooled. No fans for forced-air cooling system shall be used. The convection cooling method shall allow continuous full-load operation without activation of over-temperature circuits. Heat rejection shall be through a screened protective top, which prohibits entry of foreign material.
 4. The frame shall be configured to accept future field installation of additional bolt-on distribution sections containing additional panelboards. Unit shall be designed as a stand-alone power center or it can be attached to form a rack line-up.
 5. The complete PCC dimensions shall be a maximum of 23.5 in. wide by 78.5 in. high by 39.5 in. deep. The distributed floor weight shall be less than 250 lbs/sq. ft.
- B. Input Power Connections
1. An input voltage junction box shall be provided for input power connections. Power terminal blocks or bus bar for 2 hole lugs shall be provided for connection of the input power conductors and a parity-sized insulated ground conductor. The junction box shall have maximum dimensions of width, 22 in.; length, 38 in.; height, 6 in.
 2. A main input conduit with cables shall be provided for connection between the specified unit and the input voltage junction box. Parallel input conduit with cables shall be used on higher ampacity units. The UL/CSA listed liquid-tight, flexible metal conduit shall be 10 feet long and consist of the appropriate number and size of conductors inside.
 3. The conductors shall be UL/CSA listed, 90°C minimum insulation, copper conductors, sized in accordance with the NEC, based on the main input circuit breaker rating. Both for reliability and per the NEC, no plug-and-receptacle connectors shall be used for the input power cable(s).
- C. Cable Entry: The PCC shall have provisions for top and bottom cable entry and exit.
- D. Main Input Circuit Breaker: The specified unit shall be equipped with a main input circuit breaker to provide overcurrent protection and a means for disconnecting all power to the unit. The main input circuit breaker shall be a three-pole molded case circuit breaker sized for 125% of the specified full load input current and rated for 600 VAC. The minimum UL-listed interrupting rating for the main input circuit breaker shall be 35,000 RMS symmetrical amperes at 480 volts AC. The main input circuit breaker shall include a 24 VDC shunt trip mechanism to interface with unit controls, EPO buttons and other remote controls.
- E. Isolation Transformer
1. The unit shall contain an electrostatically shielded isolation transformer with a rating as described in Section 1.4. The transformer shall be a dry-type, double-shielded, three-phase, common-core, convection air-cooled transformer. The transformer shall conform to UL1561, with 150°C maximum temperature rise. All transformer windings shall be copper. The transformer shall exhibit the following characteristics: percent impedance 3.0 to 5.5%; common mode noise attenuation 120 dB; harmonic voltage distortion 0.5% maximum additive; full-load efficiency 96.5 to 98%.
 2. The isolation transformer shall be provided with six full-capacity compensation taps at 2-1/2% increments to accommodate field adjustment to match the source voltage. These compensation taps shall be easily accessible by removing the front accent panel. Tap changes include: two above nominal voltage (upper range limit of +5%), nominal voltage and four below nominal voltage (lower range limit of -10%).

3. The unit shall be provided with thermal overload protection for the transformer. An alarm shall notify personnel if the transformer temperature reaches 180°C. The unit shall automatically shut down if the transformer temperature reaches 200°C. Temperature sensors shall be located in each coil of the three phase windings.
- F. Manual Restart: The specified unit shall be equipped with a manual restart feature to allow for an orderly supervised startup after power failure. The control circuit shall automatically energize the shunt trip mechanism of the main input breaker upon sensing output voltage failure. A field-selectable auto-restart mode shall be provided to deactivate the manual restart if desired.
- G. Emergency Power Off (EPO): The local EPO shall include a fully guarded and illuminated "Emergency Power Off" pushbutton. Pressing the EPO switch shall immediately shut down the unit by activating the shunt trip of the main input circuit breaker. As part of the EPO circuit, an interface shall also be provided for connecting one or more normally open or normally closed remote EPO switches to the EPO circuit. For flexibility in meeting shutdown control schemes, the local EPO (unit shutdown) circuit shall be isolated from the remote EPO (room shutdown) circuit. The remote EPO circuit shall be designed to allow direct connection of multiple units with single and multiple shutdown control contacts.
- H. Computer Grade Ground: The PCC shall include a single-point ground in accordance with sensitive electronic load manufacturer's recommendations, IEEE Std. 1100 and the requirements of the NEC. The transformer output neutral shall be solidly grounded in accordance with NEC article 250-26. Grounding conductors shall be sized in accordance with IEC 364-HD-384 and applicable national and local codes.
- I. Output Distribution Panelboards: The specified system shall contain one vertically mounted bolt-in output panelboard for distribution to the intended loads. Each output distribution panelboard shall be individually protected by a main panelboard circuit breaker. Each panelboard shall be totally enclosed with a hinged access panel that provide access to that panelboard without exposing other portions of the unit. The panelboard shall have a rating of 225 amperes, with an overall short-circuit current rating of 10kA RMS symmetrical amperes. The panelboard shall provide a total of 42 single-pole branch circuit breaker positions. Each panelboard shall include separate isolated neutral and safety-ground bus bars for the neutral and safety-ground connections for at least 42 output circuits. The neutral bus bar and wiring shall be sized for at least 1.73 times the panelboard full load rating to accommodate high harmonic neutral currents associated with single-phase nonlinear loads.

2.2 POWER MONITORING SYSTEM

- A. The specified PCC shall be equipped with a microprocessor-based power monitor panel. The monitor panel shall gather and process information from electrical and environmental sensors, relays and switches both internal and external to the unit. The monitored parameters and alarms shall be displayed on the unit monitor panel and shall also be available for communication to a centralized monitoring system using a two-wire, twisted-pair, low-voltage signal circuit having an RS-422 format for reliable communication up to 1000 meters. Additionally, the monitor panel shall be equipped with an RS-232 service port for adjusting parameters and performing diagnostics and an isolated RS-232 ASCII port for communication to other monitoring systems.

B. Monitored Parameters

1. The monitoring system shall monitor and display all of the following parameters:
 - a. Input Voltage, Line-To-Line for all three phases
 - b. Output Voltages, Line-to-Line for all three phases
 - c. Output Voltages, Line-To-Neutral for all three phases
 - d. Output Voltage Total Harmonic Distortion (THD) for all three phases
 - e. Output Current for all three phases
 - f. Output Current Total Harmonic Distortion (THD) all three phases
 - g. Output Current Crest Factor (Peak/RMS) for all three phases
 - h. Output Current Harmonic K-Factor for all three phases
 - i. Output Neutral Current
 - j. System Ground Current
 - k. Output Frequency
 - l. Output kVA
 - m. Output kW
 - n. Output Power Factor
 - o. Output kW-Hours
 - p. Percent Load
 - q. Date
 - r. Time
2. All three phases of the three-phase parameters shall be displayed simultaneously. All voltage and current parameters shall be monitored using true RMS measurements for accurate representation of non-sinusoidal waveforms typical of computers and other sensitive loads.

C. Alarm Annunciation

1. The monitoring system shall detect and annunciate by audible alarm and alarm message the following conditions:
 - a. Output Overvoltage
 - b. Output Undervoltage
 - c. Output Overcurrent
 - d. Neutral Overcurrent
 - e. Ground Overcurrent
 - f. Output Voltage Distortion
 - g. Frequency Deviation
 - h. Phase Sequence Error
 - i. Phase Loss
 - j. Transformer Overtemp
2. All alarm thresholds for monitored parameters shall be adjustable by way of the service port to match site requirements. The factory setpoints for the alarms shall be as follows:
 - a. Output Overvoltage - output voltage exceeds +6% of nominal
 - b. Output Undervoltage - output voltage falls below - 13% of nominal
 - c. Output Overcurrent - output current exceeds 95% of full load amps
 - d. Neutral Overcurrent - neutral current exceeds 95% of full load amps
 - e. Ground Overcurrent - ground current exceeds 5 amps
 - f. Output Voltage Distortion - output voltage THD exceeds 10%
 - g. Frequency Deviation - output frequency exceeds $\pm 0.5\text{Hz}$ of nominal
3. To facilitate troubleshooting, all alarms shall be stored in battery-backed (non-volatile) memory until reset to protect against erasure by a power outage. Alarms shall be able to be manually reset after the alarm condition has been corrected either at the unit or by way of the central monitoring system.

- D. Custom Alarm Annunciation: The monitoring system shall be capable of providing alarm annunciation for up to five contact closures (4 N.O. and 1 N.C.). A custom alarm message up to 20 characters shall be provided for each contact. Alarm messages shall be programmable by way of the service port to match site requirements.
- E. Summary Alarm Contact: A Form C (1 N.O. and 1 N.C.) Summary Alarm Contact shall be provided for remote alarm status. The contacts shall change state upon occurrence of any alarm and shall rest upon alarm silence.
- F. Display:
 - 1. All monitored parameters and alarm messages shall be displayed on a 4 x 20 character, high visibility liquid crystal display (LCD) located on the unit front door within a decorative bezel. Included in the bezel shall be an Identifying Unit Number, Emergency Power Off (EPO) switch and an Alarm Present/Silence switch.
 - 2. The Alarm Present/Silence switch shall be illuminated upon occurrence of any alarm and remain illuminated until all alarms are reset. The switch shall also be used to silence the audible alarm and reset inactive alarms.
- G. Autoscan: For ease of operation, the monitoring system shall include an autoscan mode which provides continuous sequential selection and display of all monitored parameters and active alarm messages. A "Hold/Sequence" switch shall be provided to interrupt the autoscan mode and manually select the displayed parameters when desired.

2.3 ACCESSORIES

- A. Side Panels: Unit shall be supplied with 18-gauge sheet metal side panel(s) as necessary per floor plan layout shown on drawings. A tool shall be required to remove the exterior panels that access the hazardous voltage area of the unit.
- B. High Energy Output Surge Suppression: The unit shall be equipped with a high energy, UL1449 and UL1283 listed, Transient Voltage Surge Suppression (TVSS) module connected to the unit output with minimal interconnecting wiring for maximum surge suppression. The TVSS shall consist of multiple, gapless Metal Oxide Varistor (MOV) arrays with their clamping voltages matched to within 1%. Each MOV shall be individually fused to protect against MOV failure while still allowing maximum rated surge current to flow without fuse operation. The fuses shall have a 100 kA interrupting capacity. Each array shall be capable of withstanding at least 1250 IEEE C62:41 category C3 surges (20 kV, 10 kA) without failure. The complete TVSS module shall have a total surge current capacity of 80 kA per phase based on a standard 8 x 20 microsecond surge waveform. The UL1449 surge clamping rating shall not exceed 400 volts for a 120/208 volt system. The maximum continuous operating voltage shall be at least 150 VAC for a 120/208 volt system. The TVSS shall also provide electrical noise attenuation of 50 dB from 100 kHz to 100 Mhz (based on MIL220A and 50 OHM impedance). An alarm contact of the TVSS module shall be connected to the unit monitoring system to annunciate any TVSS failure.
- C. Subfeed Output Circuit Breaker: One (1) three-pole 225 ampere, 240 volts AC rated molded case circuit breaker shall be provided to protect subfeed circuit to an expansion or remote distribution cabinet or other loads. The subfeed circuit breaker shall be rated for 25kA amperes symmetrical minimum interrupting capacity at 240 VAC and shall be powered ahead of the panelboard main breakers on the output of the unit. The subfeed breaker shall include padlock-off provisions to allow circuit lock-out for safety in accordance with OSHA lock-out/tag-out requirements.

- D. K-Rated Transformer: Unit transformer shall have a K20 rating in accordance with UL 1561 to allow full load operation with highly nonlinear loads. Transformer neutral shall be sized for at least 173% of full load. The transformer shall be designed to operate with 100% single-phase, switch-mode power supplies and associated harmonic phase and neutral currents without derating.
- E. Transformer High-Temperature Alarm: The transformer high temperature shutdown sensors shall be connected to provide a "Transformer Hightemp" alarm instead of automatically shut down the unit when temperature reaches 200°C. Temperature sensors shall be located in each coil of the three phase windings. The NC contact off the Temperature sensors shall be connected to Power Monitoring Panel Customer Alarm number 5 and shall annunciate a "Transformer Hightemp" alarm.
- F. Basic Monitoring System
 - 1. The basic monitoring system shall have transformer overtemperature and Emergency Power Off (EPO) circuits. All indicators and controls shall be on the front door, along with identifying system number.
 - 2. The transformer overtemperature circuit shall include an audible and visual alarm if any internal transformer winding temperature reaches 180°C. A "SILENCE" switch shall be provided to quiet the audible alarm. The transformer overtemperature circuit shall also trip the main input breaker to remove power automatically when any transformer winding temperature reaches 200°C.
- G. Network Interface Card (NIC): PCC shall have a Network Interface Card (NIC), which enables the PPC to communicate to a network management system (NMS). The NIC will include internal hardware and software to communicate (via SNMP and HTTP) to any I.P.-based Ethernet network through a RJ-45 connector. The NIC shall provide redundant paths for communications that make it possible to connect to a Building Management System (BMS) using Modbus while simultaneously communicating to a NMS through SNMP and HTTP. A terminal block shall be provided to connect to Modbus.
- H. Manufacturer: Provide one of the following:
 - 1. Liebert FPC.
 - 2. Or approved equal by APC.

PART 3 - EXECUTION

- 3.1 Factory startup, preventive maintenance and full service for the specified system shall be available and included upon request. The manufacturer shall directly employ a nationwide service organization of factory-trained field service personnel dedicated to the startup, maintenance and repair of the manufacturer's power equipment. The manufacturer shall maintain a national dispatch center 24 hours per day, 365 days per year, to minimize service response time and to maximize availability of qualified service personnel.

END OF SECTION 16265

SECTION 16795 – VOICE AND VIDEO COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY OF WORK

- A. This Specification, in conjunction with the Drawings, establishes the requirements necessary to achieve the intended performance and function of the Voice and Video Communications Systems (VVCS)
- B. The VVCS consists of a Dukane multimedia retrieval system with voice, video information storage, information processing, and/or information delivery and distribution equipment integrated together to form a cohesive integrated communication system. This project shall relocate existing rack mounted district video devices and wiring to accommodate the new UPS cabinets in the rack line-up.
- C. Provide the services necessary to disconnect, remove and reinstall and/or furnish and install new, in accordance with the drawings and specifications all product required to support the VVCS including an integrated system of peripheral apparatus conforming to acceptable industry standards.
- D. Verify dimensions and conditions at the job site prior to installation, and perform installation in accordance with these Specifications, Manufacturers recommendations and the latest edition or revision of all applicable codes and standards.
- E. The VVCS includes, but is not limited to, providing, integrating and relocating the following:
 - 1. Provide all labor and materials to revise the physical layout of the existing district video devices in the existing rack line-up. Functionally, the system shall operate the same as it currently does.

1.3 GUARANTEE, SERVICE AND TRAINING

- A. The labor for all relocated systems and components shall be guaranteed free of defects in workmanship for a period of one (1) year from the date of acceptance and shall be corrected within twenty-four (24) hours following report of such defects by the Owner. The date of acceptance shall be defined as the date the Certificate of Substantial Completion shall be signed by the Architect/Engineer and the Owner.
- B. The VVCS System Contractor shall be available on call and shall respond on site within four (4) hour notice, and without cost to the Owner, during the first twelve (12) months of full scale operation, following acceptance of the system, to assist the Owner and/or his representatives in any problems that may arise during the initial period of operation.

PART 2 - PRODUCTS

2.1 VIDEO EQUIPMENT

- A. The district WAN video equipment is all currently existing.

2.2 CABLING

- A. Cabling:
1. This contractor shall provide compliance for the entire end-to-end link and will comply with the standards governing the entire channel.
 2. This Contractor shall furnish and install and/or relocate all wiring as indicated on the Drawings. All wiring and terminations shall be in full conformance with all of the current editions or revisions of all applicable codes and standards as previously listed under "Regulatory Agencies" of this Section of the Specifications for their intended use on this Project.
 3. It is the responsibility of this contractor to provide open top cable supports, i.e. "J" hooks, in the ceiling space for cable support.
 4. Cabling shall be run parallel and perpendicular to building walls.
 5. All cabling installed in ceiling spaces shall be plenum rated.
 6. All cables shall be installed in existing conduits and raceways or an Engineer approved raceway system. Where conduits do not exist, provide "J" hooks sized appropriately for the bundle.
 7. All cabling shall be continuous from termination to termination and free from splices, reverses, or other connections. Provide a 15 foot minimum service loop above accessible ceiling for each terminated cable to accommodate future changes. Cable slack shall be stored in a fashion as to protect it from damage.
 8. Remove only the amount of cable jacket necessary for termination.
 9. Carefully lay all cable with appropriate radius of curvature and protect at bends and corners. Observe minimum bend radius and tension limitations as specified by EIA/TIA.
 10. All cables must be routed and managed for a neat and aesthetically pleasing appearance. All work must be installed in a neat and workman like manner.
 11. Bundled cables shall be secured with plenum rated Velcro® ties. Zip ties will not be permitted.
 12. The contractor shall assure that at the completion of cable installation, cables are free from twists, kinks, sharp bends, cuts, gouges or any other physical damage that might cause alterations to the electrical or optical characteristics of the cables.
 13. The contractor shall work carefully with all ceilings and return ceilings to original conditions. Any damages or expenses are the responsibility of the contractor.
 14. All entrance and intra-building cable penetration, conduit, cores, wall and ceiling penetrations will be sealed with a 3 M type fire retardant.

2.3 DISTRIBUTION CABLE

A. Trunk Cable for RF System:

1. The trunk line cable shall be AL500 foam plenum rated dielectric solid shielded aluminum jacket. Refer to Drawings for exact type.
2. Loss per hundred (100') feet, at 1000 MHz shall be no greater than 4.1 dB.
3. Cable shall be free of any and all attenuation peaks greater than 1 dB from 5 to 1000 MHz.
4. The structural return loss shall be 30 dB or greater with variable bridge, slow sweep, fixed bridge.

B. Drop Cable:

1. All drop cable shall be plenum rated quad shielded RG-6U foam dielectric. Refer to drawings for exact type.
2. Loss per hundred (100') feet, at 1000 MHz shall be no greater than 6.6 dB.
3. Cable shall be free of any and all attenuation greater than 1 dB nominally from 5 MHz to 1 GHz.
4. The structural return loss shall be 20 dB or greater with variable bridge, slow sweep and fixed termination.

C. Other Cables:

1. RG-6 patch cable. Length as required.
2. RCA patch cable. Length as required.
3. VGA patch cable. Length as required.
4. The Contractor may reuse existing patch cables. If patch cables are found to be defective or the incorrect length, the Contractor shall furnish and install RG-6, RCA and VGA patch cables for connection to each TV. Length as required.
5. The Contractor may reuse existing patch cables. If patch cables are found to be defective or the incorrect length, the Contractor shall furnish and install RCA and VGA patch cables for connection to each Teachers outlet box. Length as required.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. All miscellaneous equipment required for a complete, professional installation shall be included in the base bid. No allowances for any additional equipment, hardware, cabling, or miscellaneous will be considered unless specifically excluded from the base bid.
- B. Contractor will meet with district personnel prior to commencement of installation activities to review the following implementation details:
 1. installation timeline
 2. installation process
 3. verify site requirements
- C. The contractor shall ring out and identify, with velcro ties clearly marking every cable in the system (both ends). All markings shall include purpose destination and origination of the wire or cable.

- D. The signal level at every tap shall be fifteen (+15 dB) plus or minus three (-3) dB between adjacent channels.
- E. Signal level at every outlet shall be five (+5 dB) plus or minus two (2) dB between adjacent channels.
- F. All passive components shall be designed for a frequency range of 5 to 16 Hz. The system shall be designed for adjacent channel operation.
- G. The Contractor shall carefully lay all cable with appropriate radius of curvature and protect at bends and corners.
- H. RG-6 video cabling shall be continuous and splice free unless specifically stated otherwise. Cable slack shall be provided at the jack end and the directional tap end. A minimum of five (5) feet of slack cable shall be coiled and secured at each end. This slack shall be exclusive of the length of RG-6 that shall be required to accommodate termination requirements and shall be intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage.
- I. The Contractor shall loosely bundle cables with Velcro wraps, suitable for Plenum environments, every twenty (20) feet.
- J. The Contractor shall not fasten supports to pipes, ducts, mechanical equipment or conduit.

3.2 INSTALLATION-SITE REQUIREMENTS

- A. Contractor will re-connect video and audio patch cables.

3.3 SYSTEM TESTING - RADIATION LEAKAGE TESTING

- A. Beginning July 1, 1990, every RF cable television system shall comply with the NEW FCC RULES AND REGULATIONS on signal leakage. CODE OF FEDERAL REGULATIONS TITLE 47 - TELECOMMUNICATION PART 76-CABLE TELEVISION SERVICE.
- B. The rule simply stated says any operator of an RF system CANNOT leak frequencies into the atmosphere which may interfere with aeronautical and marine emergency radio frequencies.
- C. The limits of the radiation leakage are as follows: (See Table 1)

<u>FREQUENCIES</u>	<u>RADIATION LEAKAGE UV/M</u>	<u>DISTANCE (FEET)</u>
Below 54 MHz	15	100'
Between 54 MHZ and 216 MHZ	20	10'
Over 216 MHZ	15	100'

TABLE 1

In order to test for these limits, the successful Contractor must supply the following equipment: Strength Level Meter (SLM) of adequate accuracy, such as a Wavetek Sam 1, a dipole antenna.

NOTE: Care must be taken to insure the dipole is properly tuned and placed prior to recording the measurements.

The method of accurately measuring and calculating the leakage of the RF system are as follows:

1. To get an accurate reading of the system, the lowest and highest frequencies should be tested. Lowest 55 MHz and highest 213 MHz.
2. Set-up horizontal dipole as shown in Figure 1. (Length of the elements on the dipole antenna are calculated by using the following formula:

$$L = \frac{11808 / f}{2}$$

L = Length in inches
f = Frequencies in MHz

3. Hook up antenna to the input of the SLM and read dBmv for the frequency being tested. From this reading a conversion from dBmv to uV/M will determine whether the system is in compliance with FCC RULES AND REGULATIONS, when compared to the Table listed above.
4. Critical Factors to be Aware of:
 - a. Good quality cable.
 - b. Connectors with RFI (Radio Frequency Interference) shielding.
 - c. Good quality Active and Passive Devices.
 - d. Care in the installing of cable system.
 - e. NOTE: In order to perform this next series of system tests the following test equipment shall be supplied by the installing contractor.
 - 1) IFR-7550 Spectrum Analyzer.
 - 2) WaveTek SAM I Signal Level Meter.
 - 3) Fluke 77 volt-meter

3.4 FREQUENCY RESPONSE

- A. An IFR-7550 spectrum analyzer shall be used to measure and monitor system frequency response. The test point used will be directly off the test port of the combining network. After setting up the spectrum analyzer to view all of the channels in the system, adjustments, if needed, shall be made on the processing equipment to insure a flat frequency response with at least 15 dB separation between the audio and video signals.
- B. This test should be repeated after twenty-four (24) hours to insure that the frequency response has not drifted due to head-end burn-in.

3.5 CROSS MODULATION TEST

- A. Cross modulation is the maximum usable output level of a system. This effect can easily be seen on a TV receiver. When cross modulation appears it is seen as herring bones or wipers which is an over modulation of a channel, i.e. one channel overlapping another channel.

- B. With the use of the spectrum analyzer and the Fluke 77 voltmeter, measurements shall be made using the following procedure:

1. Feed the system output into the spectrum analyzer through a six (6) dB pad and a band pass filter. Center the desired carrier on the spectrum analyzer.
2. Simultaneously modulate all channels 100%.
3. Convert the vertical output of the IF section of the spectrum analyzer to the output of the volt meter, and set the spectrum analyzer band width to 300 kHz and reduce scan width to 20 kHz. Adjust frequencies for maximum amplitude and adjust analyzer to get a good trace on the display.
4. Set band width on volt meter to 30 kHz and adjust frequency control until volt meter AFC locks on the 15 kHz modulation.
5. Adjust analyzer variable IF until volt meter reads 0.
6. Switch off modulation on channel displayed and read the cross modulation on the voltmeter. The percentage of change in levels is the percentage of cross modulation.

3.6 HUM MODULATION TEST

- A. Hum modulation is a 60 cycle AC voltage which has manifested itself into the system. This is easily detectable on a TV set as a large horizontal bar that moves slowly up or down. This test is accomplished by locking the system output to a signal level meter and reading the hum modulation directly. Because some hum is inherent in the instrument, the test is limited to relatively high levels of hum modulation (-50 dB or worse).

3.7 SIGNAL TO NOISE RATIO TEST

- A. To provide the highest quality TV picture at any point in the RF system, the signal to noise ratio must be measured at a level of at least 43 dB. What this means is that the RF signal must be sufficiently strong enough to override the noise in the system to avoid having poor quality (snowy) TV pictures.
- B. The testing procedure for (S/N) is as follows:
1. Connect your SAM I signal level meter input to the output of the last device in the system (longest run from central processing control console [headend]).
 2. Disconnect all signals from the system and take readings from the lowest and highest channels used in the system.
 3. Obtain a corrected noise level for each channel using the noise calibration of the particular meter being used.
 4. By subtracting the corrected noise level for each channel from the normal signal readings at that point in the system, you will determine the signal to noise ratio at the channel in the system.
 5. The overall S/N ratio of the system is the average of the lowest and highest channels.

3.8 TESTING

A. District Head End

1. RF Receive/RF Transmit
 - a. Test and balance RF Receive and Transmit signal via the existing fiber optic network.
 - b. Verify signal strength and quality on all frequencies and channels.
2. Dukane Database Server:
 - a. Verify the integrity of the the database and all infra-red command codes.
 - b. Verify connectivity to all database router equipment in all other buildings.

END OF SECTION 16795



BID TABULATION FORM

Project Name: Troy School District
Services Building
UPS Replacement
TSD Bid Number 9546
IDS Project No.: 03234-2007

Date: September, 2 2008

Estimate (Electrical Only): \$85,000.00

	Great Lakes Power & Lighting, Inc.	Sound Engineering	Bidder 3	Bidder4	Bidder5	Bidder 6
Bid Bond	Yes	Yes				
Addendum	n/a	n/a				
Familiar Disclosure	Yes	Yes				
Base Bid Electrical	\$87,000.00	n/a				
Base Bid Technology	n/a	\$11,424.00				

Mandatory Alternates - Electrical

1. Fixed 40KVA in lieu of Scalable 40/80KVA

-	n/a				
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Voluntary Alternates

V1. Voluntary Alternate No. 1

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V2. Voluntary Alternate No. 2

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cc: File

ec: M. Adamczak, TSD S. Bryan, TSD F. Lams, TSD
R. Bracci, ids R. Killips, ids

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