

Project Manual

for

Conveyor Electrical Installation

Distribution Facility Expansion

at

Lake City, Florida

October 29th, 2021

UPSPEC
Master Specifications
For
United Parcel Services
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SECTION 011000

SUMMARY

PART 1 – GENERAL

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- E. Section 015000 - Temporary Facility and Controls
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1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work of this Contract comprises Conveyor Electrical Installation needed to operate the conveyor system for the United Parcel Service Distribution Facility located at:

United Parcel Service, Inc.
143 NE Armor Glen
Lake City, FL 32055

- B. The following areas of additional work will be included within the Conveyor Electrical Installation Contract:
 - a. Lighting, Receptacle, Fan Installation
 - b. LAN Installation with certifications of each cable.
 - c. Demolition and / or relocation of Existing Electrical Equipment.
 - d. Panel & HMI installation with owner provided panels and HMI.

1.4 WORK BY OTHERS

- A. Work on the project which will be executed prior to the start of work of this contract, and which is excluded from this contract, as follows:
 - 1. Conveyor Electrical Design
 - 2. Conveyor Electrical programming
- B. Work on the project which may be executed concurrently with the work of this Contract, and which is excluded from this Contract, as follows:
 - 1. LAN, telephone equipment, and wiring.
 - 2. Security systems and wiring.
 - 3. Conveyor Installations
 - 4. Other Owner-supplied / Owner Installed items.

1.5 WORK SEQUENCE

- A. Schedule the work to accommodate Owner's conveyor system installation during the construction period.
- B. Delete following paragraph if phases are not required.
Energize conveyor system motors for belt tracking by others prior to full completion of the conveyor electrical installation.
- C. Perform quality assurance commissioning as described within Section 262700 prior to full completion of the conveyor electrical installation. Demonstrate to Project Engineer prior to Owner commissioning.
- D. Schedule the work to accommodate Owner during testing and commissioning of the conveyor electrical system prior to full completion. Owner testing and commission may include testing package flow and training personnel.
- E. Complete final punch list items prior to conveyor electrical installation being fully operational and ready for owner's package sorting operation.

1.6 CONTRACTOR USE OF PREMISES

- A. Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Confine operations at the project site to areas permitted by law, ordinances, permits and the Contract Documents and do not unreasonably encumber the site with any materials or equipment.
 - 1. Driveways, Walkways, and Entrances: keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times.

1.7 OWNER OCCUPANCY

- A. Owner shall have the right to occupy or use all or any portion of the work prior to its full completion.

1.8 OWNER FURNISHED ITEMS

- A. Items furnished and paid for by Owner, described in specification sections:
 - 1. Section 262700- Low Voltage Distribution Equipment
- B. Owner's Responsibilities:
 - 1. Arrange for and deliver installation drawings and/or instructions.
 - 2. Arrange and pay for product delivery to project site, in accordance with the construction schedule.
 - 3. Submit claims for transportation damage for owner furnished items.
 - 4. Arrange for replacement of damaged, defective, or missing for owner supplied items.
- C. Contractor's Responsibilities:
 - 1. Give written notice to UPS Project Engineer of delivery date required for each product, in accordance with the construction schedule.
 - 2. Receive and unload products at the project site.
 - 3. Promptly inspect products upon delivery to the project site and record shortages, damaged, or defective items on all copies of the delivery receipt.
 - 4. Retain copies of all delivery receipts and promptly deliver to UPS Project Engineer.
 - 5. Handle products at the project site, including uncrating and storage.
 - 6. Protect products from exposure to elements, damage, loss, theft and pilferage.
 - 7. Assemble, install, connect, adjust, and finish products.
 - 8. Repair or replace items damaged by Contractor.
- D. Contractor shall be fully responsible for damaged or defective items received and for missing items unless recorded on the delivery receipt as prescribed herein.

1.9 COORDINATION

- A. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner occupancy.
- B. Cooperate and coordinate with all contractors.
- C. Do not cut or alter the work of any other contractor or cut any structural members except with the written consent of the UPS Project Engineer.
- D. Do all fitting of the work that may be required to make its several parts fit together properly.

1.10 FIELD ENGINEERING

- A. Establish all lines and levels necessary for the execution of the work.
- B. Verify all dimensions shown on the Drawings and report any errors or inconsistencies in same to Project Engineer for correction before starting work.

1.11 REGULATORY REQUIREMENTS AND FEES

- A. Comply with the requirements of the Agreement Form.
 - 1. In the event of conflicting requirements between applicable codes and the Contract Documents, the applicable codes shall govern.
- B. Contractor shall procure and pay all fees and costs for approvals, permits, licenses, and utility company back charges for connections and meters.
 - 1. Only the Building permit fee (as itemized on the application or receipt) and charged by the government or agency having jurisdiction of the work to be performed, will be reimbursed by Owner.
- C. Deliver copies of all permits, licenses and certificates to UPS Project Engineer prior to final payment.

1.12 SPECIFICATION FORMAT AND LANGUAGE

- A. The Specifications are organized in sections of work based upon The Construction Specification Institute's (CSI's) 49 division format.
 - 1. The organization of the Specifications in sections is not intended to imply trade responsibilities.
 - 2. Section titles are not intended to limit the meaning or content of a section, or to be completely descriptive of requirements specified within a section.
- B. Specification sections are divided in 3 parts based upon CSI's three-part section format.
 - 1. Part 1 articles titled "Work Included" or "Section Includes" are not intended to limit the scope of a section or to imply a trade responsibility. These articles are merely a convenient listing of the significant items specified within a section.
 - 2. Part 1 articles titled "Related Work" or "Related Sections" are provided as a convenient listing of sections of work directly related to the work of a particular section. No assurance is given with respect to the completeness of these listings.

- C. The imperative language is used generally in the Specifications. These statements of instruction are directed to Contractor.
- D. Colons are used in the Specifications to list requirements generally for products. The words "shall be" shall be supplied by inference where a colon (:) is used for such purpose.

1.13 REFERENCES

- A. For products or execution requirements specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The date of the standard is that in effect as of the bid date, except when a specific date is specified.
- C. In the event of conflicting requirements between referenced standards and the Contract Documents, the Contract Documents shall govern.

1.14 MANUFACTURER'S DATA

- A. Manufacturer's specifications, recommendations, instructions or other data referenced shall be construed as data contained in manufacturer's printed publications current as of the bid date, except when a specific date is specified.
- B. For products or execution requirements specified by reference to manufacturer's data, comply with the requirements therein, except when more rigid requirements are specified or are required by applicable codes.

1.15 PAYMENT AND CHANGE ORDER PROCEDURES

- A. Payment and change order procedures shall be as prescribed in the General Conditions.

PART 2 - PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 012973

SCHEDULE OF VALUES

PART 1 – GENERAL

1.1 – PROJECT

A. Summary of values for the following project:

Conveyor Electrical Installation

For

United Parcel Service

In

Lake City, FL

October 29th ,2021

Appropriation Number: 0740190036

1.2 – SCHEDULE OF VALUES

Specification Code	Description	Bldg.	LHI	PE	Expense
DIVISION 01 – GENERAL REQUIREMENTS (Based on the percentage of total cost for each cost category (Bldg., LHI, PE, Expense))					
013000	Administrative Requirements	\$ ____	\$ ____	\$ ____	
DIVISION 02 – EXISTING CONDITIONS					
024100	Demolition		\$ ____	\$ ____	
DIVISION 05 – METALS					
055000	Metal Fabrications		\$ ____	\$ ____	
DIVISION 23 – Heating, Ventilating, and Air-Conditioning					
233400	HVAC Fans	\$ ____		\$ ____	
DIVISION 26 – ELECTRICAL					
260000	Electrical	\$ ____		\$ ____	

Specification Code	Description	Bldg.	LHI	PE	Expense
260500	Common Work Results for Electrical	\$_____		\$_____	
260526	Grounding and Bonding for Electrical Systems	\$_____		\$_____	
262200	Low-Voltage Transformers	\$_____		\$_____	
262700	Low-Voltage Distribution Equipment		\$_____	\$_____	
265000	Lighting		\$_____	\$_____	
DIVISION 27 – COMMUNICATIONS					
271500	Communications Horizontal Cabling			\$_____	

END OF SECTION

SECTION 013000

ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes requirements for administrative requirements, including, but not limited to:
 - 1. Scheduling and administration of progress meetings.
 - 2. Pre-installation conferences.
 - 3. Existing UPS Package Operation:
 - a. UPS is operating its package delivery business from the facility at which the work is to be performed. Contractor shall not interfere with the UPS operation.
 - b. UPS will conduct its package sorting operation, using the conveyor system in the facility, between the hours of 5PM-10AM on weekdays.
 - c. Contractor will have the facility free and clear for performance of the work during other weekday hours and on weekends.
 - 4. Submittal procedures per Section 013300 – Submittal Procedures.

1.2 RELATED SECTIONS

- A. Section 0133000 – Submittal Procedures

1.3 EXPANSION PROJECT PROCEDURES

- A. Contractor shall issue numbered identification cards to each of his/her employees, including each of the employees of his/her subcontractors.
 - 1. Submit a listing of the cards issued, indicating name of employee and number, to UPS Project Engineer before commencing the work. Resubmit the list immediately following any revisions.
 - 2. Access to the work will be limited through the construction gate at the corner of the fenced area and will be limited to properly identified employees, except as follows:
 - a. Suppliers' delivery employees shall access the work through the vehicle gate after signing-in and obtaining a visitor's pass. Upon completion of the delivery, the delivery employee shall immediately return the pass and sign-out.

- B. Contractor's employees shall be restricted to areas required for performance of the work.
- C. Contractor's employees can not use the existing restrooms. Contractor's employees are not permitted to use other restrooms, other telephones, lunch rooms, vending areas, or other UPS facilities.
- D. Limit project site storage of materials and equipment.
- E. Ensure utilities taken out of service for performance of the work are returned to service at least 30 minutes prior to any scheduled UPS package sorting operation.
- F. Ensure debris, rubbish and other waste material caused by Contractor are removed from the UPS operating area, both inside and outside the building, at least 30 minutes prior to any scheduled UPS package sorting operation.

PART 2 - PRODUCTS

NOT USED

PART 3 – EXECUTION

3.1 PROGRESS MEETINGS

- A. Schedule and administer weekly construction progress meetings at field offices. Schedule and administer other construction meetings as required for successful completion of project.
- B. Make physical arrangements, prepare agenda, and distribute notice of each meeting to participants and to UPS Project Engineer four days in advance of meeting date.
- C. Preside at meetings, record minutes, and distribute copies within two days after meeting to participants, UPS Project Engineer, and to entities affected by decisions at meetings.
- D. Attendance: Contractor, Contractor's superintendent, subcontractors, and suppliers as appropriate to agenda, UPS Project Engineer, and others, as deemed appropriate by UPS Project Engineer.
- E. Minimum Agenda:
 - 1. Approval of minutes of previous meetings.
 - 2. Review of work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems which impede, or will impede scheduled progress.
 - 5. Review of submittal schedule and status of submittals, including re-submittals.
 - 6. Maintenance of construction schedule. Original baseline schedule shall also show on any distributed documents.
 - 7. Expediting measures to regain compliance with the construction schedule.

8. Scheduled progress during succeeding work period.
9. Maintenance of quality of work.
10. Effect of proposed changes, if any, on construction schedule and coordination of changes.
11. Review of all claims by Contractor that are unsettled at the time of the meeting.
12. Other business relating to the work.

3.2 PRE-INSTALLATION CONFERENCES

- A. When required in individual specification sections, schedule and convene a pre-installation conference at the project site prior to commencing work of the section.
- B. Notify UPS Project Engineer four days in advance of conference date.
- C. Preside at conference, record minutes, and distribute copies to participants within two days after conference.

END OF SECTION

SECTION 013300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 RELATED SECTIONS

Section 012973 – Schedule of Values.

1.3 PROCEDURES

- A. Deliver submittals to UPS Project Engineer at the office of UPS, 143 NE Armor Glen Lake City, FL 32055
 - 1. Deliver job site copy of submittals at temporary field office.
- B. Identify each submittal with the following information:
 - 1. Contractor's name
 - 2. Project name
 - 3. Date of submittal
 - 4. Name of supplier
 - 5. Name of manufacturer
 - 6. Submittal number including revision identifier
 - a. Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 081113.01).
 - b. Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 081113.01.A).
 - 7. Copy of the appropriate Specification Section with highlighted specification
 - 8. Drawing number and Detail references, as appropriate
 - 9. Other necessary identification
- C. Make any corrections to the submittals required by UPS Project Engineer and resubmit until approved. Direct specific attention in writing to revisions on resubmittals other than the corrections requested by UPS Project Engineer on previous submittals. Utilize and coordinate the submittal register attached at the end of this Section.
- D. Use for construction: use only final submittals that are marked with approval notation from the UPS Project Engineer.
- E. Unless otherwise noted in the specification sections, submit a minimum of two (2) submittal sets to UPS Project Engineer and a PDF version.

1.4 CONSTRUCTION SCHEDULE

- A. Within ten (10) days after execution of the Contract or the date of written notice to commence the work, whichever is earlier, submit one (1) PDF copy of a detailed construction schedule for approval.
- B. Schedule shall graphically show the relationship and interdependence of all activities necessary to fully complete the work and shall show the sequence in which each activity is to be accomplished. The detail of information shall be such that duration times of activities shall normally range from one (1) to fifteen (15) days. Each activity shall be numbered.
- C. The schedule shall give a description of each activity, show its duration in calendar days, and reference its start and finish dates to calendar dates. Preceding and following event numbers shall be indicated for each activity, and those activities along the path critical to the completion of the work shall be indicated.
- D. The schedule shall show for each activity:
 - 1. The earliest start date, latest start date, earliest finish date, latest finish date, and slack or float.
 - 2. Those other activities or percentage of other activities that must be completed prior to starting the activity and the latest date that the activity can be finished without affecting the date of full completion of the work.
- E. The construction schedule, as approved by UPS Project Engineer, shall be an integral part of the Contract and shall establish interim contract completion dates for the various activities.
- F. Comply with the approved schedule and expedite the work when required to maintain the established interim contract completion dates and the full completion date, at no additional cost to Owner.
- G. Should any activity critical to the full completion date be, in the judgment of UPS Project Engineer, behind schedule by seven (7) or more days, UPS Project Engineer may direct Contractor to expedite the work to regain compliance with the schedule. If so directed, promptly expedite the work by whatever means required including, but not limited to, increasing the work force, adding additional shifts, and working overtime. Such expediting shall be at no additional cost to Owner. Failure of UPS Project Engineer to direct shall not relieve Contractor of his/her responsibility to comply with the construction schedule.
- H. Submit one (1) copy and one (1) PDF copy of the construction schedule with monthly invoice. Indicate:
 - 1. Activities or portions of activities completed up to the end of the previous month.
- I. The approved construction schedule shall not be changed without Owner's consent. In such instance, promptly submit one PDF copy of a revised schedule to UPS Project Engineer for approval.

1.5 CONSTRUCTION DOCUMENTS

- A. Within ten (10) days after execution of the Contract or the date of written notice to commence the work, whichever is earlier, Submit PDF of Construction documents for approvals.
 - 1. Direct specific attention in writing to adaptations to Owner furnished Drawings.
 - 2. Approval of construction documents shall not relieve Contractor of responsibility for any deviations from the requirements of the Contract Documents or from the responsibility for errors or omissions in the construction documents.
- B. Do not commence any portion of the work until the construction documents have been approved.
- C. All work shall be in accordance with approved construction documents.

1.6 SUBMITTAL SCHEDULE

- A. Within ten (10) days after execution of the Contract or the date of the written notice to commence the work, whichever is earlier, submit all shop drawings, samples and other submittals required by the specification sections. Utilize and verify the submittal register format provided in this Section.
- B. Prepare the schedule in chronological order of submittals. Show category of the submittal, related specification section numbers, related activity number on the construction schedule and the date for submittal.
- C. Schedule and make all submittals in an orderly sequence so as to cause no delay in the work or in the work of other contractors.
- D. In scheduling, allow at least fifteen (15) days for review following receipt of a submittal by UPS Project Engineer. Allow ten (10) days for review of a resubmittal.

1.7 PRODUCT DATA

- A. Collect information into a single submittal for each element of construction and type of product or equipment.
- B. Mark each copy of each submittal to show which products and options are applicable.
- C. Include the following information, as applicable;
 - 1. Manufacturer's catalog cuts
 - 2. Manufacturer's product specifications
 - 3. Availability and delivery time information
- D. For equipment, include the following in addition to the above, as applicable:
 - 1. Wiring diagrams showing factory-installed wiring.
 - 2. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

1.8 SHOP DRAWINGS AND SAMPLES

- A. Submit all drawings, diagrams, illustrations, schedules, performance charts, instructions, specifications, and other product data illustrating portions of the work as required by the specification sections. Such submittals, whether or not referred to as shop drawings, shall comply with the requirements for shop drawings herein prescribed. Unless otherwise noted in the specification sections, submit a minimum of five (5) sets of shop drawings to Project Engineer. Two (2) sets will be returned to Contractor unless otherwise requested.
- B. Review, stamp with approval, and submit all shop drawings and samples required by the specification sections. Shop drawings or samples submitted without Contractor's approval stamp will be returned without review.
- C. By approving and submitting shop drawings and samples, Contractor thereby represents that the Contractor has determined and verified all field measurements, field construction criteria, materials, catalog numbers, and similar data and that the Contractor has checked and coordinated each shop drawing and sample with the requirements of the work and of the Contract Documents.
- D. Shop drawings and samples will be reviewed and approved by UPS Project Engineer to determine in general if they are in compliance with the Contract Documents. Such approval shall not relieve Contractor of responsibility for any deviations from the requirements of the Contract Documents or from the responsibility for errors or omissions in the shop drawings or samples.
- E. Do not commence any portion of the work requiring a shop drawing or sample submittal until the submittal has been approved as prescribed herein. All such portions of the work shall be in accordance with approved shop drawings or samples.

1.9 SCHEDULE OF VALUES

- A. Submit a schedule of values for various portions of the work within ten (10) days after execution of the Contract or the date of written notice to commence the work, whichever is earlier. Show the amounts of the Contract Sum allocated to each portion of the work.
 - 1. Use Schedule of Values form included in Section 012973 – Schedule of Values.

1.10 CERTIFICATES OF COMPLIANCE

- A. Submit in duplicate, certificates of compliance for each product specified prior to installation of the applicable product.
- B. Certificates of compliance shall include certified laboratory test reports, manufacturer's certificates, or other evidence sufficient to verify compliance with the products specified.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

Attached: Submittal Register

END OF SECTION

UPSPEC

SUBMITTAL REGISTER

DOCUMENTS TO BE SUBMITTED BY THE CONTRACTOR

Abbreviations: PD Product Data, MSDS TR Test Reports DM Design Mix
SD Shop Drawings NO Notice MU Mock-Up
OM O & M Manuals SC Schedule WA Warranty
SA Samples ES Extra Stock CE Certificate
CC Contract Compliance

Section Number	Title	CC	PD	SD	OM	SA	XX	XX
011000	Summary							
012300	Alternates							
012973	Schedule of Values	CC						SC
013000	Administrative Requirements	CC						
013300	Submittal Procedures	CC						SC
014000	Quality Requirements	CC						
015000	Temporary Facilities and Controls	CC						
016000	Product Requirements	CC						
017000	Execution Requirements	CC						
	Safety Plan	CC						
024100	Demolition	CC						SC
055000	Metal Fabrications		PD	SD				
233400	HVAC Fans		PD	SD	OM		WA	
260000	Electrical		PD	SD				
260500	Common Work Results for Electrical		PD	SD				
260526	Grounding and Bonding for Electrical Systems		PD	SD				TR
262200	Low-Voltage Transformers		PD	SD				
262400	Switchboards and Panelboards		PD	SD				
262413	Temporary Generator Connection Switchboards		PD	SD				
262700	Low-Voltage Distribution Equipment		PD	SD				
265000	Lighting		PD	SD				
271500	Communication Horizontal Cabling		PD	SD				TR

END OF SECTION

SECTION 014000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes quality requirements for work performed under the Contract Documents.

1.2 QUALITY OF WORK

- A. Perform all work in the most workmanlike manner and according to the best standard practices. All work shall be free from faults and defects in workmanship.
- B. Contractor shall be solely responsible for quality control of the work and shall maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of specified quality.
- C. Required testing and inspection are intended to assist in determination of probable compliances of the work with the Contract Documents, but do not relieve Contractor of responsibility for those compliances. Specified testing and inspection are not intended to limit Contractor's quality control program.

1.3 TESTING AND INSPECTION

- A. All testing and inspection, whether required by the specification sections or by laws, ordinances, rules, regulations, codes or orders of any public authority having jurisdiction, or whether performed by Contractor for quality control, shall be at Contractor's expense unless otherwise indicated in the Contract Documents.
- B. Fully cooperate with the personnel of any testing agency, whether performing testing or inspection required by the Contract Documents, or any public authority having jurisdiction or performing special testing and inspection required by the UPS Project Engineer. Testing agency personnel shall have access to the work at all times for the performance of such testing and inspection and Contractor shall provide facilities for access in order that the testing agency may properly perform its duties.

1.4 TESTING LABORATORY SERVICES

- A. Where the specification sections require testing or inspection by a testing laboratory, engage at the General Contractor's expense a reputable, independent testing laboratory specializing in the required services, unless the testing or inspection is indicated as furnished by Owner.

1.5 SPECIAL TESTING AND INSPECTION

- A. In addition to testing and inspection required by the Contract Documents, UPS Project Engineer may require special testing and inspection as provided in the General Conditions. UPS Project Engineer may instruct Contractor to arrange for such special testing and inspection or may arrange for the special testing and inspection directly. If the work so tested or inspected is found to be in compliance with the Contract Documents, the cost of testing or inspection shall, by appropriate change order, be charged to Owner. If the work is found not to be in compliance, Contractor shall pay such costs.

1.6 NOTICE OF TESTING AND INSPECTION

- A. Give UPS Project Engineer timely notice of work ready to be tested or inspected.
 - 1. Unless the testing or inspection is indicated as furnished by Owner, give UPS Project Engineer timely notice of the date and time arranged so UPS Project Engineer may observe the testing or inspection.
 - 2. If the testing or inspection is indicated as furnished by Owner, UPS Project Engineer will arrange for testing laboratory to perform the required services.

1.7 TESTING AND INSPECTION REPORTS AND CERTIFICATES

- A. Submit written reports of required testing or inspection results, in duplicate, to UPS Project Engineer within three days after completion of the testing or inspection. Reports shall clearly indicate compliance or non-compliance with specified standards and with the Contract Documents.

1.8 REPLACEMENT AND CORRECTION

- A. Promptly replace or correct all work found not to be in compliance with the requirements of the Contract Documents and the requirements of any public authority having jurisdiction so as not to delay the work or the work of other contractors, regardless of how such failure to comply may be revealed. Replacement and correction shall be expedited as required to maintain interim contract completion dates and the full completion date.
- B. UPS Project Engineer may require additional testing and inspection of work previously found not to be in compliance until such work has been properly replaced or corrected. Such additional testing and inspection shall be at Contractor's expense.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes specifications and requirements for temporary facilities and controls, including, but not limited to:
 - 1. Temporary utilities and services.
 - 2. Temporary Controls: Barriers, enclosures, and fencing.
 - 3. Project identification sign(s).

1.2 TEMPORARY UTILITIES

- A. Provide all temporary equipment necessary for the proper performance of the work including rental equipment, barricades, dumpsters and portable toilets.
- B. Remove all temporary facilities upon completion of the work or when no longer required.

1.3 TEMPORARY CONTROLS

- A. Keep the premises free from the accumulation of debris, rubbish, and other waste material caused by Contractor and remove all such material from the project site at least once every week. In addition, the building concrete floor, when constructed, shall be kept free from the accumulation of dust and dirt and shall be broom cleaned at least once every week. Should Contractor fail to provide cleaning as prescribed, UPS Project Engineer may arrange for the cleaning and the costs thereof shall be deducted from the Contract Sum. Should a dispute arise between Contractor and other contractors as to the responsibility for cleaning, UPS Project Engineer may arrange for the cleaning and the portion of the cost thereof, as UPS Project Engineer determines to be just, shall be deducted from the Contract Sum.
- B. Provide temporary fencing and barricades to separate employee and UPS operations as indicated on drawings.
- C. Take all precautions and provide all protection necessary to ensure that the building concrete floor will not be marked, spotted, stained, or damaged in any way.

1.4 PROJECT IDENTIFICATION AND SIGNS

- A. Allow no advertising, signage, or identification of Owner or project at the project site.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes general product requirements. All materials and equipment shall be new, unless otherwise specified, and of first-class quality free from any faults or defects including blemishes, dents, imperfections, rust, and stains. Do not incorporate faulty or defective materials or equipment into the work.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures

1.3 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.4 SUBSTITUTIONS

- C. No substitutions for the materials, equipment, and manufacturers specified shall be made unless written approval has been given as required in the General Conditions. Substitutions will be considered only if Owner receives the advantage of lesser cost with no decrease in quality, earlier completion date, or both.

PART 2 – PRODUCTS

2.1 NEW PRODUCTS

- A. Where acceptable manufacturers are listed in the specification sections, obtain materials and equipment in compliance with the requirements specified from one of the manufacturers listed.
- B. Components required to be supplied in quantity within a specification section shall be the same, supplied by same manufacturer, and shall have uniform appearance and be interchangeable.
- C. Where all other criteria are met, Contractor shall give preference to products that:
 - 1. Are extracted, harvested, and/or manufactured closest to the location of the project.
 - 2. Have longer documented lifespan under normal use.
 - 3. Result in less construction waste.

PART 3 - EXECUTION

3.1 TRANSPORTATION, HANDLING, STORAGE, AND PROTECTION

- A. Contractor shall be fully responsible for the transportation, handling, storage, and protection of all materials and equipment including responsibility for damage, loss, theft, and pilferage except that Owner will be responsible for transportation of Owner-furnished items as provided in Division 01.
- B. Handle and store materials and equipment in accordance with manufacturer's recommendations and store packaged materials and equipment in original, undamaged condition with manufacturer's labels and seals intact.
- C. Arrange storage to provide access for inspection and maintain stored materials and equipment in a neat and orderly condition at all times.
- D. Coordinate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- E. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

END OF SECTION

SECTION 017000

EXECUTION REQUIREMENTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Section includes administrative and procedural requirements for the execution and contract closeout, including, but not limited to, the following:
 - 1. Starting of Mechanical Systems: Start-up of each item of equipment and system in accordance with specified procedures.
 - 2. Adjustments.
 - 3. Cleaning.
 - 4. Project record documents.
 - 5. Operating and maintenance manuals.
 - 6. Equipment demonstrations.
 - 7. Spare parts and operation/maintenance items.

1.2 GUARANTEES AND WARRANTIES

- A. Assemble all guarantees and warranties as required by the General Conditions and the specification sections.
- B. The guarantees and warranties shall be organized into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind the guarantees and warranties in heavy-duty, three-ring, vinyl-covered, loose-leaf binders.
 - 2. Scan guarantees and warranties and assemble complete submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.
- C. The guarantees and warranties shall be delivered to the UPS Project Engineer prior to final payment for the work.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 START-UP PROCEDURES

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

2. Notify UPS Project Engineer seven days prior to start-up of each item.
 3. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and conditions that may cause damage.
 4. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
 5. Verify that wiring and support components for equipment are complete and tested.
 6. Execute start-up under supervision of applicable Contractor personnel and manufacturers' representative(s) in accordance with manufacturers' instructions.
 7. Submit a written report that equipment or system has been properly installed and is functioning correctly.
- B. Motors:
1. Check each motor for amperage comparison to nameplate value.
 2. Correct conditions which produce excessive current flow and which exist due to equipment malfunction.

3.2 CLEANING

- A. Prior to a final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery, and surplus materials from the project site and thoroughly clean the building, including the removal of all dirt, dust, labels, marks, smears, spots, grease, and stains from all floors, walls, ceilings, steel, piping, fixtures, equipment, hardware, glass, mirrors, and all finish surfaces. In addition, provide any special cleaning required by the specification sections.

3.3 PROJECT RECORD DOCUMENTS

- A. During the progress of the work, maintain one set of drawings at the project site for preparing record drawings. Include the designation "PROJECT RECORD DRAWING" in a prominent location on each drawing. Using an erasable, red-colored pencil, neatly record all changes in the work and record specific locations of work shown schematically on the drawings. Locations must have at a minimum the following information:
1. Size, type, and capacity of each device or piece of equipment
 2. Location of each device or piece of equipment.
 3. Location of each source supplying the device or equipment.
- B. Submit the record drawings to UPS Project Engineer for approval prior to a final inspection and acceptance of the work. If UPS Project Engineer determines that the drawings are incomplete or incorrect in any way, he/she shall advise Contractor of the required corrections and Contractor shall promptly submit corrected drawings.
- C. Approved record drawings will be returned to Contractor and Contractor shall neatly record the information on a set of drawings. The final set of record documents shall be delivered to UPS Project Engineer prior to final payment for the work. Organize record

prints into three manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

- D. Contractor shall also submit the approved record drawings as PDF electronic files on two CDs or other approved electronic media.

3.4 PROJECT RECORD PROJECT MANUAL

- A. During the progress of the work, maintain one set of the Project Manual at the project site for preparing record Project Manual. Include the designation "PROJECT RECORD MANUAL" in a prominent location on the document. Using an erasable, red-colored pencil, neatly record all changes in the specifications and to indicate the actual product installation.
 - 1. Mark copy with proprietary name and model number of products, materials, and equipment furnished, including product options selected.
 - 2. Record the name of manufacturer, supplier, installer, and other information necessary to provide a record of selections made.

3.5 OPERATING AND MAINTENANCE MANUALS

- A. Prepare three complete sets of manuals containing the manufacturer's instructions for operation and maintenance of each item of equipment, apparatus, and operational system furnished under the Contract and any additional data specifically required in the specification sections.
- B. Manuals will include the following:
 - 1. Complete instructions regarding operation, service, and maintenance, including lubrication, disassembly, and reassembly.
 - 2. Complete nomenclature of all parts and part numbers of all replaceable parts.
 - 3. Complete list of sources to be contacted for service and replacement parts including names, addresses, and all other pertinent data regarding procurement procedure.
 - 4. Copy of all required guarantees and warranties.
 - 5. Manufacturers' bulletins, cuts, and descriptive data clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.
 - 6. An electronic file for all O&M information in this section.

3.6 EQUIPMENT DEMONSTRATIONS

- A. Give physical demonstrations and oral instructions for the operation of equipment, apparatus, and operational systems furnished under the Contract.
- B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

- D. Provide a qualified person knowledgeable about the Project to perform demonstration and instruction of owner personnel.
- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with UPS's personnel in detail to explain all aspects of operation and maintenance.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.7 SPARE PARTS AND OPERATION/MAINTENANCE ITEMS

- A. All spare parts and operation/maintenance items required by the specification sections shall be delivered to the UPS Project Engineer prior to final payment for the work. Label with manufacturer's name and model number and UPSPEC Section number where applicable.

END OF SECTION

SECTION 024100

DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Selective Demolition:
 - 1. Selective demolition of existing conveyor electrical system.
 - 2. Selective demolition existing conveyor related electrical systems.(SPA, DA, NGSS equipment.
 - 3. Removal of abandoned utilities and wiring systems.
 - 4. Notification to Owner of schedule of the shut off of utilities serving occupied spaces.
 - 5. Salvaging items noted to be reused within UPS only or salvaged.

1.2 RELATED SECTIONS

- A. Section 013000 - Administrative Requirements
- B. Section 311000 - Site Clearing

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Permit for transport and disposal of debris
- C. Demolition procedures and operation sequences for review and acceptance by Owner or Owner's Representative

1.4 QUALITY ASSURANCE

- A. Comply with governing codes and regulations.
- B. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- C. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; current edition.
- D. Demolition Firm Qualifications: Company specializing in the type of work required.
 - 1. Minimum of five years of documented experience.
- E. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.5 PROJECT CONDITIONS

- A. Adjacent areas may be occupied by Owner's personnel. Do not interrupt Owner's use of adjacent facilities. Refer to drawings for specific site conditions

1.6 PHASING

- A. Installation of new conveyors in the new building/MDC.
- B. Once the new MDC is connected and the conveyor installed it will tie into the existing building. Once the existing conveyor is modified/ removed the new VFD's and associated electrical work will be completed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Immediately remove from site all demolished material not being reused.

PART 3 - EXECUTION

3.1 GENERAL PROCEDURES

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Take precautions to prevent collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
- B. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- C. If unidentified hazardous materials are discovered during removal operations, stop work and notify UPS Project Engineer immediately; hazardous materials include, but are not limited to, regulated asbestos-containing materials, lead, PCBs, mercury, and petroleum products.
- D. See Section 311000 – Site Clearing – for additional requirements pertaining to demolition of sitework and vegetation.

3.2 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with utility company requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from the authority having jurisdiction.

- D. Do not close, shut off, or disrupt existing life safety systems currently in use without at least seven days' prior written notification to UPS Project Engineer.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs currently in use without at least three days prior written notification to UPS Project Engineer.
- F. Locate and mark all utilities to remain and those to be removed; mark using highly visible tags or flags with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Where conduit is to remain and where conductor is to be disconnected, remove all conductors to electrical panel.
- I. Do not interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.

3.3 DEMOLITION

- A. Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
- B. Verify that utilities have been disconnected and capped before starting demolition activities.
- C. Do not damage building elements and improvements indicated to remain. Items of salvage value not included on schedule of salvage items to be returned to Owner shall be removed from structure. Storage or sale of items at project site is prohibited.
- D. Salvaged items to be returned to owner or reused shall be stored in a secure area and protected until reinstalled or returned to owner.
- E. Do not close or obstruct streets, walks, drives, or other occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction.
- F. Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.
- G. Provide adequate protection against accidental trespassing. Secure project after work hours.
- H. Promptly repair damage to adjacent buildings, and other structure improvement systems caused by demolition operations.
- I. Unless otherwise indicated, demolition waste becomes property of Contractor.
- J. Instructions for special demolition work
- K. Repair demolition performed in excess of that required.
- L. Do not burn materials on site.

M. Pollution Controls: Comply with governing regulations for environmental protection.

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit amount of dust and dirt rising and scattering in air.
2. Provide hoses and water main or hydrant connections.
3. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

3.4 SCHEDULE

A. Items for Protection during Demolition and Construction:

1. Building structures
2. Conveyor systems

B. Items to Be Salvaged for Reinstallation:

1. Control stations
2. Lights
3. Fans

3.5 WARRANTY

A. Notify warrantor on completion of selective demolition, and obtain documentation verifying that the existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

3.6 DISPOSAL AND REMOVAL

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Open burning will not be permitted.

END OF SECTION

SECTION 055000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work includes providing metal fabrications as scheduled in this Section and as indicated on the Drawings.
- B. Work also includes, but is not limited to, providing:
 - 1. Loose angles, channels, plates, brackets, hanger rod and tubing for support of electrical materials and equipment.

1.2 RELATED SECTIONS

- A. Section 233400 – Fans
- B. Section 260000 – Electrical
- C. Section 260500 – Common Work Results for Electrical
- D. Section 262700 – Low Voltage Distribution Equipment
- E. Section 265000 – Lighting

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

1.4 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Handrail and Railing Structural Performance: ASTM E 985.
- C. Metal Bar Grating Standard: ANSI/NAAMM MBG 531.
- D. Heavy-Duty Metal Bar Grating Standard: ANSI/NAAMM MBG 532.
- E. Fire Performance: ANSI/UL 263, NFPA 251, UBC 43-1, ASTM E 119, and ASTM E 814 as applicable.

1.5 REFERENCE STANDARDS

- A. ANSI/NAAMM MBG 531 – Metal Bar Grating Manual; current edition.

- B. ANSI/NAAMM MBG 532 – Heavy Duty Metal Bar Grating Manual; current edition.
- C. ANSI/UL 263 – Standard for Fire Tests of Building Construction and Materials; current edition.
- D. ASME B18.2.1 – Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series); current edition.
- E. ASME B18.6.1 – Wood Screws (Inch Series); current edition.
- F. ASME B18.21.1 – Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series); current edition.
- G. ASTM A 53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; current edition.
- H. ASTM A 283 – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; current edition.
- I. ASTM A 307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength; current edition.
- J. ASTM A 500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; current edition.
- K. ASTM A 501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; current edition.
- L. ASTM A 653 – ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; current edition.
- M. ASTM A 786 – Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; current edition.
- N. ASTM A 1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; current edition.
- O. ASTM A 1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; current edition.
- P. ASTM F 593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; current edition.
- Q. ASTM F 594 – Standard Specification for Stainless Steel Nuts; current edition.
- R. AWS A2.4 – Standard Symbols for Welding, Brazing, Nondestructive Examination; current edition.
- S. FS FF-S-92 – Screw, Machine, Slotted, Cross Recessed or Hexagon Head; current edition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ferrous Materials:

1. Steel Plates, Shapes and Bars: ASTM A 36.
2. Rolled Steel Floor Plates: ASTM A 786.
3. Steel Tubing: ASTM A 500 or A 501, Grade B cold-form structural tubing.
4. Uncoated Structural Steel Sheet: ASTM A 1008 or A 1011.
5. Uncoated Steel Sheet: ASTM A 1008 or A 1011.
6. Galvanized Steel Sheet: ASTM A 653, G90.
7. Steel Pipe, Black Finish: ASTM A 53, Grade B Schedule 40.
8. Steel Pipe, Galvanized Finish: ASTM A 53.
9. Gray Iron Castings: ASTM A 48, Class 30.
10. Plates: ASTM A 283.
11. Slotted Channel Framing: ASTM A 653, Grade 33.
12. Slotted Channel Fittings: ASTM A 1011.
13. Brackets, Flanges, and Anchors: Cast or formed metal.
14. Concrete Inserts: Threaded or wedge type.
15. Welding Rods and Bare Electrodes: AWS specifications.
16. Zinc-Coating: Hot-dip galvanized coating for materials in exterior assemblies or exterior walls.

B. Fasteners:

1. Bolts and Nuts: Hexagon head type, ASTM A 307, Grade A.
2. Wood Screws: Flat head carbon steel, ASME B18.6.1.
3. Plain Washers: Round carbon steel, ASME B18.21.1.
4. Drilled-In Expansion Anchors: ASTM F 593 and F 594.
5. Lock Washers: Spring type carbon steel, ASME B18.21.1.
6. Zinc-Coating: Fasteners in exterior assemblies or exterior walls.
7. Stainless Steel: Fasteners for stainless steel island forms.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Take field measurements prior to fabrication, where possible. Form to required shapes and sizes with true, straight edges, lines, and angles. Provide light-tight, hairline joints.
- B. Coordinate with work of other sections; provide inserts and templates as needed. Install work plumb and level with uniform appearance in accordance with approved submittals.

- C. Form work true to line with sharp angles and edges. Weld continuously, grind flush and make smooth on exposed surfaces.
- D. Install work plumb and level with hairline joints and ground flush welds.
- E. Touch-up damaged coatings with shop primer and galvanize repair paint. See Section 099100 – Painting.
- F. Restore damaged finishes and protect work.
- G. Paint items scheduled in accordance with Section 099100 – Painting.

3.2 SCHEDULE

- A. Provide and install items listed in Schedule and shown on Drawings.
- B. The Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
- C. Metal stairs with abrasive nosings as detailed.
- D. Steel Pipe and Tube Railing Systems:
 - 1. Steel Pipe, Black Finish: ASTM A 53.
 - 2. Steel Pipe, Galvanized Finish: ASTM A 53.
 - 3. Steel Tubing: ASTM A 500 or A 501.
 - 4. Finish: Primed.
 - 5. Finish: Galvanized.
 - 6. Finish: Galvanized and shop primed.
- E. Angles, Channels, Plates, and Tubing for Support of Electrical Materials and Equipment: Prime paint finish.

3.3 PROTECTION AND CLEANING

- A. Remove all soil and foreign matter from finished surfaces and apply such protective measures as may be required to prevent damage or discoloration of any kind until acceptance of project.
- B. Protection shall be provided by strippable coating, protective sleeves, polyethylene sheets, boarding, or any other suitable means during fabrication, shipment, site storage, and erection to prevent damage to the finished work due to stains, discolorations, scratches, or any other cause. Damaged elements shall be replaced as damages occur. Provide protection for walking surfaces during construction.
- C. After installation, and after danger of subsequent damage has passed, remove all protective coverings from all exposed surfaces, and clean those surfaces of all soil and discoloration, ready for acceptance.

END OF SECTION

SECTION 233400

HVAC FANS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. This section includes requirements and specifications for the provision of fans including but not limited to circulating fans, ceiling exhaust/ventilator fans, power roof exhausters/ventilators and roof mounting curbs, and power wall exhausters/ventilators.
- B. Refer to Schedule [at end of this Section.] [on Drawings.]

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

1.3 QUALITY ASSURANCE

- A. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.
- B. Fabrication: Conform to AMCA 99.
- C. Provide fans which have been Underwriters Laboratories Inc. (UL) listed and labeled.

1.4 REFERENCE STANDARDS

- A. AMCA 99 – Standards Handbook; current edition.
- B. AMCA 210 – Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; current edition.
- C. AMCA 300 – Reverberant Room Method for Sound Testing of Fans; current edition.
- D. AMCA 301 – Methods for Calculating Fan Sound Ratings from Laboratory Test Data; current edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Air Circulator Fan - Direct Drive Manufacturers: Patterson Fan Co., (800-768-3985); Romlair Ventilating Co., (800-766-5247).
- B. Acceptable High Velocity Truck Cooler (HVTC) Manufacturers: Patterson Fan Co., (800-768-3985); Romlair Ventilating Co., (800-766-5247).

2.2 GENERAL

- A. Provide fans that have been factory assembled, wired, and tested.
- B. Provide fans in compliance with the performance and electrical requirements specified in Schedule [at end of this Section.] [on Drawings.]
- C. Fan Performance: Based on sea level [**_] conditions.
- D. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas of the building.
- E. Provide belt guards on belt driven fans.
- F. Provide safety screen and guards.

2.3 AIR CIRCULATOR FANS - DIRECT DRIVE

- A. Fan Housing: Tube type - min. 18 ga. steel.
- B. Fan Guards: OSHA approved, one at each end of tube.
- C. Fan Blades: Aluminum propeller type; three blades minimum.
- D. Fan Type:
 - 1. PF-1: Blade diameter 14 inch; installed at where indicated on drawings; UL approved, single speed; 1725 rpm, split phase, drip-proof, 1/4 HP, NEMA 48 frame.
 - 2. PF-2: Blade diameter 22 inch; installed in sort aisles or where indicated on drawings; UL approved; single speed; 1725 rpm, split phase; drip-proof, 1/2 HP, NEMA 56 frame.
- E. Power Cord: Factory wired, eight foot length; three conductor cord with no plug end.
- F. Mounting: As indicated on drawings.
- G. Electrical: 115 or 277 Volts, single phase, 60 Hz.

2.4 HIGH VELOCITY TRUCK COOLER FANS (HVTC)

- A. Fan Housing: Tube type - min. 22 ga. steel.
- B. Fan Guards: OSHA approved, 1/2 inch grill at intake and discharge outlets.
- C. Fan Blades: Squirrel cage type; 48 blades minimum, 9-1/2 inch by 11.12 inch.
- D. Motor: UL approved; single speed; 1075 rpm (min.), split phase; drip-proof; 3/4 HP, NEMA 48 frame, on dock door (HVTC) fans.
- E. Power Cord: None.
- F. Mounting Supports: Interface with framing indicated on drawings and manufacturer furnished mounting brackets.
- G. Capacity: 2800 CFM min.; air throw 60 feet; on dock door (HVTC) fans.
- H. Electrical: 115 or 277 Volts, single phase, 60 Hz.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install items shown on the drawings. Verify final locations with the project engineer.
- B. Install in accordance with manufacturer's instructions.
- C. Install metal fabrication items plumb and level, accurately fitted and aligned and free from distortion or defects.
- D. Install a NEMA Type 1, 1-pole, single phase, toggle type, fractional horsepower manual motor starter with each air circulating fan, PF-1 and PF-2. The starter to include overload protection, red pilot light, and padlocking attachment.
- E. Set roof mounted fans on curbs.

3.2 FAN SCHEDULE

- A. Schedule:

	PF-1	PF-2
Type	14 inch	22 inch
Capacity cfm	2600	5400
Air Throw (ft)	60	120
Motor HP	1/4	1/2
Volts,Hz,Phase	As indicated	As indicated

END OF SECTION

SECTION 260000

ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. This section includes requirements and specifications for electrical work including, but not limited to:
 - 1. Equipment Grounding
 - 2. Supporting devices.

1.2 RELATED SECTIONS

- A. 013300 – Submittal Procedures
- B. Section 015000 - Temporary Facilities and Controls
- C. Section 055000 - Metal Fabrications
- D. Section 233400 - Fans
- E. Section 260500 – Common Work Results for Electrical
- F. Section 262700 – Low Voltage Distribution Equipment
- G. . Section 265000 - Lighting

1.3 SUBMITTALS

- A. Submit shop drawings and manufacturer's product data and installation instructions in accordance with Section 013300 – Submittal Procedures.
- B. Submit cable tray manufacturer's support recommendations and installation instructions.
- C. Submit wireway manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70 requirements for electrical materials and installation.
- B. Keep copy of NFPA 70 in field office for duration of project.
- C. Provide products and components which have been UL listed and labeled, including UL marks indicating special type usage whenever applicable.

1.5 REFERENCE STANDARDS

- A. National Fire Protection Association (NFPA)
 - 1. NFPA 70 - National Electrical Code (NEC), including state and local amendments; current edition.

- B. National Electrical Manufacturers Association (NEMA)
 - 1. Requirements applicable to product manufacturing standard; current edition.
- C. Underwriters Laboratories Inc. (UL)
 - 1. Requirements applicable to product listing and labeling.
- D. NECA 1, Standard for Good Workmanship in Electrical Construction; current edition.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING

- A. Provide each electrical grounding system with assembly of materials required for complete installation including wires/cables, connectors, lugs, clamps, rods, bonding jumpers, and accessories.
- B. Provide equipment grounding conductors for grounding connections matched to supply power overcurrent device and sized according to the NEC.
- C. Provide equipment ground connectors, lugs, clamps, bonding jumpers, and accessories in accordance with the NEC and as recommended by the respective manufacturer for the particular application.
- D. Insulated Conductors: Green in color.

2.2 SUPPORTING DEVICES

- A. Acceptable Conduit, Cable Tray, and Wireway Supports Manufacturers:
 - 1. Same as manufacturers of U-channel, conduit and fittings cable trays, fittings, and accessories.
- B. Acceptable U-Channel Manufacturers:
 - 1. Cooper B-Line, Inc.; a division of Cooper Industries
 - 2. Thomas & Betts Corporation
 - 3. Unistrut; Tyco International, Ltd.
- C. Cable Tray and Wireway Supports: As recommended by the manufacturer.
- D. Conduit Supports:
 - 1. As described in NECA 1.
 - 2. Single Run Hangers: Galvanized steel conduit straps, hangers, or clamps. Use clamps with spacers when mounting to wall or column. Do not use perforated straps and spring steel clips or clamps.
 - 3. Group Run Hangers: Minimum 12-gage galvanized, preformed U-channel rack with conduit fittings; 25% spare capacity.
 - 4. Hanger Rods: Threaded steel, 3/8 inch diameter.
 - 5. Vertical Run Supports: Minimum 12-gage galvanized, preformed U-channel struts with conduit fittings.

- E. Equipment and Lighting Supports:
 - 1. U-Channel: Minimum 12-gage galvanized, preformed U-channel struts with fixture and conduit fittings, as applicable.
 - 2. Loose Steel Angles, Channels, Plates and Tubing: As specified in Section 055000 – Metal Fabrications.
- F. Anchors:
 - 1. For Hollow Masonry: Toggle bolts.
 - 2. For Solid Masonry: Lead expansion anchors.
 - 3. For Concrete: Self drilling anchors.
 - 4. For Wood: Wood screws.
 - 5. For Metal: Machine screws or bolts or steel clamps, as required for application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with requirements for Class 1, Division 2 location for building areas where vehicles are parked, in accordance with NFPA 70.
- B. Comply with welding requirements of Section 055000 – Metal Fabrications.
- C. Determine exact route or location of all electrical materials prior to installation.
- D. Verify the exact locations and elevations of electrical materials as well as the location of future conveyors with UPS Project Engineer prior to installation where dimensions are not indicated.
- E. Install electrical materials as indicated with offsets, fittings, and changes in elevations as required to make adjustments for obstacles or interference.
- F. Do not allow the installation of electrical materials and conduit routing to cause any mechanical or conveyor equipment to be unserviceable or inoperable. Install electrical materials and route conduit away from conveyor pulleys, tails, rollers, belting, safety guards, and all adjustment screws, bolts, and nuts. Ensure sufficient clearance to permit ready removal of conveyor system safety guards.
- G. Do not allow electrical materials to be installed within 3 feet-6 inches above a belt, chute, or slide of conveyor system, including future conveyors indicated on drawings, as measured perpendicular to belt, chute, or slide surface. Maximize all clearances.
- H. Do not allow electrical materials to protrude into pedestrian walk aisles, egress paths, cart paths, sort positions, or platform areas. Coordinate with UPS Project Engineer.
- I. Do not allow electrical materials to be installed in areas where future conveyors are designated.
- J. Do not drill holes in conveyor intermediate section (frame) or sidepanel for the purpose of supporting electrical materials or conduit except as indicated on Detail Drawings.

3.2 GROUNDING INSTALLATION

- A. Install an equipment ground conductor within all power, control, and lighting raceway even when not indicated on the drawings. Adjust conduit size, where necessary, for addition of equipment ground conductor.
- B. Install grounding locknuts and bushings as required.
- C. Install grounding bushings with lug on outgoing conduits at panelboards, motor control centers/panels, control consoles, and main distribution board. Connect #4 copper wire to grounding bushings and to ground bus or lug.
- D. Install double locknuts, one inside and one outside, on all RGS, IMC, and FMC penetrating enclosures and boxes with a clean knockout (no concentric rings remaining).
- E. Install listed fitting outside and one locknut inside on all EMT penetrating enclosures and boxes with a clean knockout (no concentric rings remaining).
- F. Install bonding jumper wire between conduit, grounding locknuts, bushings, and enclosure or box that contains knockouts with concentric rings remaining.
- G. Install bonding jumpers from non-flexible conduit to motor terminal boxes and other equipment where FMC is required for connections, unless liquid tight FMC of 1-1/4 inches in diameter or smaller and six feet long or less is used for the connection.
- H. Install bonding jumpers to connect conduit, cable tray, and wire way expansion fittings or sections where crossing building expansion joints.
- I. Bond equipment ground conductor to all metal enclosures and boxes.
- J. Ensure that entire electrical system is electrically continuous and permanently and effectively grounded, including all electrical equipment and motors.

3.3 SUPPORTING DEVICE INSTALLATION

- A. Install supports, anchors, sleeves, and seals to rigidly fasten conduit, wireway, and equipment.
- B. Support conduit at intervals not to exceed 10 feet and within three feet of any box, conduit body, panel, or other terminating equipment.
 - 1. Install wall supported conduit with a clearance of not less than 1/4 inch from wall.
 - 2. Install conveyor system supported conduit with a clearance of not less than 1/4 inch from support.
 - 3. Install tube steel or U-channel vertical run supports if conduit is not supported by wall, column, conveyor system, or equipment.
 - 4. Install additional support for vertical drops of EMT from joist where necessary to prevent the conduit from pulling away from the fitting.
 - 5. Install conduit at cable trays with listed cable tray clamps or adapters.
- C. Support wireway at intervals not to exceed five feet.
- D. Do not weld supports of any kind to building structural steel members.

- E. Do not fasten supports of any kind to steel roof deck.
- F. Do not use conduit or other pipe of any kind as a means of support.
- G. Welding supports to building structural members and/or fastening supports to roof deck panels or other conduit or pipe will not be permitted.

END OF SECTION

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes requirements and specifications for common electrical work results including, but not limited to:
 - 1. Raceways.
 - 2. Wires and connectors.
 - 3. Boxes and fittings.
 - 4. Wiring devices.
 - 5. Enclosures.
 - 6. Electrical identification.
 - 7. Testing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 014000 – Quality Requirements
- C. Section 033000 – Cast-In-Place Concrete
- D. Section 055000 – Metal Fabrications
- E. Division 31 - Earthwork

1.3 SUBMITTALS

- A. Submit shop drawings and manufacturer's product data and installation instructions in accordance with Section 013300 – Submittal Procedures.
- B. Submit cable tray manufacturer's support recommendations and installation instructions.
- C. Submit wireway manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70 requirements for electrical materials and installation.
- B. Keep copy of NFPA 70 in field office for duration of project.
- C. Provide products and components which have been UL listed and labeled, including UL marks indicating special type usage whenever applicable.

1.5 REFERENCE STANDARDS

- A. ANSI C80.1 – Galvanized Rigid Conduit (GRC); current edition.
- B. ANSI C80.3 – Steel Electrical Metal Tubing (EMT); current edition.
- C. ANSI C80.5 – Electrical Rigid Aluminum Conduit (ERAC); current edition.
- D. ANSI Z535.4 – Product Safety Signs and Labels, Includes Errata; current edition.
- E. 29 CFR 1910.145 – Specifications for accident prevention signs and tags; current edition.
- F. National Fire Protection Association (NFPA)
 - 1. NFPA 70 - National Electrical Code (NEC), including state and local amendments.
- G. National Electrical Manufacturers Association (NEMA); current editions.
 - 1. Requirements applicable to product manufacturing standard.
 - 2. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)
 - 3. NEMA FB 1 – Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
 - 4. NEMA ICS 2 or IEC – Controllers, Contactors and Overload Relays Rated 600 V
 - 5. NEMA ICS 6 – Industrial Control and Systems: Enclosures
 - 6. NEMA TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit
 - 7. NEMA TC 3 – Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
 - 8. NEMA TC 13 – Electrical Nonmetallic Tubing (ENT)
 - 9. NEMA VE 1 – Metal Cable Tray Systems
 - 10. NEMA WC 70 – Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy
- H. Underwriters Laboratories Inc. (UL); current editions.
 - 1. Requirements applicable to product listing and labeling.
 - 2. UL 870 – Standard for Wireways, Auxiliary Gutters, and Associated Fittings
 - 3. UL 1660 – Liquid-Tight Flexible Nonmetallic Conduit

PART 2 - PRODUCTS

2.1 WIRES, CABLES AND CONNECTORS

- A. Acceptable Wire and Cable Manufacturers:
 - 1. Wires and Cable Conductors:
 - a. General Cable Corporation.
 - b. Southwire Company.

2. Control, Instrumentation, Data and Communication Cables
 - a. Alpha Wire
 - b. Belden CDT Inc., Electronics Division
 - c. CommScope, Inc.
 - d. Genesis Cable Products
 - e. General Cable Company
 - f. National Wire and Cable Corporation
- B. Acceptable Wire and Cable Connector Manufacturers:
1. Burndy Corp.
 2. Ideal Industries, Inc.
 3. AFC Cable Systems, Inc.
 4. Hubbell Power Systems, Inc.
 5. Tyco Electronics Corporation
 6. O-Z/Gedney, EGS /Electrical Group LLC.
 7. Thomas & Betts Corp.
- C. Acceptable Terminal and Distribution Block Manufacturers:
1. Allen Bradley/Rockwell Automation
 2. Cutler Hammer, Div. of Eaton Corp.
 3. General Electric
 4. Square D, Schneider Electric
- D. Wires:
1. Conductors: stranded copper complying with NEMA WC 70.
 2. Insulation type as follows:
 - a. Dry locations: all conductors Type THHN (90°C); 600 volt, flame retardant and heat resistant thermoplastic.
 - b. Wet locations: all conductors Type THWN (75°C); 600 volt, flame retardant, moisture and heat resistant thermoplastic.
- E. Cables:
1. Complying with NEMA WC 70.
 2. Flexible Cord: Type SO (60°C); 600 volt; copper conductors with green colored ground, rubber insulation and oil resistant neoprene outer covering.
 3. Tray Cable: Type TC (90°C); 600 volt; copper conductors with green colored ground and PVC outer covering.
 4. Control, Instrumentation, Data and Communication Cable: Type CM, CL (60°C) and PLTC (105°C); 300 volt; copper conductors; 100 % shield coverage and drain wire. For DC voltage applications, including photoelectric sensors and variable frequency drives.
 5. Device Cable: Cables that are factory assembled as part of a permanent non-removable connection to a device shall have insulation rated in accordance with

the maximum circuit voltage applied to the cable. Where the cable shares a raceway or enclosure with other conductors that operate at a higher circuit voltage, it must have an insulation rating in accordance with the maximum voltage applied to the other conductors.

6. Communication cable for Programmable Logic Controllers (PLC) and Personal Computers (PC): as recommended by the equipment manufacturer.
 7. Metal Clad Cable: Type MC (90°C), THHN Copper conductors factory assembled with insulated circuit conductors enclosed in an armor of interlocking metal tape or corrugated metallic sheath.
- F. Splice and Terminal Connectors: Factory fabricated, metal connectors compatible with conductor material, as follows:
1. Bolted or screwed mechanical pressure type.
 2. Compression/crimped pressure type.
 - a. Tin-plated, aluminum adapter sleeves are not permitted.
 3. Twist-on pressure type plastic or nylon insulator cap with internal threaded core and spring insert
- G. Terminal Blocks: NEMA ICS 4 or IEC; modular, channel (rail) mounted with end stops; solderless, box clamp type terminals 300 volt rated for control conductors, 600 volt rated for power conductors; current rated for the applicable conductors; suitable for connection of copper conductors; with marking strips. Maximum of two control conductors per terminal lug if permitted by the terminal UL listing. Maximum of one power conductor per terminal lug.
- H. Distribution Blocks: For distributing high current carrying capacity to multiple power loads; direct mounted; pressure type lug terminals; 600 volt rated for power conductors; ampere rated for the applicable conductors and loads; suitable for connection of copper conductors; with marking strips. Multiple conductors per block. Distribution blocks to be covered with a UL listed clear cover for personnel protection.

2.2 RACEWAYS

- A. Cable Trays, Fittings and Accessories:
1. Acceptable Manufacturers:
 - a. B-Line Systems, Inc.
 - b. Cope Cable Tray, a division of Allied Electrical Group
 - c. P –W Industries, Inc.
 - d. Square D, Schneider Electric
 2. Provide cable tray system complying with NEMA VE 1.
 3. Provide straight sections, reducers, bends, tees, crosses, elbows, covers, clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, expansion connectors, drop-outs, conduit adapters, bonding jumpers, and any other component parts reasonably incidental to providing a complete cable tray system.

4. Provide ladder type cable trays capable of supporting a uniformly distributed load of 50 lbs./ft. with a maximum deflection of 0.6 inch at midpoint of a 10 foot simple span and capable of supporting concentrated loads of 200 pounds at any point, over and above full cable loads, as follows:
 - a. Material and Finish: Galvanized steel or aluminum.
 - b. Cross Rungs: Six inches o.c. spacing.
 - c. Construction: Four inch I-beam or channel shape side rails, welded to rungs.
 - d. Fittings: 12 inches minimum radius.
 - e. Covers: Flanged, ventilated.
5. Fabricate units with rounded edges and smooth surfaces.

B. Conduit and Fittings:

1. Acceptable Metal Conduit and Fittings Manufacturers:
 - a. RGS, IMC, EMT and FMC Conduit and Fittings:
 - 1) Allied Tube & Conduit, a Tyco International Ltd. Co.
 - 2) Hubbell Raco
 - 3) LTV Copperweld
 - 4) O-Z/Gedney, a unit of General Signal.
 - 5) Southwire Company
 - 6) Thomas & Betts Corp.
 - 7) Wheatland Tube Co.
 - 8) Western Tube & Conduit
 - b. Expansion Fittings:
 - 1) Crouse-Hinds, a division of Cooper Industries, Inc.
 - 2) O-Z/Gedney Co.
 - 3) Southwire Company
 - 4) Spring City Electrical Mfg. Co.
 - 5) Thomas & Betts Corp.
 - c. Sealing and Drainage Fittings:
 - 1) American Electric Industries
 - 2) Appleton Electric Co.
 - 3) Crouse-Hinds, a division of Cooper Industries, Inc.
 - 4) O-Z/Gedney, a unit of General Signal.
 - 5) Spring City Electrical Mfg. Co.
 - 6) Thomas & Betts Corp.
 - d. Wall and Floor (Smoke and Fire) Seals:
 - 1) American Electric Industries
 - 2) Appleton Electric Co.
 - 3) Crouse-Hinds, a division of Cooper Industries, Inc
 - 4) O-Z-Gedney, a unit of General Signal.
 - 5) Spring City Electrical Mfg. Co.
 - 6) Thomas & Betts Corp.
2. Minimum Conduit Size: 1/2 inch.

3. Rigid Galvanized Steel Conduit (RGS) conforming to ANSI C80.1 and Intermediate Metal Conduit (IMC) conforming to ANSI C80.5; hot dip galvanized; standard threaded conduit couplings.
4. RGS and IMC Fittings: Conforming to NEMA FB 1; hot dip galvanized or zinc or cadmium electroplated, threaded, split-couplings unacceptable; Fittings compatible with conduit.
5. Electrical Metallic Tubing (EMT): Conforming to ANSI C80.3; electro-galvanized, compression type.
6. EMT Fittings: Conforming to NEMA FB1; electro-galvanized; steel compression type; rain and concrete tight; insulated throat connectors with case hardened locknuts. Do not use indentation or set screw type fittings of any kind.
7. Flexible Metal Conduit (FMC): complying with UL 1; hot dip galvanized steel.
8. FMC Fittings: Conforming to NEMA FB 1, Type 1, Class 1, Style A; hot dip galvanized or zinc or cadmium electroplated; connectors compatible with conduit.
9. Liquid Tight FMC: Complying with UL 1660; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; hot dip galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride.
10. Liquid Tight FMC Fittings: Conforming to NEMA FB 1; Type 1, Class 3, Style G; hot dip galvanized or zinc or cadmium electroplated; connectors compatible with conduit.
11. Rigid Nonmetallic Conduit (RNC): Schedule 40 Rigid PVC; conforming to NEMA TC 2, for direct burial underground or above ground installations.
12. RNC: Schedule 80 Rigid PVC; conforming to NEMA TC 2, Type 1 for encasement in concrete underground.
13. RNC Fittings: Conforming to NEMA TC3; matched to conduit/tubing type and material.
14. Electrical Nonmetallic Flexible Tubing (ENT): Conforming to NEMA TC 13; for above ground installations, connectors compatible with tubing.
15. Expansion Fittings: Specifically designed to permit four inches linear movement and 30 degrees angular movement in conduit runs, and to mate with adjoining conduit; iron or steel body, hot dip galvanized or zinc electroplated; with bonding jumper.
16. Sealing and Drainage Fittings: Corrosion resistant cast metal body with openings for filling/inspection and drainage; corrosion resistant opening plugs; female hub, top and bottom; specifically designed for sealing vertical runs of conduit to restrict the passage of gases, vapors, and flames and to limit explosions; sealing compound as required and recommended by fitting manufacturer to provide a complete seal.
17. Wall and Floor (Smoke and Fire) Seals: Factory assembled watertight seals suitable for sealing around conduit passing through concrete foundations, fire rated walls, and fire rated floors; constructed with steel sleeves, iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

Sleeve seal manufacturers:

- a. Advance Products & Systems, Inc.
- b. Calpico, Inc.
- c. Metraflex Co.
- d. Pipeline Seal and Insulator, Inc.

C. Wireway, Fittings and Auxiliary Gutters:

1. Acceptable Manufacturers:
 - a. Cooper B-Line, Inc.
 - b. Hoffman
 - c. Square D, Schneider Electric
2. Provide wireway straight sections, couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, hangers, and any other component parts reasonably incidental to providing a complete wireway system.
3. Provide lay-in type wireway and auxiliary gutters as follows:
 - a. Material and Finish: Sheet metal, phosphatized and gray enamel finished.
 - b. Construction: NEMA Type 1, with hinged covers, conforming to NEMA ICS 6 and complying with UL 870.

2.3 BOXES AND FITTINGS

A. Acceptable Manufacturers:

1. Crouse-Hinds, a division of Cooper Industries, Inc.
2. EGS/Appleton Electric Co.
3. Hubbell Incorporated, Killark Electric Manufacturing Co. Division
4. RACO, a Hubbell Company
5. O-Z/Gedney, a unit of General Signal
6. Spring City Electrical Mfg. Co.
7. Thomas & Betts Corporation
8. Hoffman

- B. Provide boxes compatible with conduit and of types, shapes, and sizes, including box depths, to suit each respective location.
- C. Provide box covers of same material as box, unless otherwise indicated, and of types, shapes, and sizes to suit each respective location.
- D. Provide box accessories as required for mounting at each respective location including mounting brackets, wallboard hangers, extension rings, fixture studs, clamps, and straps.
- E. Provide boxes equipped with plaster rings and carpet flanges where applicable.
- F. Pull and Junction Boxes (without terminal or distribution blocks): Conforming to NEMA OS 1; galvanized sheet steel; welded seams; screw-on covers; equipped with stainless steel nuts, bolts, screws and washers. NEMA Type 1.

- G. Floor Boxes: Conforming to NEMA FB 1; cast iron [watertight] [concrete tight] adjustable type; threaded conduit entrance end; vertical adjusting rings; gasketed; brass floor plates, flush screw-on covers.
- H. Terminal and Distribution Boxes (containing terminal or distribution blocks): Gray finish; white subpanel; welded seams; hinged door; conforming to NEMA 250; NEMA Type 12.
- I. Interior Outlet Boxes: Conforming to NEMA OS 1; galvanized sheet steel; stamped knockouts in back and sides; threaded screw holes with corrosion resistant screws for securing box covers and wiring devices.
- J. Conduit Bodies (condulets): Conforming to NEMA FB 1; galvanized cast metal; threaded conduit entrance ends; removable covers, corrosion resistant screws.
- K. Bushings, Knockout Closures and Locknuts: Conforming to NEMA OS 1; corrosion resistant punched steel box knockout closures and conduit locknuts; malleable iron conduit bushings and offset connectors.
- L. Receptacle Floor Fitting: Aluminum with brushed finish, three inches high maximum; complete with mounting base, insert adaptor, and locking nipple for duplex floor receptacle specified in this section.
- M. Telephone Floor Fitting: Aluminum with brushed finish; flush mounting with single faced one-hole cover.
- N. Exterior Outlet Boxes: Corrosion resistant cast metal; threaded conduit ends; include “weatherproof while in use” hinged cover.
- O. Strain Relief Grip: Woven steel mesh with connection fitting, designed to absorb pull, flexure, and vibration exerted on cord or cable and prevent disconnection at wired terminals.
- P. LAN Outlet Boxes: Aluminum FS device box with ¾ inch threaded hub epoxy powdered coated.

2.4 ENCLOSURES

- A. Provide enclosures for terminal and distribution blocks, manual and magnetic motor starters, motor safety switch disconnects, contactors, relays, control stations, controllers, transformers, and all other power and control equipment, conforming with NEMA 250 and suitable for surface mounting, as follows:
 - 1. In NFPA 70 Class 1, Division 2 Interior Locations: NEMA Type 7 (Explosion Proof).
 - 2. Exterior Locations: NEMA type 3R.
 - 3. All Other Locations: NEMA Type 12 (dust tight) or 13 (Dust and oil tight - heavy duty).
- B. Provide enclosures for manual motor starters complying with NEMA Standards and suitable for surface mounting as follows:
 - 1. NEMA 12

2.5 WIRING DEVICES

- A. Acceptable Manufacturers:
 - 1. Arrow Hart Motor Controls Co.
 - 2. Eagle Electric Mfg. Co., Inc.
 - 3. Hubbell Inc.
 - 4. Leviton Mfg. Co., Inc.
 - 5. Pass & Seymour/Legrand
 - 6. Cooper Wiring Devices, a division of Cooper Industries, Inc.
- B. Provide factory fabricated wiring devices conforming to NEMA WD 1, unless otherwise indicated.
- C. Wall Switches: NEMA heavy duty class; rated at 20 amperes; AC quiet slow make, slow break design; toggle handle with totally enclosed case; mounting yoke insulated from mechanism; back or side wiring, metal plaster ears; brown or gray color.
- D. Standard Duplex Receptacles: NEMA heavy-duty class; 2-pole, 3-wire grounding with green hexagonal equipment ground screw; ground terminal and poles internally connected to mounting yoke; rated at 20 amperes, 125 volts; back or side wiring, metal plaster ears; NEMA configuration 5-20R, unless otherwise indicated; brown or gray color.
- E. Floor Receptacles: NEMA heavy-duty class; 2-pole, 3-wire grounding; rated at 20 amperes, 125 volts, back to back duplex receptacle; NEMA configuration 5-20R; brown or gray color.
- F. Special Purpose Outlets: NEMA heavy-duty class, grounding type, with matching plug.
- G. Pilot Light Switches: NEMA heavy-duty class; rated at 20 amperes, 120 volts; AC quiet design; lighted red polycarbonate (Lexan) toggle handle when switch is in ON position, neon lamp, single pole, back or side wiring.
- H. Interior Plate Covers: Stainless Steel, type 302 satin finished, minimum 0.032 inch thick; accurately die cut and beveled; smooth rolled outer edge for flush mounted boxes edge smoothed to fit surface mounted boxes; with screws to match plate cover finish.
- I. Exterior Plate Covers: Die cast aluminum, satin finished, weatherproof, individual spring loaded, gasketed lift lids for devices, corrosion resistant screws to match plate cover finish.

2.6 ELECTRICAL IDENTIFICATION

- A. Wire and Cable Markers: Machine printed sleeve or adhesive wrap around type with black non-smear indelible ink. Identification shall be legible with bold, non-faded, distinct characters. Sleeve type markers shall have the marking printed once. Do not heat shrink sleeve markers to allow for the sleeve to be rotated. Adhesive type shall have the marking printed multiple times around the circumference of the wire or cable.

Brady Corporation shall manufacture adhesive wrap around type. Replace ink cartridge regularly to maintain clear identification.

- B. Nameplates: Laminated plastic with beveled edges; white face ply engraved through to expose contrasting black core ply lettering; 1/16 inch thick, 5/8 inch high with 3/8 inch lettering; length as required; punched for riveted fastening.
- C. Warning Labels and Signs: Comply with NFPA 70 and 29 CFR 1910.145 and conform to ANSI Z535.4.

PART 3 – EXECUTION

3.1 GENERAL

- A. Comply with requirements for Class 1, Division 2 location for building areas where vehicles are parked, in accordance with NFPA 70.
- B. Comply with welding requirements of Section 055000 – Metal Fabrications.
- C. Determine exact route or location of all electrical materials prior to installation.
- D. Verify the exact locations and elevations of electrical materials as well as the location of future conveyors with UPS Project Engineer prior to installation where dimensions are not indicated.
- E. Install electrical materials as indicated with offsets, fittings, and changes in elevations as required to make adjustments for obstacles or interferences.
- F. Do not allow the installation of electrical materials and conduit routing to cause any mechanical or conveyor equipment to be unserviceable or inoperable. Install electrical materials and route conduit away from conveyor pulleys, tails, rollers, belting, safety guards, and all adjustment screws, bolts, and nuts. Ensure sufficient clearance to permit ready removal of conveyor system safety guards.
- G. Do not allow electrical materials to be installed within 3'-6" above a belt, chute, or slide of conveyor system, including future conveyors indicated on drawings, as measured perpendicular to belt, chute, or slide surface. Maximize all clearances.
- H. Do not allow electrical materials to protrude into pedestrian walk aisles, egress paths, cart paths, sort positions, or platform areas. Coordinate with UPS Project Engineer.
- I. Do not allow electrical materials to be installed in areas where future conveyors are designated.
- J. Do not drill holes in conveyor intermediate section (frame) or sidepanel for the purpose of supporting electrical materials or conduit.

3.2 CABLE TRAY INSTALLATION

- A. At Contractor's option install cable tray system instead of conduit and fittings for horizontal runs in joist and vertical drops to motor control panel(s) and other free standing panels.

- B. Route cable tray system above the bottom chords and below the top chords of steel roof support joists or between glue laminated wood beams wherever possible. Where this is not possible route within 2'-6" of bottom of joist for single tray and within 5'-0" of bottom of joist for double tier tray. Coordinate routing with UPS Project Engineer to determine future conveyor interference.
- C. Install cable tray system in accordance with manufacturer's installation instructions.
- D. Route cable trays parallel or perpendicular to building lines.
- E. Maintain minimum of six inches clearance at flues and heat sources.
- F. Install system with allowance for expansion and contraction at building expansion joints. Clamp cable trays rigidly only at midpoints between expansion connectors.
- G. Install covers on vertical tray runs for the first six feet above motor control panel(s) and main distribution board.
- H. Install continuous barrier strips with barrier splice clips in trays to separate power cables from control cables.
- I. Ensure cable trays are aligned in a neat uniform manner.
- J. Before starting installation, provide UPS Project Engineer with shop drawings indicating cable tray and tray cable runs for approval.

3.3 CONDUIT INSTALLATION

- A. Install conduit underground only for service to main building, and other connections to electrical equipment located outside of main building as indicated on the contract documents.
- B. Install conduit and fittings exposed, except conceal conduit and fittings in office complex rooms other than mechanical equipment rooms, and elsewhere as indicated.
- C. Route all exposed conduits parallel or perpendicular to building lines.
- D. Group runs of conduit wherever possible.
- E. Route conduit runs above the bottom chords and below the top chords and steel roof support joist with vertical drops along walls/columns or to equipment as applicable, unless otherwise indicated.
- F. Install IMC:
 - 1. For all outdoor power and control devices.
 - 2. For horizontal runs attached to or supported from the underside of the bottom chord of open web steel roof or mezzanine support joists and below 8 inches of bottom of solid steel roof joist or glue laminated wood roof beams as follows:
 - a. For AC three phase power
 - b. For AC single phase control
 - 3. All IMC conduit installations for conveyor equipment shall follow the requirements indicated in the Conveyor Electrical Project Manual. Refer to UPS project manager for details.

- G. Install EMT:
1. For horizontal runs above the bottom chords and below the top chords of open web steel roof or mezzanine support joists and within eight inches below bottom of solid steel roof joist or glue laminated wood beams as follows:
 - a. For AC three phase power
 - b. For AC single phase control
 - c. For DC control, instrumentation, data, and communication
 2. For horizontal runs along walls as follows:
 - a. For AC three phase power
 - b. For AC single phase control
 - c. For DC control, instrumentation, data, and communication
 3. For vertical drops down walls and building columns from steel roof or mezzanine support joist, laminated wood beams or cable tray as follows:
 - a. For AC three phase power
 - b. For AC single phase control
 - c. For DC control instrumentation, data, and communication
 4. For horizontal and vertical runs between Main Distribution Board (MDB) and MCC or MCP as follows:
 - a. For AC three phase power
 5. In office complex rooms and ceilings.
 6. Make transition from EMT to IMC conduit where required, along horizontal run at least two feet from vertical drop, transition to be above the bottom chords of open web steel roof or mezzanine support joists, or within eight inches of bottom of solid steel roof joist or laminated wood roof beams. Transition from EMT to IMC to be made only once per run.
 7. All EMT conduit installations for conveyor equipment shall follow the requirements indicated in the Conveyor Electrical Project Manual. Refer to UPS project manager for details.
- H. Install RGS and fittings in place of IMC, where required by NFPA 70 (e.g., electrically classified areas) or by federal, state, and local governments or agencies having jurisdiction.
- I. Install FMC and fittings for motor, lighting connections, and for other equipment connections where subject to movement and vibration.
- J. Install ENT and fittings for all data and telephone installations concealed in walls or above ceilings.
- K. Install insulated bushings in open ends of all conduits penetrating enclosures and boxes.
- L. Install a locknut on one side and sealing locknut on the other side of a clean knockout (no concentric rings remaining) where penetrating enclosures or boxes with RGS or IMC. Install listed fitting outside and one locknut inside of a clean knockout (no concentric rings remaining) where penetrating enclosures or boxes with EMT.

- M. Install grounding locknuts or grounding bushings on all conduits that penetrate enclosures or boxes that contain knockouts with concentric rings remaining. Install bonding jumper wire.
- N. Install expansion fittings complete with bonding jumpers where conduits cross building expansion joints.
- O. Install smoke and fire stop fittings where conduits pass through fire rated walls and floors. Restore original fire-resistance rating of assembly.
- P. Install sealing and drainage fittings with sealing compound to provide a complete seal, as required for Class 1 locations.
- Q. Maintain minimum of six inches clearance at flues and heat sources.
- R. Install conduits free from dents and bruises. Plug ends to prevent entry of dirt, debris, and moisture during installation.
- S. Cut ends of conduit square. Ream ends of field-cut conduit and remove burrs.
- T. Join conduit butt-tight in couplings.
- U. Ensure conduit is aligned in a neat, uniform manner.
- V. Holes drilled into NEMA Type 12 enclosures for conduit entry shall be tightly sealed using sealing locknuts to maintain the NEMA rating of the enclosure.
- W. Do not run conduits parallel or perpendicular under any conveyor belt except as detailed on Detail Drawings.
- X. Do not run conduits parallel along conveyor side panels except as detailed on Detail Drawings.
- Y. Do not run conduit across open spans below 8'-0" above floor or platform unless the entire length of conduit within the span is supported. Avoid conduit installation that creates "chin-up bars," footrests, and ladders, which expose conduit to damage.
- Z. Do not run conduits on the floor or along handrail.
- AA. Do not run conduits within 18 inches of the floor in areas where vehicles will be parked.

3.4 WIREWAY INSTALLATION

- A. Install wire way only where specifically indicated on Drawings.
- B. Install wire way system in accordance with manufacturer's installation instructions.
- C. Install wire way system free from dents and bruises
- D. Route wire way parallel or perpendicular to building lines.
- E. Maintain minimum of six inches clearance at flues and heat sources.
- F. Install wire way system with allowance for expansion and contraction at building expansion joints.
- G. Ensure wire way is aligned in a neat uniform manner.

3.5 WIRE, CABLE AND CONECTOR INSTALLATION

- A. Install all conductors in raceways, including low voltage wiring, unless otherwise indicated on the drawings. Keep AC power, AC control, DC control and DC instrumentation, data, and communication cable in separate raceways. Do not mix voltage levels within the same raceway.
- B. Install copper conductors.
 - 1. Install minimum #12 AWG conductors for AC power circuits and minimum #14 AWG conductors for AC control circuits.
 - 2. Install stranded conductors for all wiring, except solid #10 AWG and #12 AWG copper conductors may be used for lighting and convenience receptacle circuits.
 - 3. Install tray cable in cable trays. Use multi-conductor cable with ground for control circuits and three-conductor cable with ground for power circuits.
 - a. Limit the number of cables in cable trays to 80 percent of the maximum allowable cable fill area specified in NFPA 70.
 - 4. Terminate the shield from all shielded cable to ground at one end only: Panel end. Do not terminate shield to ground at the field device.
 - 5. Factory bound multiple conductor bundle or multi-conductor cable may be used in place of individual conductors for conduit system.
 - 6. Install communication cable for computers, PLC's, or other equipment as recommended by the communication equipment manufacturer.
 - 7. Install metal-clad cable (MC) at contractors option, for runs concealed in walls and ceilings only. No exposed MC cable shall be permitted.
- C. Color code conductor insulation as follows:
 - 1. Control Circuits – Single conductor
 - a. 24 Volt, DC
 - 1) Positive-Blue
 - 2) Negative-Blue with white spiral tracer
 - 3) Signal-Blue with red spiral tracer
 - b. 120 Volt, AC
 - 1) Supply-Red
 - 2) Neutral-White
 - 3) Ground-Green
 - 2. Control Circuits – Multi-Conductor system
 - a. 120 Volt, AC – Single conductors bound
 - 1) Multi-conductor system consisting of single insulated conductors, factory bound together to form a bundle. All red supply conductors with white for neutral and green for ground. Each conductor within a bundle shall be factory numbered every 12 inches with no duplication of numbers. Each bundle shall be identified with a unique letter.
 - b. 120 Volt, AC – Tray Cable

- 1) Multi-conductor system consisting of multiple insulated conductors, factory bound to form a cable. Multiple color supplies conductors with only one white for neutral and only one green for ground. Duplicated colors shall be distinguished with a different colored tracer stripe. Insulated jacket encloses conductors.
- c. 24 Volt, DC – Cable
 - 1) Multi-conductor system consisting of multiple insulated conductors, factory bound to form a cable. Multiple color conductors. Duplicated colors shall be distinguished with a different factory printed number or a different colored tracer stripe. Insulated jacket encloses conductors.
3. Power Circuits – Single conductor
 - a. 240/120 Volt, Single Phase, 3 Wire System:
 - 1) Hot Phase A Black
 - 2) Hot Phase B Red
 - 3) Neutral White
 - 4) Switch Leg other than phase wire color.
 - 5) Ground Green
 - b. 208/120 Volt, Three Phase, 4 Wire Wye System:
 - 1) Hot Phase A- Black
 - 2) Hot Phase B- Red
 - 3) Hot Phase C- Blue
 - 4) Neutral- White
 - 5) Switch Leg- other than phase wire color.
 - 6) Ground- Green
 - c. 240/120 Volt, Three Phase, 4 Wire Delta System:
 - 1) Hot Phase A- Orange
 - 2) Hot Phase B- Black
 - 3) Hot Phase C- Blue
 - 4) Neutral- White
 - 5) Ground- Green
 - d. 480/277 Volt, Three Phase, 4 Wire Wye System:
 - 1) Hot Phase A- Brown
 - 2) Hot Phase B- Orange
 - 3) Hot Phase C- Yellow
 - 4) Neutral- Gray
 - 5) Switch Leg- other than phase wire color.
 - 6) Ground- Green
 - e. 480 Volt, Three Phase, 3 Wire System:
 - 1) Hot Phase A- Brown
 - 2) Hot Phase B- Orange
 - 3) Hot Phase C- Yellow
 - 4) Ground- Green
4. Power Circuits – Multi-Conductor system
 - a. 208, 240, 480, 600 Volt – Tray Cable

- 1) Multi-conductor system consisting of multiple insulated conductors, factory bound to form a cable. All black conductors. Each conductor shall be distinguished with a different factory printed number. Insulated jacket encloses conductors.
 5. For all conductors, AC and DC, the insulation color and factory printed number, if applicable, shall be maintained throughout the entire length. Do not change color or number at termination points, terminal blocks, distribution blocks or splices.
- D. Install spare conductors as indicated on drawings.
- E. Bundle spare conductors at each location with nylon ties. Wrap the end of the bundle with electrical tape. Do not terminate any spares on empty terminal blocks.
- F. Clean raceways of dirt and debris and remove moisture prior to installation of conductors. Do not install conductors in raceways until raceways have been fully installed and aligned.
- G. Make conductor length for parallel feeders identical.
- H. Keep conductors off ground and floor; wipe conductors clean as they are installed in raceways.
- I. Lace or clip groups of feeder conductors at distribution centers, and pull and junction boxes.
- J. Installation in Cable Trays:
1. Contractor to utilize existing horizontal cable trays where applicable and install new tray at Contractor's option for AC power and control, DC control, instrumentation, data, and communication cable. Install AC power and AC control in the same tray. Install barrier strips with splice clips in new and existing tray along the entire length to separate AC power and AC control cable. Install DC control, instrumentation, data, and communication cable in separate tray. Do not install barrier strips in tray that contains only power cable or in tray that contains only control. Do not install barrier strips in any unused trays.
 2. Securely fasten cable to cross rungs with nylon ties at intervals not to exceed eight feet for horizontal tray runs, and four feet for vertical tray runs.
 3. Cable to be continuous. Splice cable only if a splice or tap is required as indicated on the drawings. Do not splice or tap within tray.
 - a. Power cable may be spliced or tapped by connecting to terminal or distribution blocks within terminal or distribution boxes located at tray elevation or below. Make transition between tray cable and individual conductors at this location.
 - b. Control cable may be spliced or tapped by connecting to terminal blocks within terminal or distribution boxes located within 10 feet of finished floor. Make transition between tray cable and individual conductors at this location.
 4. Do not allow any cable to project above side rails or through cross rungs.
- K. Installation in Conduit:
1. Pull conductors together where more than one is being installed in a conduit.

2. Use pulling means which cannot damage conductor or insulation.
 3. Use pulling lubricant for pulling wire and cable. Lubricant must not deteriorate the conductor or insulation.
 4. All AC power and control wires and low voltage DC cables to be continuous without splices unless a splice is required as indicated on the drawings. Splice or tap conductors only in accessible pull and junction boxes that are located within 10 feet of finished floor except for motor terminations at motor conduit box. Do not splice at joist elevation.
 5. Install AC power conductors, AC control conductors, DC control conductors and instrumentation, data, and communication cable in separate conduits. Do not mix voltage levels within the same conduit.
- L. Installation in Wire way:
1. All AC power and control wires and low voltage DC cables to be continuous without splices unless a splice is required as indicated on the drawings. Splice or tap conductors within wire way.
 2. Install AC power conductors, AC control conductors, DC control conductors and instrumentation, data, and communication cable in separate wire way.
 3. AC power and control conductors may only be run within the same wire way provided that a continuous full depth barrier strip is installed along the entire length, the insulation rating is the same and the power and control is functionally associated.
- M. Install splice and terminal connectors which have mechanical strength and insulation rating equivalent-or-better than conductor.
1. Tape uninsulated connectors with electrical insulating tape to 150 percent of the insulation rating of conductor.
- N. Install split bolt mechanical connectors for copper conductor splices, #6 AWG and larger, or for multiple taps use terminal or distribution blocks.
- O. Install twist-on connectors for copper conductor splices, #8 AWG and smaller for five or fewer splices. Limit the number of conductors per twist-on connector to three. For more than five splices install terminal or distribution blocks for connectors in terminal or distribution boxes.

3.6 BOX INSTALLATION

- A. Locate boxes to allow accessibility after completion of construction.
- B. Locate pull and junction boxes in office complex rooms, either above removable ceilings or in mechanical equipment rooms and as shown on drawings.
- C. Locate lighting outlet boxes above ceilings in office complex rooms.
- D. Mount outlet boxes flush in office complex rooms other than mechanical equipment rooms, unless otherwise indicated.
- E. Rigidly fasten boxes or solidly embed boxes in concrete.

- F. Securely anchor floor fittings to floor boxes. Where floor fittings are mounted on conduit floor stubs, provide independent anchorage to floor to prevent fitting movement.
- G. Size all junction and pull boxes in accordance with national state and local codes.
- H. Rigidly fasten boxes or solidly embed boxes in concrete or masonry as applicable
- I. Do not install round boxes where conduit must enter side of box.
- J. Install knockout closure to cap unused knockout holes where blanks have been removed.
- K. Support terminal and distribution boxes at cable tray from roof joist independent of cable tray supports. Locate boxes to allow accessibility after completion of construction.

3.7 WIRING DEVICE INSTALLATION

- A. Clean dirt and debris from electrical boxes and remove moisture prior to installing wiring devices.
- B. Mount switches vertically with bottom of box 48 inches above floors and platforms, unless otherwise indicated.
- C. Provide electrically continuous, tight grounding connections for wiring devices, unless otherwise indicated.
- D. Install interior plate covers on electrical receptacles, outlets, and wall switches.

3.8 ELECTRICAL IDENTIFICATION INSTALLATION

- A. Tag the jacket of control circuit multi-conductor tray cable and control, instrumentation, data, and communication cables at all termination points, terminal blocks, distribution blocks, and splices, including pull and junction box splices, using cable markers identifying the name or names of the load served as designated on the drawings.
- B. Tag individual control circuit conductors at all termination points, terminal blocks, distribution blocks, and splices, including pull and junction box splices, using wire and cable markers with identification numbers or names as designated on the drawings.
- C. Tag all black power circuit conductors from multi-conductor cable at all termination points, terminal blocks, distribution blocks, and splices, including pull and junction box splices, using colored tape consistent with the insulation color code for the appropriate voltage level as described within Item 3.5 of this specification. Wrap each conductor with a minimum of two layers of tape.
- D. Identify spare conductors individually, at both ends, and at junction box splices with numbers between 1 and 999. Do not duplicate numbers. Label as: "Spare From _____ To _____." Fill in the blanks with the appropriate locations.

- E. Identify wire numbers on terminal block marking strips. Use identification numbers as designated on the drawings.
- F. Identify motor starters, control stations, disconnects, contactors, and panel boards with laminated plastic nameplates corresponding to designations on the drawings. Attach nameplates with rivets. Coordinate exact location on control stations with UPS Project Engineer.

3.9 FIELD QUALITY CONTROL

- A. Perform testing in accordance with Section 014000 – Quality Requirements.
- B. Upon completion of installation of electrical systems, perform testing as follows:
 - 1. Ensure all equipment connections, including Owner furnished motor control center bus splices between shipping splits, if applicable, are torqued according to the manufacturer's specifications prior to energizing.
 - 2. Perform Megger test of all feeders and branch circuits with over current protection at 100 Amps and larger. Record all measurements and report all findings to the UPS Project Engineer. Conductors with test results below the minimum insulation resistance values provided by the insulated power cable engineers association (IPCEA) shall be re-pulled.
- C. Subsequent to tests and correction of malfunctions detected, energize circuitry and demonstrate functioning of electrical systems in accordance with requirements. Demonstrate proper rotation of all motors.
 - 1. Correct motor rotation only at the motor terminal box.
- D. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes requirements and specifications for grounding and bonding for electrical systems including, but not limited to:
 - 1. Building Master Ground Bar (MGB)
 - 2. Electrical System Grounding
 - 3. Low Voltage Systems Grounding
 - 4. Testing

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit in accordance with Section 013300 – Submittal Procedures, description and specification of each major system component.
- B. Test Report:
 - 1. Submit in accordance with Section 013300 – Submittal Procedures, a certified test report of earth resistance test.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70 requirements for electrical materials and installation.
- B. Keep copy of NFPA 70 in field office for duration of project.
- C. Provide products and components which have been UL listed and labeled, including UL marks indicating special type usage whenever applicable.

1.5 REFERENCE STANDARDS

- A. IEEE 81 – Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System; current edition.
- B. National Fire Protection Association (NFPA)

1. NFPA 70 - National Electrical Code (NEC), current edition, including state and local amendments.
- C. National Electrical Manufacturers Association (NEMA)
 1. Requirements applicable to product manufacturing standard.
- D. TIA J-STD-607-A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; current edition.
- E. Underwriters Laboratories Inc. (UL)
 1. Requirements applicable to product listing and labeling.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Burndy
- B. ERICO Products
- C. ITT Blackburn Co.
- D. McGraw-Edison
- E. T&B

2.2 BUILDING MASTER GROUND BAR

- A. General:
 1. Provide a master ground bar with terminations areas arranged left to right and identified as P, A, and N corresponding to:
 - a. P – Denotes producers of disturbances.
 - b. A – Denotes absorbers of disturbances.
 - c. N – Denotes non-isolated systems.
- B. Materials:
 1. Tin plated copper ground bar.
 2. Thickness: ¼ inch.
 3. Four inches wide with two sets of holes drilled and tapped.
 4. Minimum four foot long unless otherwise indicated on the drawings.
 5. Wall mounted on two inches insulated standoffs.

2.3 ELECTRICAL SYSTEM GROUNDING:

- A. General:
 1. Provide grounding electrode system to achieve a maximum of five ohms earth resistance.
 2. Provide grounding electrodes as indicated in the drawings.

3. Provide electrical system grounding including:
 - a. Connections to water service metallic piping.
 - b. Connections to building structural steel.
 4. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of building.
- B. Materials:
1. Ground Rods:
 - a. Copper clad steel
 - b. Diameter: 5/8 inch
 - c. Length:
 - i. Provide minimum 10-foot ground rods unless otherwise indicated on the drawings.
 - ii. Adjust length to obtain a minimum of eight feet of driven rod below the maximum frost depth.
 2. Concrete encased Electrode:
 - a. Minimum #3/0 AWG bare copper conductor unless otherwise indicated on the drawings.
 - b. Minimum 20 foot length.
 - c. Encased in minimum of two inches of concrete at the bottom of foundation or footings in direct contact with the earth.
 3. Grounding electrode conductor terminations:
 - a. Provide grounding electrode conductor to connect MGB to grounding electrodes.
 - b. Bare stranded copper conductor
 - c. Minimum #3/0 AWG unless otherwise specified or indicated on the drawings.
 - d. Grounding electrode conductor terminations:
 - i. Terminations at ground bars.
 - a) Compression type lugs.
 - b) Two holes for bolted connection to ground bar.
 - ii. Terminations to building water service
 - a) Heavy-duty ground clamps consisting of steel U-bolts and bronze toothed saddles.
 - iii. Exothermic weld terminations at:
 - a) Ground rods
 - b) Connections to steel reinforcing bars.
 - c) Connection to Structural steel.
 4. Ground Ring:
 - a. Install tinned-copper conductor not less than No. 3/0 AWG for ground ring and for taps to building steel.
 - b. Bury ground ring not less than 24 inches from building's foundation

2.1 TELECOMMUNICATIONS SYSTEM GROUNDING:

A. General:

1. Comply with TIA J-STD-607-A.
2. Provide telecommunications system grounding including:
 - a. Telecommunications main ground bar (TMGB).
 - b. Telecommunications ground bars (TGB).
 - c. Telecommunications entrance facilities ground bar (TEF).
 - d. Telecommunications backbone bonding conductors (TBB).
3. Provide connections to the master ground bar from TMGB and from TEF.
4. Provide connections from TGB to TMGB.

B. Materials:

1. TMGB
 - a. Tin plated copper ground bar.
 - b. Thickness: ¼ inch.
 - c. Four inch wide with two sets of holes drilled and tapped.
 - d. Minimum two foot long unless otherwise indicated on the drawings.
 - e. Wall mounted on two inch insulated standoffs.
2. TGB
 - a. Tin plated copper ground bar.
 - b. Thickness: ¼ inch.
 - c. Two inch wide with two sets of holes drilled and tapped.
 - d. Minimum one foot long unless otherwise indicated on the drawings.
 - e. Wall mounted on two inch insulated standoffs.
3. TEF
 - a. Tin plated copper ground bar.
 - b. Thickness: ¼ inch.
 - c. Two inch wide with two sets of holes drilled and tapped.
 - d. Minimum one foot long unless otherwise indicated on the drawings.
 - e. Wall mounted on two inch insulated standoffs.
4. TBB
 - a. Stranded copper conductors
 - b. Minimum #2 AWG unless otherwise indicated on the drawings.
 - c. THWN insulation marked with two inch wide green tape banding at every access point.
 - d. Lugs
 - i. Compression type lugs
 - ii. Two holes for bolted connection to ground bars.

5. Grounding Conductors:
 - a. Stranded copper conductors.
 - b. Minimum #6 AWG unless otherwise indicated on the drawings.
 - c. THWN insulation marked:
 - i. Continuous green for #6 AWG
 - ii. Two inch wide green tape banding at every access point FOR #4 AWG and larger.
 - d. Lugs
 - i. Compression type lugs
 - ii. Two holes for connection to ground bars.
6. Connections:
 - a. Provide ground connections to conduits, cabinets, equipment, and similar items by means of suitable lugs, pressure connectors, and clamps as follows:
 - i. Provide heavy duty ground clamps consisting of steel U-bolts and bronze toothed saddles for connections to pipes or conduits.
 - ii. Provide exothermic welded connections to steel building columns, ground rods, or reinforcing steel imbedded in concrete.
 - iii. Provide OZ type "KGM" or Burndy "BBM" for connections to flat metal.
 - iv. Provide OZ type "PMX" or Burndy "UC" for cable to cable connections.
 - v. Provide grounding clip or screw connections to boxes.

2.2 LOW VOLTAGE SYSTEM GROUNDING

A. General:

1. Provide electrical system grounding to the master ground bar for:
 - a. Fire alarm control panels.
 - b. Sound system panels.
 - c. Security system panels.
 - d. Other systems as indicted on the drawings.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Master Ground Bar:

1. Install master ground bar in locations as indicated by drawings.
2. Ground bar labeling:
 - a. MGB label:
 - i. Provide a permanent label wall mounted above the bar.
 - ii. Minimum three inch high letters indicating "MGB".
 - b. PAN label:
 - i. Provide a permanent label wall mounted above the bar and under the MGB label.

- ii. Minimum two inch high letters indicating the P, A, and N sections of the bar.
 - iii. Provide permanent stripe on the bar separating the areas of the bar.
 - 3. Make all ground connections to the MGB with lugs bolted to the bar with two bolts.
- B. Grounding Electrode System:
 - 1. Install complete grounding electrode system as indicated on the drawings.
 - 2. Install an unspliced grounding electrode conductor from area "A" of the MGB to each grounding electrode.
 - 3. Grounding electrodes:
 - a. Building water service with bonding jumper around.
 - i. Water meter
 - ii. Non conductive piping.
 - b. Building structural steel
 - c. Driven ground rods:
 - i. Minimum of three ground rods unless otherwise indicated on the drawings.
 - ii. Install ground rods to form triangle
 - a) Install one rod at each corner.
 - b) Bond rods together with a minimum #2 AWG Bare copper conductor.
 - d. Concrete encased electrode.
 - i. Install electrode in minimum of two inches of concrete.
 - ii. Install at the bottom of foundation or footings which are in direct contact with the earth.
- C. Electrical Service Ground:
 - 1. Install an unspliced grounding electrode conductor between service entrance enclosure ground bus and Area "A" of the MGB.
- D. Telecommunications System Grounding:
 - 1. Telecommunications ground bars;
 - a. Install TMGB in main as indicated on the drawings.
 - b. Install TEF in location as indicated on the drawings.
 - c. Install TGB in telecommunications closets in locations as indicated on the drawings.
 - d. Make all grounding connections to the bars with lugs bolted to the bar with two bolts.
 - 2. Telecommunications backbone bonding conductors (TBB):
 - a. Install TBBs to bond telecommunications ground bars to the MGB.
 - b. Install TBBs unspliced in shortest, straight-line route between bars.
 - c. Route TBBs in cable trays and trough.
 - d. Minimize the routing of TBB through ferrous conduits.

- i. Where TBBs must be routed in ferrous conduits, bond both ends of each conduit to the TBB with a #6 AWG.
 - e. Install a TBB from the TEF to area “P” of the MGB.
 - f. Install a TBB from TMGB to area “N” of the MGB.
 - g. Install a series TBBs connecting the TGBs to the TMGB:
 - i. Install TBB from TMGB to nearest TGB.
 - ii. Install TBB from nearest TGB to next TGB.
 - iii. Continue to form a daisy chain out to the farthest TGB.
- 3. Ground Bar Labeling:
 - a. Provide a permanent label wall mounted above the bar.
 - i. Minimum two inch high letters indicating “TMGB”
 - ii. Minimum one inch high letters indicating “TEF”
 - iii. Minimum one inch high letters indicating “TGB”
 - b. Provide telecommunications grounding conductors from the TMGB and TGB’s to:
 - i. Accessible building steel.
 - ii. Telecommunications raceway system.
- E. Separately Derived Systems:
 - 1. Install an unspliced grounding electrode conductor size as indicated on the drawings.
 - 2. Install conductor from enclosure ground bus, or bolted connection to enclosure if ground bus is not present, to:
 - a. Grounded structural steel
 - b. Cold water pipe
 - c. Area “N” of the MGB if separately derived system is:
 - i. Within the same room as the MGB.
- F. Equipment Ground:
 - 1. Unless indicated otherwise, form equipment ground with non-flexible metallic raceway.
 - 2. Install bonding jumpers around fittings where ground becomes discontinuous.
 - 3. In addition to the raceway ground, provide equipment ground conductors as indicated on the drawings.
- G. Raceway Grounding:
 - 1. Form electrical wiring raceway system consisting of continuous, permanent, and effective equipment grounding circuit installed as follows:
 - a. Metallic threaded couplings and conduits wrench tight.
 - b. Make termination of rigid conduits at boxes, cabinets, and other enclosures with double locknut arrangement and bushing and insulating tape where required by NEC.
 - c. At each section of flexible metal and liquid tight conduits provide bonding jumper for ground circuit continuity. Install bonding conductor (insulated or

bare) inside conduit and terminate with proper lugs or ground clamps in nearest access outlets on both ends.

- d. Greenfield flexible conduit and type "U.A." liquid tight flexible conduits over six feet long and carrying over 20 amps: Install proper size ground conductor jumper bonded to rigid conduit system and to electrical equipment where flexible conduit is terminated as required by NEC article 250.
- e. Effectively bond service equipment enclosures and other enclosures mentioned in NEC article 250.
- f. Firmly bond and effectively ground sections of wiring gutters and wire ways, outlet boxes and receptacle ground terminals, metal sections of continuous rigid cable supports and fittings, cable bus and other built-up enclosures with bolted joining of sections. Provide conduit expansion fittings with factory installed bonding jumpers.
- g. Raceway runs of non-metallic conduits:
 - i. Provide with equipment ground conductor as required by NEC article 250.
 - ii. Properly terminate in each outlet of access opening.

H. Ground Conductor Labeling:

1. Provide permanent labels for all grounding and bonding conductors connecting to ground bars including:
 - a. MGB
 - b. TMGB
 - c. TEF
 - d. TGB
 - e. Other bars as indicated on the drawings.
2. Install labels on each accessible end of each conductor.
3. Indicated source and destination location on each label.
4. Examples:
 - a. MGB/GROUND RODS
 - b. MGB/TMGB
 - c. MGB/ELECTRICAL SERVICE ENTRANCE

3.2 TESTING

A. Test Earth Resistance:

1. Test earth resistance from grounding electrode system to specified maximum allowable value of five ohms.
2. Perform earth resistance in the presence of the UPS Project Engineer.
3. Perform test a minimum of two days after any measurable precipitation without soil being moistened by any means other than natural drainage or seepage.
4. Utilize the fall of potential test method according to IEEE 81.

5. Install additional ground rods as required to achieve specified maximum earth resistance.

B. Certified Test Report:

1. Provide a certified test report of the final earth resistance test. Including on the report:
 - a. Date of test
 - b. Time of test
 - c. Most recent date of measurable precipitation.
 - d. Parameters of test:
 - i. Designation of grounding electrode being tested.
 - ii. Driven depth of ground rods if applicable.
 - iii. Distance from grounding electrode to auxiliary potential electrode.
 - iv. Distance from grounding electrode to auxiliary current electrode.
 - e. Test results.

END OF SECTION

SECTION 262200

LOW VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes specifications and requirements for dry-type distribution transformers with primary and secondary voltages of 600V and less and capacity ratings through 1000 KVA.

1.2 RELATED SECTIONS

- A. 013300 – Submittal Procedures
- B. 260500 – Common Work Results for Electrical Systems

1.3 SUBMITTALS

- A. Submit Shop Drawings and manufacturer's product data and installation instructions in accordance with Section 013300 – Submittal Procedures.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70 requirements for electrical materials and installation.
- B. Keep copy of NFPA 70 in field office for duration of project.
- C. Provide products and components which have been UL listed and labeled, including UL marks indicating special type usage whenever applicable.

1.5 REFERENCE STANDARDS

- A. National Fire Protection Association (NFPA)
 - 1. 1. NFPA 70 - National Electrical Code (NEC), including state and local amendments.
- B. National Electrical Manufacturers Association (NEMA)
 - 1. Requirements applicable to product manufacturing standard.
 - 2. NEMA ST 20 - Dry Type Transformers for General Applications; current edition.
 - 3. NEMA TP 1 – Guide for Determining Energy Efficiency for Distribution Transformers; current edition.
 - 4. NEMA TP 2 – Standard Test Method for Measuring the Energy Consumption of Distribution Transformers; current edition.
 - 5. NEMA 250 - Enclosures for Electrical Equipment

- C. Underwriters Laboratories Inc. (UL)
 - 1. UL 1561 - Dry-Type General Purpose and Power Transformers
 - 2. Requirements applicable to product listing and labeling.
- D. ANSI 49 – Biosafety Cabinetry: Design, Construction, Performance, and Field Certification; current edition.
- E. IEEE C57.12.91 – Standard Test Code for Dry-Type Distribution and Power Transformers; current edition.

PART 2 - PRODUCTS

2.1 TRANSFORMERS

- A. Acceptable Manufacturers:
 - 1. Acme Electric Corporation
 - 2. Eaton Corp.
 - 3. General Electric Company
 - 4. Jefferson Electric
 - 5. Siemens
 - 6. Sola/Hevi-Duty
 - 7. Square D, Schneider Electric
- B. All insulating materials are to exceed NEMA ST 20 standards and be rated for 220°C UL Component recognized insulation system.
- C. Transformers 15kVA and larger shall be 150°C temperature rise above a 40°C ambient and have a minimum of four, 2.5% full capacity primary taps (two above and two below normal full capacity).
- D. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.
- E. Transformer coils shall be of the continuous wound construction without splices (except for taps) and coils shall be encapsulated within resin compound, sealing out moisture and air
- F. All cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating. Cores for transformers greater than 500kVA shall be clamped utilizing insulated bolts through the core limitations to ensure proper pressure throughout the length of the core. The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety between ground strap. Cores and coils shall be impregnated with a polyester varnish or encapsulated resin compound to provide a high dielectric flame retardant seal.

- G. Core and coil designs shall be low loss type with minimum efficiencies per NEMA TP1 when operated at 35% of full load capacity. Efficiency shall be tested in accordance with NEMA TP2.

Single phase		Three Phase	
kVA	Efficiency	kVA	Efficiency
15	97.7%	15	97.0%
25	98.0%	30	97.5%
37.5	98.2%	45	97.7%
50	98.3%	75	98.0%
75	98.5%	112.5	98.2%
100	98.6%	150	98.3%
167	98.7%	225	98.5%
250	98.8%	300	98.6%
333	98.9%	500	98.7%
		750	98.8%
		1000	98.8%

- H. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible-grounding conductor sized in accordance with applicable UL and NEC standards.
- I. The transformer enclosures shall ventilated and be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degassing, cleaning, and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be ANSI 49. The enclosure and enclosure finish shall conform to NEMA 250.
- J. Sound levels shall be warranted by the manufacturer not to exceed the following (sound levels factory tested according to IEEE C57.12.91):

Sound Levels	
kVA	dB
15-50	45
51-150	50
151-300	55
301-500	60
501-700	62
701-1000	64

- K. Provide wall-mounting brackets for units up to 75kVA max unless noted otherwise on the drawings.
- L. Provide ceiling mounting brackets for units between 75kVA and up to 150kVA, unless noted otherwise on the drawings.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Verify exact locations and elevations of electrical materials with UPS Project Engineer prior to installation, where dimensions are not indicated.
- B. Install electrical materials as indicated with offsets, fittings, and changes in elevations as required to make adjustment for obstacles or interference.
- C. Do not allow electrical materials installations to cause any equipment to be unserviceable or inoperable.
- D. Ensure all equipment connections are torqued according to manufacturer's specifications prior to energizing.
- E. Mount transformers allow access to terminal compartments and to allow flow of air through transformer vents per vendor requirements and maintain working clearances required by the NEC.
- F. Cushion mount all transformers on vibration isolation supports as required to prevent sound transmission to building structure and piping. Provide shop drawing of vibration methods and components.
- G. Install wall-mounting transformers level and plumb with wall brackets fabricated by the transformer manufacturer.

3.2 QUALITY CONTROL

- A. Perform quality control as referenced in Section 260500 – Common Work Results for Electrical System.

END OF SECTION

SECTION 262700

LOW-VOLTAGE DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes requirements and specifications for low-voltage distribution equipment including, but not limited to:
 - 1. Motor starters.
 - 2. Contactors.
 - 3. Motor safety switch disconnects.
 - 4. Transfer switches.
 - 5. Variable Frequency Drive.
 - 6. Photoelectric sensor controls.
 - 7. Fuses, circuit breakers and overload heaters.
 - 8. Fueling facility consoles.
 - 9. Installation of power and control devices

1.2 RELATED SECTIONS

- A. 013300 – Submittal Procedures.

1.3 SUBMITTALS

- A. Submit Shop Drawings and manufacturer's product data and installation instructions in accordance with Section 013300 – Submittal Procedures.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70 requirements for electrical materials and installation.
- B. Keep copy of NFPA 70 in field office for duration of project.
- C. Provide products and components which have been UL listed and labeled, including UL marks indicating special type usage whenever applicable.

1.5 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association (NEMA)
 - 1. Requirements applicable to product listing and labeling.
 - 2. NEMA 250 – Enclosures for Electrical Equipment; current edition.
 - 3. NEMA FU 1 – Low Voltage Cartridge Fuses; current edition.

4. NEMA KS 1 – Heavy Duty Enclosed and Dead-Front Switches; current edition.
 5. NEMA ICS 2 – Industrial Control and Systems – Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; current edition.
 6. NEMA AB 1 – Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures; current edition.
- B. National Fire Protection Association (NFPA)
1. NFPA 70 – National Electrical Code (NEC).
- C. Underwriters Laboratories Inc. (UL)
1. Requirements applicable to product listing and labeling.

PART 2 - PRODUCTS

The acceptable manufacturers of all products listed below are for reference only. All new products will match the existing manufacturer and type, to reduce spare parts, as determined from field investigation. However, the product description still applies. Where a new product is required that does not match with an existing manufacturer, the acceptable manufacturers listed and the description will apply.

2.1 MOTOR STARTERS

- A. Acceptable Manufacturers:
1. Rockwell Automation, Inc; Allen-Bradley brand.
 2. Eaton Electrical Inc.; Cutler Hammer Business Unit
 3. General Electric Company; GE Consumer & Industrial – Electrical Distribution
 4. Square D; a brand of Schneider Electric
- B. NEMA
1. Provide factory fabricated starters complying with NEMA ICS 2 with NEMA Type enclosures conforming to NEMA 250. IEC starters will not be accepted.
 2. Provide starters with thermal overload protection on each phase utilizing interchangeable melting alloy, Class 20 (trip in 20 seconds or less when carrying a current equal to 600 percent of its current rating) overload heaters, sized in field for full load current rating indicated on each motor nameplate.
 3. Manual Motor Starter: Quick-make, quick-break, trip free pushbutton operating mechanism for group fusing; provisions for positive padlocking in OFF position.
 4. Combination Magnetic Motor Starter/Contactor: Non-reversing or reversing, as indicated; fusible, NEMA KS 1, 3-pole, heavy-duty, horsepower rated disconnect switch mounted in common enclosure; full voltage starting; 120-volt control circuit, fuse protected; control transformer of sufficient capacity to handle operating coil and associated controls; auxiliary contacts on coil as required; manual reset overload relay with reset button on face of enclosure and red overload “tripped” pilot light with legend plate for starter only; operating handle provided

with means for positive padlocking in OFF position; opening of enclosure restricted unless operating handle is in OFF position.

2.2 CONTACTORS

- A. Provide contactors complying with NEMA ICS 2 and with NEMA type enclosures conforming to NEMA 250, unless otherwise indicated. IEC starters will not be accepted.

2.3 MOTOR SAFETY SWITCH DISCONNECTS

- A. Acceptable Manufacturers:
 - 1. Eaton Electrical Inc; Cutler–Hammer Business Unit
 - 2. General Electric Company
 - 3. Square D; a brand of Schneider Electric
- B. Provide factory fabricated visible blade switches complying with NEMA KS 1 (Enclosed Switches) with NEMA Type enclosures conforming to NEMA KS 1. NEMA 3R for outdoor and wet areas, NEMA 12 for all others.
- C. Safety Switches: NEMA KS 1, 3-pole or 6-pole as indicated, heavy-duty, horsepower rated disconnect: rated at 600 volts; quick-make, quick-break operating mechanism; integral operating handle provided with means for positive padlocking in OFF position; current carrying parts constructed of high conductivity copper, with silver-tungsten type switch contacts; fusible or non-fusible as indicated; positive pressure type reinforced fuse clips for fusible switches; equipped with auxiliary electrical interlock, interlocked with operating handle, with one normally open and one normally closed contacts (1#NO, 1 NC) where indicated.
- D. Fuses: NEMA FU 1, dual element type, with time delay, non-renewable, current limiting.

2.4 TRANSFER SWITCHES

- A. Acceptable Manufacturers:
 - 1. Eaton Electrical Inc; Cutler–Hammer Business Unit
 - 2. General Electric Company
 - 3. Square D; a brand of Schneider Electric
- B. Provide manual transfer switches complying with NEMA KS 1, specifically designed to transfer power from one load to another load, with NEMA Type enclosures conforming to NEMA 250.
- C. Manual Transfer Switches: Double throw, 3-pole, heavy-duty, safety switch; quick-make, quick-break operating mechanism; blades visible from front of unit for positive indication that switch is OFF; integral three position operating handle provided with means for positive padlocking in OFF position; current carrying parts constructed of high conductivity copper, with silver-tungsten type switch contacts; non-fusible.

Equipped with two auxiliary electrical interlocks interlocked with operating handle, each having one normally open and one normally closed contacts.

2.5 VARIABLE FREQUENCY DRIVES

- A. Variable Frequency Drive (VFD)
 - 1. Acceptable Manufacturers:
 - a. Square D; a brand of Schneider Electric,
 - 2. AC drive input power to a proportional and variable AC frequency and voltage output; pulse width modulated (PWM) output wave form induction motor; programmable function keypad; capable of supplying 120% of full rated load current for one minute at ambient temperature.

2.6 PHOTOELECTRIC SENSOR CONTROLS

- A. Provide receivers, mounting brackets, hardware, and all other component parts for a complete photoelectric control system.
- B. Outside Site Lighting Controls: Dry seal photocell (type for dusk to dawn operation), voltage as required, 60 Hertz, relay type, waterproof enclosure, 1000 Watt minimum rating, suitable for box mounting.

2.7 FUSES AND CIRCUIT BREAKERS

- A. Fuses
 - 1. Acceptable Manufacturers:
 - a. Cooper Industries – Bussman brand
 - b. Ferraz Shawmut
 - c. Littlefuse
 - 2. Provide dual element, time delay type; non-renewable conforming to NEMA FU 1; current limiting for motor control centers, fusible motor safety switch disconnects and motor starters as indicated on the drawings. Fuses shall mate with rejection type fuse clips for all motor loads.
- B. Circuit Breakers
 - 1. Provide factory circuit breakers for existing panelboards with ampere rating as indicated on the drawings for lighting or receptacle circuits.
 - 2. Match the manufacturer, type and interrupting rating of the existing panelboard circuit breakers.
 - 3. Conform to NEMA AB 1.

2.8 OVERLOAD HEATERS

- A. NEMA Starters

1. Provide melting alloy, Class 20 (trip in 20 seconds or less when carrying a current equal to 600% of its current rating); sized set in field for full load current rating and service factor indicated on each motor nameplate.
- B. IEC Starters
1. Do not use.

PART 3 – EXECUTION

3.1 GENERAL

- A. Comply with requirements for Class 1, Division 2 location for building areas where required in accordance with NFPA 70.
- B. Comply with welding requirements of Section 055000 – Metal Fabrications.
- C. Determine exact route or location of all electrical materials prior to installation.
- D. Verify exact locations and elevations of electrical materials as well as the location of future conveyors with UPS Project Engineer prior to installation where dimensions are not indicated.
- E. Install electrical materials as indicated with offsets, fittings, and changes in elevations as required to make adjustments for obstacles or interferences.
- F. Do not allow the installation of electrical materials and conduit routing to cause any mechanical or conveyor equipment to be unserviceable or inoperable. Install electrical materials and route conduit away from conveyor pulleys, tails, rollers, belting, safety guards, and all adjustment screws, bolts and nuts. Ensure sufficient clearance to permit ready removal of conveyor system safety guards.
- G. Do not allow electrical materials to be installed within 3'-6" above a belt, chute, or slide of conveyor system, including future conveyors indicated on drawings, as measured perpendicular to belt, chute, or slide surface. Maximize all clearances.
- H. Do not allow electrical materials to protrude into pedestrian walk aisles, egress paths, cart paths, sort positions or platform areas. Coordinate with UPS Project Engineer.
- I. Do not allow electrical materials to be installed in areas where future conveyors are designated. Coordinate with UPS Project Engineer.
- J. Do not drill holes in conveyor intermediate section (frame) or side panel for the purpose of supporting electrical materials or conduit except as indicated on Detail Drawings.

3.2 MOTOR STARTER INSTALLATION

- A. Install manual and magnetic motor starters for motors as indicated on the drawings.
- B. Surface mount motor starters, plumb and level to U-channel support rack.

- C. Install overload heaters to NEMA starters, sized for full load current rating indicated on each motor nameplate in accordance with starter manufacturer's heater selection tables.

3.3 MOTOR SAFETY SWITCH INSTALLATION

- A. Surface mount disconnect switches, plumb and level to U-channel support rack.
- B. Install fuses in fusible disconnect switches.

3.4 VARIABLE FREQUENCY DRIVES INSTALLATION

- A. Surface mount drives, plumb and level to U-channel support rack.
- B. Drives shall be installed in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 265000

LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Building and Site Lighting
- B. Emergency Lighting
- C. Occupancy Sensors

1.2 SUBMITTALS

- A. Submit shop drawings if applicable.
- B. Submit luminaire product data in booklet form with separate sheet for each type of fixture, assembled in the order specified, with proposed fixture and accessories clearly indicated on each sheet in accordance with Section 013300. Include technical data and information on features, accessories, and finishes.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70 requirements for electrical materials and installation.
- B. Keep copy of NFPA 70 in field office for duration of project.
- C. Provide products and components, which have been UL listed and labeled, including UL marks indicating special type usage where applicable.

1.4 REFERENCES

- A. National Electrical Manufacturers Association (NEMA)
 - 1. Requirements applicable to product manufacturing standard.
- B. National Fire Protection Association (NFPA)
 - 1. 70 National Electrical Code (NEC).
- C. Underwriters Laboratories Inc. (UL)
 - 1. Requirements applicable to product listing, labeling and classification.

PART 2 PRODUCTS

2.1 BUILDING AND SITE LIGHTING

- A. Provide luminaires complying with applicable requirements of NEMA Standards Publications.
- B. Provide luminaires complete with housings, fittings, lamps, lamp holders, sockets, diffusers, lenses, reflectors, ballasts, wiring, hangers, supports and installation accessories.

2.2 Interior LED Luminaires:

- A. Type L5: Enclosed wall mount type; die-cast aluminum housing, Polyester powder coat paint, dark bronze finished, aluminum hinged removable door, universal back box, silicone sealed optical LED chamber with impact-resistant tempered glass, minimum 2900 lumen output, 4000k, 6kV Surge protection minimum, UL Listed, suitable for wet locations, Design Lights Consortium Qualified, 120-277v, ADA Compliant; 347 Volt rated cUL Listed for Canadian Projects.
1. Primary Application: Interior Wall Mount Flood Light Type Usage
 2. Acceptable Luminaire Manufacturers:
 - a) Crosstour 30Watt with Refractive Lens– Eaton/Cooper Lighting
 - b) TWR1 LED 1 – Acuity Lighting
 - c) WGH Series – Hubbell Lighting
 - d) WP30-NW-G1-8BZ -Signify
- B. Type L7: Enclosed flood light type; heavy duty, die-cast aluminum housing, Polyester powder coat paint, dark bronze finished, sealed optical LED chamber with impact-resistant acrylic lens, 5000k, 6kV Surge protection minimum, IP 65 rated, UL Listed, yoke type mounting bracket, suitable for wet locations, 12' pre-wired pigtail, multivolt 120-277v 347 volt rated cUL Listed for Canadian Projects.
1. Primary Application: Inbound/Outbound Door Dock Lights for Small Package Facilities.
 2. Acceptable Luminaire Manufacturers:
 - a) DSXF1 Series – Acuity Lighting,
Catalog # - DSXF1 LED P2 MSP MVOLT C613 UPSYK DDBXD
General Contractors to Contact local Acuity Distributor for pricing/ordering
 - b) PARA SPL Series – PARA LIGHT Group
Catalog # SPL-40WDF- CW-U
 - c) General Contractors to Contact: PARA LIGHT GROUP
515 Spanish Lane Walnut, CA 91789
1-909-468-4866 x 118 for pricing and ordering.
 - d) DL11240SW50 – RCA Lighting

C. L10: 4 feet long industrial narrow lens type strip light luminaire; domed acrylic frosted lens, die formed steel housing with phosphate pretreatment, fabricated for rigidity; channel shall be prime coated and porcelain or baked white enamel finished, designed for continuous row alignment, 0-10 volt dimming driver compliant, 4000K Color Temperature, CRI > 80, minimum 3000 lumen output, Universal electronic driver 120-277volts, UL, and Design Light Consortium (DLC) Qualified; 347 volt rated, cUL Listed for Canadian projects.

1. Primary Application: Lighting at DA Areas and other General Lighting Applications requiring a 4' fixture
2. Acceptable Luminaire Manufacturers:
 - a) SNLED Series – Eaton/Cooper Lighting
 - b) ST4B3208DU50 - RCA Lighting
 - c) ZL1D Series – Acuity Lighting
 - d) LS Series – Cree Lighting
 - e) ALV1 Series – GE Lighting
 - f) FSS430L840-UNV-DIM - Signify

D. Type L10A: 4 feet long industrial narrow lens type strip light luminaire, domed acrylic frosted lens, die formed steel housing with phosphate pretreatment, fabricated for rigidity; channel shall be prime coated and porcelain or baked white enamel finished, designed for continuous row alignment, 0-10 volt dimming driver compliant, 4000K Color Temperature, CRI > 80, minimum 5000 lumen output, Universal electronic driver 120-277volts, UL, and Design Light Consortium (DLC) Qualified; 347 volt rated, cUL Listed for Canadian projects.

1. Primary Application: Lighting at DA Areas and other General Lighting Applications requiring a 4' fixture for mounting heights above 10'.
2. Acceptable Luminaire Manufacturers:
 - a) SNLED Series – Eaton/Cooper Lighting
 - b) SD4B4808DU50 - RCA Lighting
 - c) ZL1D Series – Acuity Lighting
 - d) LS Series – Cree Lighting
 - e) ALV1 Series – GE Lighting
 - f) FSS430L840-UNV-DIM - Signify

E. Type L22: Custom manufactured, 8 feet long, narrow single-sided industrial type strip light, steel housing with premium polyester powder coat, 0-10 volt dimming driver compliant, 5000K Color Temperature, CRI > 80. frosted

lens, minimum 10000 lumen output, Universal electronic driver 120-277volts, UL, 347 volt rated, cUL Listed for Canadian projects.

1. Primary Application: Where a continuous row of lighting is required at Package Car positions at Boxlines, Slide to Car, where package car parking positions can change
2. Acceptable Luminaire and lamp protector Manufacturer:
 - a) UPS-8LBLED-LD4-140HL-LASYMW-UNV-L850-CD4-U – Eaton/Cooper Lighting
 - b) UPS – MMSHL8B4808DU50 – RCA Lighting
Identifiable with ‘Black’ endcaps
 - c) FSI8110L850-UNV-DIM – Signify
 - d) CLX L96 14000LM SEF WDL MVOLT GZ10 50K 80CRI WH – Acuity lighting

- F. All inquiries regarding “Cooper Lighting” light fixtures listed with a unique UPS Part Number shall be directed through:

Eaton/Cooper Lighting
Attn: Denny Mescko - National Account Manager
dennismescko@Eaton.com
Ph: 251-648-9769

- G. All inquiries regarding “RCA Lighting” light fixtures listed with a unique UPS Part Number shall be directed through:

Grainger Industrial Supply
Attn: Nathan Kolenovsky
Nathan.kolenovsky@grainger.com
Ph: 210-889-6497

OR

McNaughton McKay
Electrical Co
6685 Best Friend Road
Norcross, GA 30071
Attn: Nick Gastley - National
Account Manager
UPS-101@mc-mc.com
Ph: 770-825-8682

- H. All inquiries regarding “Acuity Lighting” light fixtures listed with a unique UPS Part Number shall be directed through:

Acuity Lighting
Attn: Mark W Wollenhaupt
National account Manager
wollenhaupt@acuitybrands.com

OR

McNaughton McKay
Electrical Co
6685 Best Friend Rd
Norcross, GA 30071
Attn: Nick Gastley-

2.3 EXTERIOR METAL HALIDE LUMINAIRES:

A. N/A

2.4 EMERGENCY LIGHTING

A. Acceptable Manufacturers:

1. Dual Lite, Inc.
2. Cooper Lighting (Sure-Lites)
3. Emergency Lighting Products Div. of Lithonia Lighting
4. Emergi-Lite, a product of Thomas & Betts
5. Evenlite, Inc.
6. Light Panel Day-Brite Lighting (Philips)
7. Mule Lighting, Inc.

B. Luminaires:

1. Type E1: Self-contained LED or Light Panel exit sign lighting unit; operation on both normal power source and integral emergency battery power source; fully automatic operation on power failure; white baked enamel finished steel or white injection molded thermoplastic or natural finished aluminum housing with downlight; 6 to 8 inches height red EXIT letters, $\frac{3}{4}$ inch stroke and universal arrows; sealed maintenance free, nickel cadmium 12V battery with solid state fully automatic charger, transfer/brownout circuit and low voltage battery disconnect; capable of full recharge in 24 hours after full discharge; overload and short circuit protection; unit test switch and AC "ON" pilot light; Light-Emitting Diode lamps and (2) 5 watt DC lamps; universal mounting; single faced for surface mounting, double faced for end or ceiling mounting; capable of supplying connected load for period of 2 hours; 120/277V dual voltage input line AC volts.
3. Type E2: Self-contained battery powered emergency lighting unit; fully automatic operation on power failure; bake enamel finished steel or thermoplastic cabinet; sealed maintenance free, nickel cadmium 12V battery with solid state fully automatic charger, transfer/brownout circuit and low voltage battery disconnect; capable of full recharge in 24 hours after full discharge; overload and short circuit protection; unit test switch and AC "ON" pilot light; two (2) adjustable, unit mounted sealed beam type lampheads with LED; matching shelf mounting brackets; capable of supplying connected load for period of 1-1/2 hours; 120/277V dual voltage input line AC volts.
4. Type E3: Combination self-contained LED exit sign lighting unit with side or front mount base heads; operation on both normal power source and integral emergency battery power source; fully automatic operation on power failure;

white baked enamel finished steel or white injection molded thermoplastic or natural finished aluminum housing with downlight; 6 to 8 inches height red EXIT letters, 3/4 inch stroke and universal arrows; sealed maintenance free, nickel cadmium 6V battery with solid state fully automatic charger, transfer/brownout circuit and low voltage battery disconnect; capable of full recharge in 24 hours after full discharge; overload and short circuit protection; unit test switch and AC "ON" pilot light; Light-Emitting Diode lamps and (2) 5 watt DC lamps; universal mounting; two (2) adjustable unit mounted sealed beam type headlamps with LED DC lamps, single faced for surface mounting, capable of supplying connected load for period of 2 hours; 120/277V dual voltage input line AC volts.

C. Emergency Fluorescent Lamp Power Supply:

1. Self-contained battery powered inverter unit for direct mounting in high output, rapid start fluorescent luminaires indicated; fully automatic operation on power failure; sealed maintenance free, nickel-cadmium battery with solid state fully automatic charger, transfer/brownout circuit and low voltage battery disconnect; capable of full recharge in 12 hours after full discharge; overload and short circuit protection; unit test switch and AC "ON" pilot light; capable of supplying 600 lumens for period of 1-1/2 hours.

PART 3 EXECUTION

3.1 GENERAL

- A. Comply with requirements for Class 1, Division 2 locations for building areas where required, in accordance with NFPA 70.
- B. Comply with welding requirements of Section 055000.
- C. Determine exact route or location of all electrical materials prior to installation.
- D. Verify exact locations and elevations of electrical materials with Project Engineer prior to installation, where dimensions are not indicated.
- E. Install electrical materials as indicated with offsets, fittings and changes in elevations as required to make adjustments for obstacles or interferences.
- F. Do not allow the installation of electrical materials and conduit routing to cause any mechanical or conveyor equipment to be unserviceable or inoperable. Install electrical materials and route conduit away from conveyor pulleys, tails, rollers, belting, safety guards and all adjustment bolts. Ensure sufficient clearance to permit ready removal of conveyor system safety guards.
- G. Do not allow electrical materials to be installed within 3'-6" above a belt, chute or slide of conveyor system, including future conveyors indicated on drawings, installed by others, as measured perpendicular to belt, chute or slide surface. Maximize all clearances.

- H. Do not allow electrical materials to protrude into pedestrian walk aisles, egress paths, cart paths, sort positions or platform areas. Coordinate with Project Engineer.
- I. Do not allow electrical materials to be installed in areas where future conveyors are designated. Coordinate with Project Engineer.
- J. Do not drill holes in conveyor intermediate section (frame) or sidepanel for the purpose of supporting electrical materials or conduit except as indicated on Detail Drawings.

3.2 LIGHTING INSTALLATION

- A. Mount luminaires level with edges aligned parallel to building/office complex walls, unless otherwise indicated.
- B. Mount continuous rows of luminaires in straight line. Utilize alignment clips between reflectors.
- C. Securely mount surface fixtures tight to surface without distortion of surface.
- D. Connect recessed office luminaires to boxes with 6 feet extra of flexible metal conduit and wiring with bonding jumper, to allow future adjustment of luminaire location by Owner.
- E. Verify aiming of directional luminaires/lampheads with Project Engineer prior to setting direction.
- F. Lay-in Ceiling Lighting Fixtures Supports: Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
 - 1. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- G. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

3.3 FIELD QUALITY CONTROL

- A. Test for Exit, Emergency Lighting: upon installation, all exit lighting, emergency lighting and emergency lamp power supplies shall be tested to

ensure proper operation. Test shall verify that fixtures transition properly from normal utility power to back-up battery power and remain energized at full lumen output for 90 minutes. Any deficiencies shall be immediately corrected by the contractor to meet the above requirements. A written report shall be generated documenting the results of all fixtures tested and submitted to the UPS Project engineer for acceptance.

- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest completely to demonstrate compliance with standards.

End of Section

SECTION 271500

COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1.1 Section includes:

- A. Cables
- B. Raceways
- C. Boxes
- D. Installation
- E. Identification
- F. Testing

1.2 Related Sections

- A. Section 260000 - Electrical
- B. Section 260500 – Common Work Results for Electrical
- C. Unless otherwise specified in this Section 271500, the LAN installation shall conform to all sections and requirements of this Project Manual.

1.3 References - Latest Edition

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Electronic Industries Association (EIA)
- D. National Electrical Manufacturers Association (NEMA)
- E. National Fire Protection Association (NFPA)
 - 1. National Electrical Code (NEC).
- F. Underwriters Laboratories Inc. (UL)
- G. Manufacturers recommendations

1.4 Submittals

- A. Submit manufacturer's product data and installation instructions in accordance with Section 013300.
- B. Submit cable tray manufacturer's support recommendations and installation instructions.

1.5 Quality Assurance

- A. Comply with NFPA 70 requirements for electrical materials and installation.
- B. Keep copy of NFPA 70 in field office for duration of project.
- C. Provide products and components which have been UL listed and labeled, including UL marks indicating special type usage whenever applicable.

1.6 Scope of LAN Work

- A. The work will comprise of one of the following.
 - 1. Installing raceway and boxes only.
 - 2. Installing raceway, boxes and LAN cables only.
 - 3. Installing raceway, boxes, LAN cables, terminating and testing.
- B. All materials and labor necessary to complete the installation is included.
- C. Verify the scope of work with Project Engineer. Verify location of Intermediate Distribution Frames (IDF), PC's and other equipment. Obtain in writing the scope of work and all other items listed within this Section 271500 that require the Project Engineer's approval.

PART 2 PRODUCTS

2.1 LAN Cables – Copper Conductors

A. Acceptable Manufacturers:

- 1. Siemon
- 2. Berk-Tek
- 3. Panduit
- 4. Belden
- 5. Mohawk
- 6. Commscope
- 7. General Cable
- 8. Ortronics
- 9. Systemax
- 10. Corning
- 11. Draka
- 12. OFS
- 13. OCC
- 14. Superior Essex

B. Cable. The cable shall be Category 6A UTP.

- 1. The cables shall be rated for use in communications circuits.

2. The cables shall be rated for riser applications.
3. The cables shall be rated for 167F degrees applications.
4. The cables shall be free of defects and splices.
5. The cables shall be rated for outdoor applications.
6. The cables shall pass a -40F degree cold bend test per UL 1581.
7. The cables must be UL third party verified to ANSI/TIA-586-C.2 Category 6A.
8. The cables shall have a max pulling tension of 25 lbs.
9. The cable shall be ROHS compliant.

C. Conductors

1. The conductors shall be solid, bare copper per ASTM B-3.
2. The conductors shall be #23 AWG.

D. Insulation

1. The insulation shall be polyolefin
2. The insulation shall be free of defects and splices

E. Pairs

1. The cable shall contain four pairs.
2. The insulated conductors shall be bonded together down the entire length of the pair.
3. The pairs shall be marked with a permanent, extruded stripe identification of tip and ring insulated conductors.
4. Each pair shall have a unique twist length to minimize pair to pair coupling.
5. The four pair cable core shall be bisected with a foam polyolefin tape to enhance crosstalk performance.

F. Jacket

1. All cables shall have a continuous jacket of Polyvinyl Chloride (PVC).
2. Jacket thickness: The jackets shall be .030" (.75 mm) nominal thickness.
3. The jackets shall be ultraviolet (UV) radiation and sunlight resistant per UL 1581
4. The jackets shall be oil resistant per UL 1581 Table 50.182 60C oil-resistant jacket

G. Identification:

The cables shall be permanently marked with the following information at 2 foot intervals:

1. Manufacturer's name and or trademark.
2. The electrical performance rating (i.e. Cat 6A).
3. The number of pairs and size (AWG).
4. UL NEC (CMR, CMX Outdoor) and CEC (CMR, FT4) listings.
5. Sequential footage marking.

2.2 Fiber Optic Cable

- A. For Small Buildings Multi-mode (400 m or 1312 ft.) or Single mode (great than 400 m or 1312 ft.) (Verify with Project Engineer)
 - 1. Multi-mode 12 strands, 50/125 micron OM4, LC type connectors, armored aqua jacket, complying with TIA/EIA-568-B.3.
 - 2. Single mode 12 strands, 9/125 micron OS2, LC type connectors, armored yellow jacket, complying with TIA/EIA-568-B.3.
- B. For Large Buildings Multi-mode (400 m or 1312 ft.) or Single mode (great than 400 m or 1312 ft.) (Verify with Project Engineer)
 - 1. Multi-mode 36 strands, 50/125 micron OM4, LC type connectors, armored aqua jacket, complying with TIA/EIA-568-B.3.
 - 2. Single mode 36 strands, 9/125 micron OS2, LC type connectors, armored yellow jacket, complying with TIA/EIA-568-B.3.

2.3 Cable Management

- A. In the telecommunications room/closet where cable trays or cable racking are used, the contractor shall provide appropriate means of vertical and horizontal cable management such as reusable color-coded hook and loop cable managers (hook and loop cable ties) to create a neat appearance and practical installation.

2.4 Raceway

- A. Conduit and Fittings
 - 1. Electrical metallic tubing (EMT).
 - 2. Steel compression type fittings
- B. Cable Support System
 - 1. Cable tray – ladder, center rail or wire basket type
 - 2. Cable support hardware – J- hooks or bridle rings

2.5 Boxes

- A. LAN data outlet boxes are by Appleton Electric Co or approved equal. Single gang, type FS, aluminum with 3/4" hub.
 - 1. Appleton part #FS-1-75-A.
- B. Each outlet box will include cover plate and cable connector hardware. The type of cover plate and hardware required will be specified in writing by Project Engineer.

PART 3 EXECUTION

3.1 Raceway Installation

- A. Vertical and horizontal runs of LAN cables will be run using conduit, cable tray or cable support hardware. Verify type of raceway required based on existing LAN installation. Obtain written approval from Project Engineer.
- B. LAN cables in conduit, cable tray or cable support hardware as follows:
 - 1. For horizontal runs above the bottom chords and below the top chords of open web steel roof or mezzanine support joists and within 8 inches below bottom of solid steel roof joist or glue laminated wood beams.
 - a. Where cable support hardware is used install every 5ft. Do not exceed 5ft spacing.
 - 2. For office complex rooms and ceilings
 - a. Cable installed above suspended ceilings will use J-hook or bridle ring support hardware unless local codes specify otherwise.
 - b. Do not lay cables directly on ceiling tiles, rails, or supports. Install cable support hardware every 5ft. Do not exceed 5ft spacing.
 - c. Cable supports shall be mounted a minimum of 75 mm (3 in) above the ceiling grid supporting the tiles.
 - d. Cable must exhibit some sag in hanging between supports. This provides visual evidence that cable tension is within 25lbs as required in ANSI/TIA-568-C.0.
 - e. Cable bundles not to exceed 200 cables without additional support. Reduce the size of the bundles where cables exhibit too much stress due to weight and tension.
- C. LAN cables in Electrical metallic tubing (EMT):
 - 1. For horizontal runs along walls.
 - 2. For vertical drops down walls and building columns from steel roof or mezzanine support joist, laminated wood beams, cable tray or cable support hardware.
 - 3. For vertical drops to top of enclosures from steel roof or mezzanine support joist, laminated wood beams, cable tray or cable support hardware.
 - 4. For vertical and horizontal runs along conveyor support steel structure.
 - 5. Do not install conduit runs longer than 100ft between pull points or pull boxes and limit each conduit run to two 90-degree bends.
 - 6. Inside bending radius must be at least 10 times the conduit diameter.
 - 7. Route EMT parallel and perpendicular to building lines.
- D. Conduit cable fill table

1. Maximum number of copper communication cables within a specified conduit based on a maximum conduit fill capacity of 40% or less as follows:

EMT CONDUIT – OUTSIDE DIAMETER

Cable Outside Diameter	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
0.275	3	6	10	13	22	39	59	99
0.29	3	5	9	12	20	35	53	89
0.30	3	5	8	11	19	33	50	83
0.33	2	4	7	9	15	27	41	69
0.34	2	4	6	9	14	26	39	65
0.354	0	3	6	8	13	24	36	60
0.523	0	0	2	3	6	11	16	27
0.70	0	0	0	0	3	6	9	15
.95	0	0	0	0	0	3	5	8

E. Cable tray system.

1. Utilize existing communications cable trays and wire ways provided sufficient space is available and upon written approval from Project Engineer.
2. Locate and route new cable tray parallel and perpendicular to building lines to properly support cables, provide long term protection and ease of access.
3. All cable tray systems should be grounded. Each tray section should have a ground strap to the adjoining section.
4. Locate and route tray to avoid sources of EMI such as motors, transformers, copiers, construction equipment and the branch circuit power cables that supply them.
5. Cables should be routed away from all sources of electrical interference or electro-magnetic fields.
6. Data cables in cable trays should be a minimum distance of 2 feet from parallel power cable trays.
7. Do not run cables in parallel with electrical power wiring. Separate cables at least 5in. from fluorescent light fixtures. Use conduit if separation is not possible.
8. Cables should not be routed through building where they will be exposed to direct sunlight, direct lightning strikes and power surges.
9. Fire stopping material must be used where cables pass through walls designated as a "fire wall".

3.2 LAN Cable Installation

- A. All cable runs will be continuous with no intermediate splicing used.
- B. Maximum cable distance between Intermediate Distribution Frame (IDF) and workstation is 295ft.

- C. Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both be observed throughout the entire cabling system.
- D. Do not kink or bend cable sharply. Minimum bend radius for category 6A cable is 1.25 inches with a maximum fold of 90 degrees. Restrict the number of bends and avoid where possible.
- E. Maximum bending radius is 4 times cable outside diameter.
- F. Do not damage cable jackets.
- G. Use equipment and procedures to minimize cable tension and avoid breakage. Use uniform pulling and continuous management of cable feed.
- H. Do not exert more than 25 pounds of pulling tension on 4 pair cables. Larger capacity cables should be pulled as per the manufacturer's specifications.
- I. Do not twist cables. Cables may twist by over-tightening tie wraps close to cable bends or by pulling a cable that has looped itself.
- J. Use hook and loop cable ties at appropriate intervals to secure cable and to provide strain relief at termination points.
- K. Do not over tighten hook and loop cable ties to the point of deforming or crimping the cable sheath. Hook and loop cable ties should rotate 360 degrees when applied correctly.
- L. Hook and loop cable managers (or owner specified equivalent) should be used in spaces where reconfiguration of cables and terminations may be frequent.
- M. Do not run power in the same conduit with LAN cable.
- N. Do not run cables within hollow cinder blocks without conduit.
- O. Keep cables away from sources of heat such as hot water pipes and heating ducts.
- P. Leave 18in of spare cable at each outlet box. Terminate all wires within cable to connector.
- Q. Separation from sources of EMI shall be as specified in the TIA/EIA 569-A Pathways and Spaces Standard. Recommended distances as specified by the table below:

PURPOSE	TYPE OF WIRE	MINIMUM SEPARATION
Electrical Supply	Bare light or power	5 feet
	Open wiring	2 inches
	Wire in metal conduit	None
Radio & TV	Antenna lead & ground	4 inches
	Wires without grounded shield	4 inches
Signal / Control Wire	Open wiring < 300 volts	None

CATV Cables	Community television systems	None
	Systems with grounded shield coaxial cable	None
Telephone Service	Arial or buried	2 inches
Sign	Neon sign & associated wiring	6 inches
Lighting System	Lighting rods & wires	5 feet

3.3 Cable Identification

A. Cable Labeling

1. Horizontal and backbone cables shall be labeled at each end. The cable or its label shall be marked with its identifier.

B. Faceplate Labeling

1. A unique identifier shall be marked on each faceplate to identify it as connecting hardware.
2. Each port in the faceplate shall be labeled with its identifier.

C. Racks, Panels, Blocks

1. A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
2. Each port on the connecting hardware shall be labeled with its identifier.

D. Verify the size and type of labels and identifiers with Project Engineer.

3.4 Category 6A Copper Testing

- A. All Category 6a channels are qualified for linear transmission performance up to 300 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.

- B. Testing of cable channels shall be performed prior to system cutover.

- C. All UTP cables exceeding 90 m (295 ft) or 100 m (328 ft) shall be 100% tested for continuity if applications assurance is not required.

- D. Category 6A UTP horizontal cables, whose length does not exceed 90 m (295 ft) for the basic link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA-568-C.2.

- E. Test parameters include wire map plus ScTP shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return Loss, attenuation, propagation delay, and delay skew.

- F. Category 6a backbone cables, that exceed 90 m (295 ft) or 100 m (328 ft), but less than 800 m (2,624 ft) or 815 m (2,674 ft), and applications warranty is desired, shall have 100 percent of the cables tested according to ISO/IEC Class A, B, or C.
- G. All installed category 6a channels shall perform equal to or better than the minimum requirements as specified by the table below:

Parameter	100MHz (dB)	200MHz (dB)	250MHz (dB)
Insertion Loss	20.3 dB	29.7 dB	33.7 dB
NEXT Loss	42.1 dB	37.5 dB	36.1 dB
PS NEXT Loss	40.6 dB	36.1 dB	24.6 dB
ACR	21.8 dB	7.8 dB	2.4 dB
PS ACR	20.3 dB	6.4 dB	0.9 dB
ELFEXT	23.9 dB	17.9 dB	15.9 dB
PS ELFEXT	20.9 dB	14.9 dB	12.9 dB
Return Loss	14.8 dB	11.7 dB	10.5 dB
Propagation Delay	488 ns	487 ns	487 ns
Delay Skew	29 ns	29 ns	29 ns

3.5 Test Equipment Parameters

- A. All UTP/ScTP field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
- B. Auto test settings provided in the field tester for testing the installed cabling shall be set to the default parameters.
- C. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.
- D. All proposed Category 6 field-testing shall be performed with an approved level III UTP/ScTP field test device.

3.6 Support and Warranty

- A. Support
 - 1. Applications Supported
Existing and future applications supported for a channel model warranty include those approved by the Institute of Electronic and Electrical Engineers (IEEE), the Asynchronous Transfer Mode (ATM) Forum, the American National Standards Institute (ANSI) or the International Organization of Standards (ISO) that specify compatibility with the cable referenced herein. Additional applications that are covered by this warranty include those under development for use on Gigabit Ethernet (IEEE 802.3z, 802.3ab) and 622 Mb/s ATM.

B. Warranty Data

Either a basic link or channel model configuration may be applied to the horizontal and/or backbone sub-systems of the structured cabling system. Applications assurance is only applied to a channel model configuration.

1. Warranty

A twenty (20) year warranty available for pending category 6 structured cabling system shall be provided for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement

2. Product Warranty

The manufacturer of passive telecommunications equipment used in a manner not associated with the Systems Warranty must have a minimum five (5) year Component Warranty on all its product. The Products Warranty covers the components against defects in material or workmanship under normal and proper use.

End of Section

CONVEYOR ELECTRICAL INSTALLATION AUDIT

INSPECTED: **DATE** **BY**

PROJECT: _____

TOOLS REQUIRED:

1) padlock, 2) insulated screwdrivers, straight & phillips-blade, 3) 10ft. tape measure, 4) flashlight, 5) project manual for conveyor electrical installation, 6) set of conveyor electrical drawings, 7) wear proper PPE where power is present and enclosures are open.

NOTE: 1. The Project Manual specification sections listed indicate where the audit item can be found. For additional clarification and information refer to the conveyor electrical drawing mounting details.

2. Provide a copy of this audit to the Project Engineer.

<i>ITEM</i>	<i>OK</i>	<i>NOT OK</i>	<i>NOT INSTALLED</i>	<i>N/A</i>	<i>REMARKS</i>
A. GENERAL Section 011000, 013000, 013300, 015000, 016000, 017000					
1. Owner furnished items are protected from the elements, damage, loss, theft & pilferage					
2. Expansion only (013000): Work being performed does not interfere with the package sorting operation					
3. Expansion only (013000): Days work is complete & conveyor system is fully operational at least 30 minutes prior to the sorting operation					
4. Expansion only (013000): Debris, rubbish & waste materials are removed from the operational area inside & outside the facility					
5. Submittals are in the possession of the Project Engineer					
6. Submittals match the actual equipment installed					
7. No project or advertising signs are displayed by contractor					
8. Devices and equipment of the same product line is the same type and by the same manufacturer					
9. Products supplied are UL labeled					
10. Equipment is new & free of faults, blemishes, dents, imperfections, rust & stains					
11. Finished floor is protected to prevent marking, spotting, staining and damage					
12. For final inspection: all debris removed from boxes & enclosures. Consoles & panels vacuumed clean					
B. METAL FABRICATIONS Section 055000 - 2.02, 2.03, 3.02					
1. Welds & sharp edges on channel, plates, brackets, etc. are ground smooth					
2. Fabrications are installed plumb and level					
3. Welded & bolted fabrications for devices, consoles & panels provide adequate support to withstand vibration of conveyor operation					
4. Welding is not being performed around electronic devices (VFDs, PLC racks, PCs and photoeyes) with power to those devices turned on					
5. Welding is not being performed around electrical equipment unless covered or protected					
6. Fabrications are not welded to building structural steel or building columns					
7. Welds are prime painted					

ITEM	OK	NOT OK	NOT INSTALLED	N/A	REMARKS
C. FANS Section 233400 - 1.05, 2.01, 3.02					
1. Fans have safety screen guards on inlet and outlet					
2. Fans are hardwired (no plug) with strain relief grip at junction box					
3. Fans are controlled with a NEMA 1, toggle type, padlockable manual motor starter w/pilot light					
D. GROUNDING AND BONDING Section 260000 - 2.01, 3.02					
1. Ground conductor is green or green w/yellow stripes or taped green (bare is option for tray cable)					
2. Ground conductor is installed within each power, control, lighting and wiring device raceway and in multi-conductor cables					
3. Double locknuts, sealing type outside / standard type inside, is on RGS & IMC conduit penetrating enclosure or box with a clean knockout (drilled hole or all rings punched out). Exception *					
4. Double locknuts, sealing type outside / bonding locknut or bonding bushing inside with a bonding jumper, is on RGS & IMC conduit penetrating enclosure or box when knockout rings are still in place					
5. Compression type box connector outside / standard locknut inside is on EMT conduit penetrating enclosure or box with a clean knockout (drilled hole or all rings punched out). Exception *					
6. Compression type box connector outside / bonding locknut or bonding bushing inside with a bonding jumper is on EMT conduit penetrating enclosure or box when knockout rings are still in place					
7. Box connector outside / standard locknut inside is on FMC & LFMC conduit penetrating enclosure or box with a clean knockout (drilled hole or all rings punched out). Exception *					
8. Box connector outside / bonding locknut or bonding bushing inside with a bonding jumper is on FMC & LFMC conduit penetrating enclosure or box when knockout rings are still in place					
9. Ground bushing with #4 or larger ground is looped between each conduit at MDB, MCC, MCP, consoles & panels when knockout rings are still in place. Ground is run to ground bus or lug					
10. Bonding jumper is used at expansion fittings to connect conduit, wireway & cable tray sections when crossing building expansion joints					
11. Bonding jumper is used to connect all non-continuous or separated sections of cable tray					
12. Bonding jumper or approved connectors are used to connect conduits to cable tray and cable tray to MCC or panel ground lug					
13. Ground conductor is terminated inside enclosures and boxes whenever circuit conductors are spliced or terminated to equipment					
14. Ground conductor is terminated to devices at the ground symbol or ground identification point					
15. Sheet metal screws are not used to terminate ground conductors					
16. Sheet metal screws are not used to connect ground lugs or other ground connections to enclosures or boxes					

ITEM	OK	NOT OK	NOT INSTALLED	N/A	REMARKS
17. Mounting screws or bolts that secure equipment in place are not used to terminate a ground or bond conductor					
18. Equipment ground conductor is not terminated to building or conveyor steel					
19. Equipment ground conductor is not connected in series or daisy chained between equipment					
* Locknuts not required on enclosures with threaded hubs or bosses					
E. RACEWAY SUPPORTS Section 260000 - 2.02, 3.01, 3.03					
1. Single conduit is supported to wall or column using ribbed straps or clamps with clamp back spacers					
2. Multiple conduits are supported on U-channel with ribbed straps, rounded clamps or hangers					
3. Perforated straps or spring steel clips or clamps are not used to support conduit					
4. Conduit hangers with bolts are not used within 6'-8" of floor or platform					
5. Conduit ribbed straps or rounded clamps are used within 6'-8" of floor or platform					
6. U-channel for multiple conduits has 25% spare capacity					
7. Hanger rods are 3/8" diameter					
8. RGS, IMC & EMT conduit is supported at intervals not exceeding 10'-0" & within 3'-0" of conduit body, box, enclosure or equipment					
9. Minimum clearance between any surface and conduit is 1/4 inch					
10. U-channel provides conduit support to within 10ft of joist where conduit is not supported by wall, column or conveyor steel					
11. RGS or IMC may be unsupported for vertical drops up to 20ft only for special circumstances where it is impractical to support conduit to within 10ft of joist and only if approved by Project Engineer					
12. FMC & LFMC conduit is supported at intervals not exceeding 4'-6" and within 1'-0" of conduit body, box, enclosure or equipment except for equipment motion it can be unsupported up to 3'-0"					
13. FMC & LFMC conduit used for lighting whips is not unsupported for more than 6'-0"					
14. Wireway with individual sections of 5ft or less are supported at each end and at intervals not exceeding 5'-0"					
15. Wireway with individual sections over 5ft are supported at each end and at each joint but not more than 10'-0" between supports					
16. MC cable is supported at intervals not exceeding 6'-0" and within 1'-0" of conduit body, box, enclosure or equipment					
17. Raceway supports are not welded to building structural steel					
18. Raceway supports are not fastened to roof deck					
19. Raceway supports are not used to support other devices					
20. Holes are not drilled into conveyor intermediate frames or sidepanel to support raceway					

ITEM	OK	NOT OK	NOT INSTALLED	N/A	REMARKS
F. WIRE, CABLE & CONNECTORS Section 260500 - 2.01, 3.05, 3.09					
1. Conductors are copper stranded except solid may be used for lighting and receptacles					
2. AC power & control conductors have type THHN insulation for dry locations: THWN for wet					
3. DC power & control conductors have type THHN or MTW insulation for dry locations					
4. Minimum size conductors is #12 AWG for AC power, #14 AWG for AC control and #18 for DC control					
5. AC power, AC control, DC control & DC data wires are installed in separate raceway					
6. Single DC conductors are blue for (+) and blue w/white tracer for (-)					
7. Single AC control conductors are red for supply, white for neutral & green for ground					
8. Single AC power conductors are color coded per voltage level or all black with taped color designation					
9. Multi-conductor AC & DC control cables are multi-colored with factory number, letter or stripe on individual conductors to distinguish each					
10. Multi-conductor AC power & control cables have outer jacket removed between entry point of panel or equipment and termination point					
11. Multi-conductor DC control cables have jacket removed 12 inches from termination point					
12. Multi-conductor DC shielded cable has the shield connected at the panel only and does not have the shield connected to ground at the field device					
13. Conductor color, numbering and identification is consistent throughout its entire length					
14. Single conductor power and control splices are within 10'-0" of floor, platform or conveyor system access					
15. Cable tray cable and multi-conductor cables include green, green w/yellow stripes, taped or bare ground wire					
16. Cable tray cable is attached to cross rungs at intervals not exceeding 8ft for horizontal runs & 4ft for vertical runs					
17. Cable tray power and control cable is spliced in enclosures within 10'-0" of floor, platform or conveyor system access					
18. Cable tray cable is not spliced within tray					
19. Cable tray cable is not stacked above tray side rails and does not droop between cross rungs					
20. PLC, PC or HMI communications cable is not installed within DC control cable tray					
21. Twist-on connectors are used for #8 AWG & smaller wire splices and split bolt connectors are used for #6 AWG & larger wire splices					
22. Twist-on and split bolt connectors are limited to 3 conductors per splice					
23. Twist on and split bolt splices are limited to 5 or fewer within any box					
24. Splices of 6 or more within any box use terminal blocks within NEMA 12 boxes					
25. Terminal blocks do not contain more than 1 power conductor or more than 2 control conductors per terminal lug					
26. Main feeders at MCC and MCP terminate to mechanical or compression/crimp lugs					
27. Flexible rubber cord such as "SO" includes green ground wire					

ITEM	OK	NOT OK	NOT INSTALLED	N/A	REMARKS
28. Flexible rubber cord such as "SO" has strain relief mesh grips at each end					
29. Conductor & cable terminations have sufficient slack & support to prevent stress					
30. Conductors terminated to VFD panel pull-apart terminal blocks have slack to move block from VFD to Bypass					
G. CONDUIT AND FITTINGS Section 260500 - 2.02, 3.01, 3.03					
1. Minimum size conduit is ½ inch					
2. Conduits are installed parallel & perpendicular to building lines and have expansion fittings where crossing building expansion joints					
3. Separate conduits are used for VFD line and load side power					
4. IMC installed to outdoor devices					
5. IMC installed when attached to or supported from bottom of open web joist for AC three phase and single phase wiring **					
6. IMC installed when run below 12 inches of solid steel joist or laminated wood beams for AC three phase and single phase wiring **					
7. IMC installed when run along conveyor support steel for AC three phase and single phase wiring **					
8. IMC installed for vertical drops to conveyor support steel from joist for AC three phase and single phase wiring **					
9. EMT installed when above bottom of open web joist for AC three phase, single phase and DC wiring **					
10. EMT installed when run within 12 inches below solid steel joist or laminated wood beams for AC three phase, single phase and DC wiring **					
11. EMT installed along walls and building columns for AC three phase, single phase & DC wiring **					
12. EMT installed when run along conveyor support steel for DC wiring					
13. EMT installed when run straight from joist or tray to top of control consoles and panels, MCC, MCP and lighting / receptacle panelboards for AC three phase, single phase and DC wiring **					
14. EMT installed when run from MDB to MCC, MCP or lighting panelboards for AC three phase wiring					
15. EMT installed for PLC, PC or HMI communication cables					
16. Transition between EMT and IMC performed at joist level a minimum of 2ft from vertical drop and the transition is made only once per run					
17. EMT uses compression type fittings only not indentation or set screw type fittings					
18. Flexible metal conduit or metal clad cable installed for vertical drops from joist to light fixtures					
19. Liquid tight flexible metal conduit installed to motors does not exceed 3ft.					
20. Liquid tight flexible metal conduit installed to photoeyes does not exceed 3ft.					
21. Insulated plastic bushings used on open ends of all conduit within boxes and enclosures					
22. Conduits have fire and smoke fittings where passing through floors or walls					
23. Sealing & drainage fittings used on conduits to motors that are within 18" of floor in areas where vehicles are parked in accordance with the drawings					
24. Sealing compound is installed within sealing and drainage fittings					

ITEM	OK	NOT OK	NOT INSTALLED	N/A	REMARKS
25. Conduits are supported along entire length across open spans below 8ft above floor or platform					
26. Conduit headroom is minimum of 6'-8" in walk aisles, egress and cart paths, sort positions and work areas					
27. Conduits are not installed between top of roof joist and roof deck					
28. Conduits are not installed to roof deck					
29. Conduits are not installed on floor					
30. Conduits are not installed along top of handrail					
31. Conduits are not installed within 18" of floor in areas where vehicles are parked					
32. Conduits are not installed as chin-up bars, footrests or ladders					
33. Conduits are not installed within 3'-6" above any conveyor, chute or slide					
34. Conduits are not installed where future conveyors are designated					
35. Conduits do not interfere with walk aisles, egress paths, cart paths or sort positions					
36. Conduits do not interfere with screen guards, pulleys, tails, etc. making them unserviceable					
37. Multiple conduits are not supported to the underside of conveyors					
38. Multiple conduits are not supported along the sidepanel of conveyors except as approved by Project Engineer					
** Single phase wiring includes AC control, lighting, fans and receptacles					
H. CABLE TRAY Section 260500 - 2.02, 3.02					
1. Tray has 4 inch minimum load depth from top of rung to top of rail					
2. Channel style side rails: When facing inward rungs are welded. When facing outward rungs penetrate side rails					
3. Tray is ladder type with rungs 6 inches apart					
4. Single tier tray installed within 2'-6" from bottom of roof joist					
5. Double tier tray installed within 5'-0" from bottom of roof joist					
6. Tray is run parallel and perpendicular to building lines and has expansion fittings where tray crosses building expansion joints					
7. Tray has fire and smoke fittings where passing through floors or walls					
8. Ventilated cover is installed for the first 6ft above MDB, MCC or MCP on front side when against wall or front and back when in open areas					
9. Continuous barrier strip is installed to separate AC power & AC control cables					
10. Separate trays are installed for AC & DC cables					
11. Terminal & distribution boxes are not supported from tray					
I. WIREWAY AND AUXILIARY GUTTERS Section 260500 - 2.02, 3.04, 3.05					
1. NEMA 1 gray with stamped knockouts. Wireway has hinged covers. Auxiliary gutters have screw covers					
2. Wireway & auxiliary gutters limited to 5ft for group installation of motor disconnects & VFD panels unless indicated otherwise on the drawings					

ITEM	OK	NOT OK	NOT INSTALLED	N/A	REMARKS
J. BOXES, ENCLOSURES AND FITTINGS Section 260500 - 2.01, 2.03, 2.04, 3.05, 3.06					
1. Pull & junction boxes without terminal blocks are NEMA 1 with screw cover					
2. Terminal & distribution boxes with terminal blocks are NEMA 12 with hinged door & subpanel					
3. Terminal blocks and lugs within terminal and distribution boxes are finger safe					
4. Receptacle and wiring device boxes are drawn type with continuous rounded corners, stamped knockouts and covers					
5. Enclosures for control stations, starters, motor safety disconnects & other field devices are NEMA 12 (no stamped knockouts)					
6. Enclosures for IEC manual starters are IP55 (NEMA 12 equivalent) non-metallic housing					
7. Enclosures for fan manual starters are NEMA 1					
8. Control stations, starters, motor safety disconnects and other field devices are not used as pullboxes or junction boxes					
9. Conduit bodies are malleable iron with threaded ends & removeable domed covers with open gasket					
10. Grounding bushings are malleable iron with insulated throat and locknuts are case hardened steel					
11. Strain relief grips are used on each end of flexible rubber cord except where cord is factory installed					
12. Unused knockout holes in boxes and enclosures are plugged with steel snap-in blanks					
K. WIRING DEVICES Section 260500 - 2.05, 3.07					
1. Wall switches are industrial heavy duty type, quiet toggle, 20A rated, green ground screw, brown or gray					
2. Duplex receptacles are industrial heavy duty type, 20A rated (one straight slot/one "T" slot) green ground screw, brown or gray					
3. Switches and receptacles are mounted vertically					
4. Wall switches are 48 inches above floor or platform					
5. Switches and receptacles are mounted flush with or slightly protruding from box cover not recessed into cover					
6. Duplex or quad receptacles are located at each DA position, smalls sort bin, air container, EDS, IDS, SSLA, etc					

ITEM	OK	NOT OK	NOT INSTALLED	N/A	REMARKS
L. ELECTRICAL IDENTIFICATION Section 260500 - 2.06, 3.08					
1. Conductors and cable jackets are identified using sleeve type or self laminating adhesive wrap-around markers with machine made thermal transfer print not dot matrix print					
2. Sleeve markers have identifying markings printed once. Wrap-around markers have markings printed multiple times					
3. Conductor and cable sleeve markers rotate freely and are not heat shrunk					
4. Multi-conductor AC power cable jackets are tagged at termination points with name of load served or destination					
5. Multi-conductor DC control, instrumentation, data and communication cable jackets are tagged at termination points with name of load served or destination					
6. Conductors are tagged with wire number markers at termination & splice points					
7. Black three phase power wire has each phase labeled or taped with a color					
8. Spare wires and cables are bundled, coiled & labeled with destination using a metal grommet tag					
9. Nameplate for each field device is engraved white laminated plastic with black lettering					
10. Nameplates are riveted to devices that can accept riveting					
11. Nameplates are attached to conduit for devices that cannot accept riveting					
M. FIELD QUALITY CONTROL Section 260500 - 3.09					
1. Project Engineer has written test results for the Ground Fault Protection test performed on overcurrent devices rated 1000A and greater					
2. Project Engineer has written test results for the exit and emergency light test performed on light fixtures installed by the contractor					
3. Motor rotation for conveyors without a VFD is correct and is proper for package flow					
4. Motor rotation for reversing conveyors without a VFD is correct for both forward & reverse direction and is proper for package flow					
5. Motor rotation for conveyors with a VFD is correct and is proper for package flow					
6. Motor rotation for reversing conveyors with a VFD is correct for both forward & reverse direction and is proper for package flow					
7. Motor rotation for conveyors with a VFD is correct in both the VFD position and bypass position and is proper for package flow in both positions					
8. Sufficient conductor length and slack is provided to interchange VFD panel pull-apart terminal blocks					
9. VFD speed switch changes the conveyor speed					
N. DEMOLITION (expansions / alterations only) Section 260505 - 3.02, 3.03					
1. Project Engineer performed a walk-through with the contractor prior to bid					
2. Abandoned conduits terminate into a junction box with cover at both ends of conduit. Boxes identified as "spare"					
3. Abandoned wires are terminated with twist-on connectors and identified as "spare"					
4. Barricades are used around demolition work in progress and existing equipment is protected					

ITEM	OK	NOT OK	NOT INSTALLED	N/A	REMARKS
O. POWER & CONTROL DEVICES Section 262700					
1. Control station buttons, switches and pilot lights have engraved legend plate (start, stop, tripped,etc)					
2. Control station stop buttons have securing guard with "SECURED" label					
3. Control station stop buttons can not be reset with securing guard in place					
4. Pressing mushroom head stop button turns on "tripped" light. Pulling stop button or pressing reset button turns light off					
5. Pendant control stations do not interfere with metro unloader along runouts and peninsulas					
6. Pull cord cable is 5/16" diameter red vinyl covered steel cable					
7. Pull cord cable has 3 saddle clamps & cable end protectors at each end					
8. Motor disconnects are not group installed unless motors are directly above or adjacent to one another					
9. Motor disconnects are installed with 3'-6" clearance in front for 240, 480 & 600V					
10. Motor disconnects are installed with 3'-0" clearance in front for 120 & 208V					
11. Fusible disconnect switches have fuses installed					
12. Motor disconnects and fusible disconnect switches have a factory installed ground lug					
13. Photoelectric sensor holes drilled into sidepanel are ground smooth					
14. Photoelectric sensors are adjustable in 4 directions: up / down / in / out					
15. Photoelectric sensor receiver is installed on most accessible or platform side					
16. Multiple photoelectric sensors are not installed directly across from each other to avoid crosstalk					
17. Signal horns for starting are installed a maximum 200 ft apart or 100ft from one direction					
18. Signal horns for starting are not installed directly above or aimed at sort positions					
19. Devices, MCC, MCP, consoles & panels installed plumb & level with adequate support					
20. MCC or MCP is installed with 3'-6" clearance in front (and back if back-to-back) for 240, 480 & 600V					
21. MCC or MCP is installed with 3'-0" clearance in front (and back if back-to-back) for 120 & 208V					
22. MCCs or MCPs facing each other have a minimum 4'-0" clearance between for 240, 480 & 600V and 3'-0" between for 120 & 208V					
23. MCC circuit breaker panelboard directory legibly identified with name of load. Unused breakers are labeled "spare" and are in the off position					
24. MCC buckets have fuses installed					
25. Fuses are dual element, time delay Class R rejection type or Class J					
26. MCC buckets with NEMA starters have overload heaters installed					
27. Manual motor starters (NEMA) have overload heaters installed					
28. Manual motor starters (IEC) have overload adjusted to motor nameplate full load amps					
29. IEC starters at MCP have overload adjusted to motor nameplate full load amps					
30. Randomly verify conveyor motors for proper horsepower, voltage, full load amps & 1.15 service factor. Compare with drawings.					

ITEM	OK	NOT OK	NOT INSTALLED	N/A	REMARKS
P. LIGHTING Section 265000					
1. Fluorescent fixtures have T-8 lamps installed					
2. Lamps are installed in all fixtures					
3. All fixtures below 10'-0" have a hinged wire guard or lens cover					
4. Fluorescent fixtures have local switches					
5. Continuous and non-continuous rows of fluorescent fixtures have local switches wired to alternate phases					
6. Continuous rows of fluorescent fixtures are supported from continuous U-channel					
7. Fluorescent fixtures are installed down the center of runout conveyors for package cars					
8. Fluorescent fixtures are located at all package car positions, under conveyors at primary unload area, sort aisles, sort positions, mis-sort chutes, MDB, MCC, MCP, catwalks, supervisor workstations, driver turn in counters, egress paths, stairs, etc					
9. Fixtures do not interfere with package unload device on metro conveyors at runouts, boxlines & peninsulas					
10. Metal Halide fixtures have glass refractors (only applicable when adding to existing MH fixtures)					
11. Metal Halide fixtures are installed in the center of each vehicle position on metro conveyors (only applicable when adding to existing MH fixtures)					
12. Exit and Emergency fixtures tested. Fixtures transition to battery power when normal power is removed and remain at full output for 90 minutes.					
Q. LAN Section 271500					
1. LAN outlet box with cover and connector hardware installed at each DA position, smalls sort bin, air container, EDS, IDS, SSLA, etc					
2. LAN cables installed (if in contract)					
R. MISCELLANEOUS ITEMS Supplied with conveyor system					
1. Any conveyor with 3 or more cycling diverters is equipped with a belt rollover switch					
2. Each power turn used for an irreg application is equipped with a current sensing device					
3. Each power turn used for a standard application is equipped with a speed sensing device, current sensing device or both					
4. Moveable/liftable chutes or conveyors are equipped with dual limit switches on each side for left/right movement or top and bottom for up/down movement					
S. ADDITIONAL COMMENTS					

