

Specifications for this project are arranged in accordance with the Construction Specification Institute numbering system and format. Section numbering is discontinuous and all numbers not appearing in the Table of Contents are not used for this Project.

DOCUMENTS BOUND HERewith

Division	Section Title	Pages
SERIES 0 – PROCUREMENT AND CONTRACT REQUIREMENTS		
<u>INTRODUCTORY INFORMATION</u>		
00 01 01	PROJECT TITLE PAGE	
00 01 10	TABLE OF CONTENTS	6
00 01 15	LIST OF DRAWINGS	1
<u>PROCUREMENT REQUIREMENTS</u>		
00 11 16	INVITATION TO BID	1
00 21 13	INSTRUCTIONS TO BIDDERS	13
00 41 13	BID FORM	11
00 43 13	BID BOND	1
<u>CONTRACTING REQUIREMENTS</u>		
00 52 13	STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR A101-2017	16
00 54 13	SUPPLEMENTS TO AGREEMENT BETWEEN OWNER & CONTRACTOR A101-2017	1
00 54 14	SUPPLEMENT TO A101-2017 – EXHIBIT A – INSURANCE & BONDS	1
00 61 13.13	PERFORMANCE BOND	2
00 61 13.16	PAYMENT BOND	2
00 62 76	APPLICATION OF PAYMENT (SAMPLE AIA G702 & G703)	2
00 72 13	GENERAL CONDITIONS TO THE CONTRACT (AIA A201-2017)	41
00 73 13	SUPPLEMENTARY GENERAL CONDITIONS	15
00 73 46	DELAWARE DEPARTMENT OF LABOR PREVAILING WAGE RATES CLASSIFICATION OF WORKERS UNDER DELAWARE'S PREVAILING WAGE RATES	22
00 81 13	GENERAL REQUIREMENTS	16
00 81 14	DRUG TESTING FORMS	2
DIVISION 1 – GENERAL REQUIREMENTS		
01 10 00	SUMMARY	6
01 14 00	WORK RESTRICTIONS	2
01 21 00	ALLOWANCES	4
01 22 00	UNIT PRICES	2
01 23 00	ALTERNATES	
01 24 00	PERMITS	2
01 25 00	CONTRACT MODIFICATION PROCEDURES	2
01 29 00	PAYMENT PROCEDURES	3
01 31 00	PROJECT MANAGEMENT AND COORDINATION	3
01 31 50	FIELD ENGINEERING	2
01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION	4
01 32 23	PHOTOGRAPHIC DOCUMENTATION	2

01 33 00	SUBMITTAL PROCEDURES	11
01 40 00	QUALITY REQUIREMENTS	8
01 42 00	REFERENCE STANDARDS AND DEFINITIONS	4
01 50 00	TEMPORARY FACILITIES AND CONTROLS	11
01 56 00	ENVIRONMENTAL PROTECTION	3
01 56 39	TREE PROTECTION	6
01 60 00	PRODUCT REQUIREMENTS	10
01 71 17	ANIMAL MANAGEMENT REQUIREMENTS OF CONSTRUCTION	2
01 73 00	EXECUTION REQUIREMENTS	6
01 73 29	CUTTING AND PATCHING	4
01 74 19	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL	9
01 77 00	CLOSEOUT PROCEDURES	6
01 78 23	MAINTENANCE DATA	4
01 78 39	PROJECT RECORD DOCUMENTS	4
01 79 00	DEMONSTRATION AND TRAINING	3
 DIVISION 2 – EXISTING CONDITIONS		
02 32 00	GEOTECHNICAL INVESTIGATION	36
02 41 00	SELECTIVE DEMOLITION	7
 DIVISION 3 – CONCRETE		
03 30 00	CAST-IN-PLACE CONCRETE	24
 DIVISION 4 – MASONRY		
04 20 00	UNIT MASONRY	21
04 43 13	STONE MASONRY VENEER	7
04 72 00	CAST STONE MASONRY	6
 DIVISION 5 – METALS		
05 05 00	POST INSTALLED ANCHORAGE	5
05 12 00	STRUCTURAL STEEL FRAMING	10
05 31 00	STEEL DECKING	8
05 40 00	COLD-FORMED METAL FRAMING	13
05 50 00	METAL FABRICATIONS	6
05 51 00	METAL STAIRS	4
05 52 13	PIPE AND TUBE RAILINGS	4
05 59 64	GALVANIZED STEEL ANIMAL CAGING & KEEPER GATES	8
05 59 66	GALVANIZED ANIMAL TRANSFER DOOR ASSEMBLIES	7
 DIVISION 6 – WOOD, PLASTICS AND COMPOSITES		
06 10 00	ROUGH CARPENTRY	7
06 16 00	SHEATHING	4
 DIVISION 7 – THERMAL AND MOISTURE PROTECTION		
07 13 00	SHEET WATERPROOFING	5
07 21 00	THERMAL INSULATION	5
07 25 00	WEATHER BARRIERS	3
07 46 23	WOOD SIDING	3
07 54 23	THERMOPLASTIC POLYOLEFIN ROOFING	12
07 62 00	SHEET METAL FLASHING AND TRIM	3

07 72 00	ROOF ACCESSORIES	3
07 92 00	JOINT SEALANTS	9

DIVISION 8 – OPENINGS

08 16 13	FIBERGLASS DOORS	6
08 54 13	FIBERGLASS WINDOWS	5
08 71 00	DOOR HARDWARE	11
08 80 00	GLAZING	8
08 91 00	LOUVERS	3

DIVISION 9 – FINISHES

09 21 16	GYPSUM BOARD ASSEMBLIES	6
09 22 16	NON-STRUCTURAL METAL FRAMING	3
09 22 36.23	METAL LATH	4
09 24 00	CEMENT PLASTERING	4
09 51 00	ACOUSTICAL CEILINGS	5
09 67 00	FLUID-APPLIED FLOORING	3
09 91 13	EXTERIOR PAINTING	7
09 96 00	HIGH PERFORMANCE COATINGS	6

DIVISION 10 – SPECIALTIES

10 14 00	SIGNAGE ((NOT INCLUDED IN DD SUBMISSION)	4
10 28 00	TOILET, BATH AND LAUNDRY ACCESSORIES	5
10 44 00	FIRE PROTECTION SPECIALTIES	2
10 51 13	METAL LOCKERS	3
10 56 13	METAL STORAGE SHELVING	3
10 57 23	CLOSET AND UTILITY SHELVING	2

DIVISION 11 (NOT USED)**DIVISION 12 - FURNISHINGS**

12 21 13	HORIZONTAL LOUVER BLINDS	2
12 31 00	MANUFACTURED METAL CASEWORK	6

DIVISIONS 13 THRU 21 (NOT USED)**DIVISION 22 – PLUMBING**

22 01 01	PLUMBING GENERAL PROVISIONS	13
22 05 00	COMMON WORK RESULTS FOR PLUMBING	12
22 05 01	EXCAVATION AND FILL FOR PLUMBING WORK	5
22 05 02	SLEEVES AND PLATES FOR PLUMBING PIPING	3
22 05 06	CURBS AND FLASHINS FOR PLUMBING PIPING AND EQUIPMENT	2
22 05 09	PLUMBING EXPANSION SYSTEM	2
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT	5
22 05 19	METERS AND GAGES FOR PLUMBING PIPING	4
22 05 23	GENERAL-DUTY VALVES FOR PLUMBING PIPING	7
22 05 29	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT	9
22 05 48	VIBRATION CONTROL SUPPORTS FOR PLUMBING	2
22 07 00	PLUMBING INSULATION	2

22 07 19	PLUMBING PIPING INSULATION	11
22 11 16	DOMESTIC WATER PIPING	6
22 11 19	DOMESTIC WATER PIPING SPECIALTIES	8
22 11 23	DOMESTIC WATER PUMPS	4
22 13 16	SANITARY WASTE AND VENT PIPING	5
22 13 19	SANITARY WASTE PIPING SPECIALTIES	3
22 14 13	STORM DRAINAGE PIPING	8
22 14 23	STORM DRAINAGE PIPING SPECIALTIES	4
22 34 00	FUEL-FIRED DOMESTIC WATER HEATERS	5
22 42 00	INSTITUTIONAL PLUMBING FIXTURES	11
22 70 00	ANIMAL WATERER SYSTEMS	2

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

23 01 00	OPERATION AND MAINTENANCE OF HVAC SYSTEMS	6
23 01 01	HVAC GENERAL PROVISIONS	12
23 05 00	COMMON WORK RESULTS FOR HVAC	12
23 05 01	EXCAVATION AND FILL FOR HVAC WORK	5
23 05 02	SLEEVES AND PLATES FOR HVAC PIPING	3
23 05 06	CURBS AND FLASHINGS FOR HVAC EQUIPMENT	4
23 05 08	HVAC PIPING SPECIALTIES	6
23 05 09	HVAC EXPANSION SYSTEM	3
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT	6
23 05 19	METERS AND GAGES FOR HVAC	4
23 05 23	GENERAL-DUTY VALVES FOR HVAC PIPING	6
23 05 29	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT	14
23 05 48	VIBRATION CONTROL SUPPORTS FOR HVAC	3
23 05 93	TESTING, ADJUSTING AND BALANCING	7
23 07 00	HVAC INSULATION	2
23 07 13	DUCT INSULATION	6
23 07 16	HVAC EQUIPMENT INSULATION	5
23 07 19	HVAC PIPING INSULATION	12
23 08 00	SYSTEMS COMMISSIONING	10
23 09 01	AUTOMATIC TEMPERATURE CONTROL SYSTEM	4
23 09 02	CONTROL SYSTEMS WIRING	5
23 09 07	CONTROL DAMPERS	3
23 09 08	CONTROL VALVES	2
23 09 13	INSTRUMENTATION AND CONTROL DEVICES FOR HVAC	6
23 09 23	DIRECT DIGITAL BUILDING SYSTEMS CONTROL	17
23 11 26	LIQUEFIED-PETROLEUM GAS PIPING	3
23 21 13	HYDRONIC PIPING	7
23 21 23	HVAC PUMPS	5
23 23 00	REFRIGERANT PIPING	12
23 31 13	METAL DUCTS	12
23 33 00	DUCT ACCESSORIES	6
23 34 00	HVAC FANS	4
23 36 00	AIR TERMINAL UNITS	5
23 37 13	DIFFUSERS, REGISTERS, AND GRILLES	4
23 41 00	PARTICULATE AIR FILTRATION	4
23 52 16	CONDENSING BOILERS	7
23 81 26	SPLIT-SYSTEM AIR-CONDITIONING UNITS	5

23 81 27	DUCTLESS SPLIT-SYSTEM UNITS	6
23 82 39	UNIT HEATERS	4
23 84 13	HUMIDIFIERS	4

DIVISION 26 – ELECTRICAL

26 01 01	ELECTRICAL GENERAL PROVISIONS	12
26 05 00	COMMON WORK RESULTS FOR ELECTRICAL	5
26 05 01	EXCAVATION AND FILL FOR ELECTRICAL WORK	5
26 05 03	ACCESS DOORS FOR ELECTRICAL SYSTEMS	2
26 05 04	ELECTRICAL DEMOLITION	2
26 05 07	FIRESTOPPING FOR ELECTRICAL WORK	5
26 05 19	WIRES AND CABLES	11
26 05 21	WIRING CONNECTIONS	2
26 05 26	GROUNDING AND BONDING	5
26 05 28	EQUIPMENT FOUNDATIONS	2
26 05 33	CONDUITS	11
26 05 34	BOXES	3
26 05 41	LOW-VOLTAGE SERVICE ENTRANCE	3
26 05 44	UNDERGROUND DUCTS AND UTILITY STRUCTURES	7
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS	9
26 05 73	OVERCURRENT PROTECTIVE DEVICE STUDIES	9
26 09 23	STAND-ALONE LIGHTING CONTROL DEVICES	7
26 09 32	TUNABLE WHITE LIGHTING CONTROL SYSTEM	9
26 09 36	MODULAR LIGHTING CONTROLS	12
26 24 16	PANELBOARDS	9
26 27 16	CABINETS AND ENCLOSURES	2
26 27 26	WIRING DEVICES	3
26 28 00	ENCLOSED CIRCUIT PROTECTIVE DEVICES	3
26 28 13	FUSES	2
26 29 14	ENCLOSED MOTOR CONTROLLERS	3
26 29 23	VARIABLE FREQUENCY DRIVES	12
26 32 13	GENERATORS, WEATHER-PROTECTED	19
26 36 00	TRANSFER SWITCHES	10
26 43 13	SURGE PROTECTIVE DEVICES	6
26 51 00	INTERIOR LIGHTING	7
26 56 00	EXTERIOR LIGHTING	4

DIVISION 27 - COMMUNICATIONS (NOT USED)**DIVISION 28 - ELECTRONIC SAFETY AND SECURITY**

28 31 00	FIRE DETECTION AND ALARM SYSTEMS	11
----------	----------------------------------	----

DIVISION 31 – EARTHWORK

31 10 00	SITE CLEARING	4
31 20 00	EARTHWORK SITE	12
31 23 19	DEWATERING	6

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 12 16	HOT-MIX ASPHALT PAVING	4
----------	------------------------	---

32 31 00	DECORATIVE CANTILEVER GATE SYSTEM	6
32 22 10	EROSION AND SEDIMENT CONTROL	3
32 31 10	DECORATIVE CANTILEVER GATE SYSTEM	6
32 31 13	CHAIN LINK FENCES & GATES	3
32 31 19	DECORATIVE FENCES & GATES	8
32 91 13	TOPSOILING	9
32 91 15	AMENDED PLANTING SOIL	6
32 92 00	LAWN TURF AND GRASSES	10
32 93 00	PLANTING	17

DIVISION 33 - UTILITIES

33 25 10	WATER DISTRIBUTION	10
33 41 00	STORM DRAINAGE & SANITARY SEWER PIPING	12

END OF TABLE OF CONTENTS

QUARANTINE SUPPORT BUILDING
BRANDYWINE ZOO
1101 N. PARK DRIVE, WILMINGTON, DELAWARE 19802
DIVISION OF PARKS AND RECREATIONS CONTRACT No. 2020-WBZ-100

BID FORM

For Bids Due: Wednesday, July 15, 2020 at 2:00 PM

To: Dept. of Natural Resources and Environmental Control
Division of Parks and Recreation
Office of Design and Development
89 Kings Highway, Dover DE 19901

Name of Bidder: _____

Delaware Business License No.: _____ **Taxpayer ID No.:** _____
(A copy of Bidder's Delaware Business License must be attached to this form.)

(Other License Nos.): _____

Phone No.: () _____ - _____ **Fax No.:** () _____ - _____

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems, and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

Rock Removal Allowance: 50 CY x Unit Price \$ /Unit of Measure = \$ /Amount

Dewatering Allowance	\$	<u>\$25,000</u>
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Total Bid: _____
 \$ _____
 (\$ _____)

ALTERNATES

Alternate prices conform to the applicable project specification section. Refer to specifications for a complete description of the following Alternates. An “ADD” or “DEDUCT” amount is indicated by the crossed-out part that does not apply.

ALTERNATE No. 1: Caging Material

Add/Deduct: _____
(\$ _____)

QUARANTINE SUPPORT BUILDING
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BID FORM

UNIT PRICES

Unit prices conform to the applicable project specification section. Refer to the specifications, **01 22 00 – Unit Prices**, for a complete description of the following Unit Prices:

		<u>ADD</u>	<u>DEDUCT</u>
UNIT PRICE No. 1:	Concrete Paving	\$	\$
UNIT PRICE No. 2:	Asphalt Paving	\$	\$
UNIT PRICE No. 3:	Unsatisfactory Soil	\$	\$
UNIT PRICE No. 4:	Unsatisfactory Soil at Walkways	\$	\$
UNIT PRICE No. 5:	Landscape Boulders	\$	\$
UNIT PRICE No. 6:	Excavation of Rock/Boulders	\$	\$

QUARANTINE SUPPORT BUILDING
BRANDYWINE ZOO
1101 N. PARK DRIVE, WILMINGTON, DELAWARE 19802
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BID FORM

I/We acknowledge Addendums numbered _____ and the price(s) submitted includes any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for thirty (30) days from the date of opening of bids (60 days for School Districts and Department of Education), and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid.

The Owner shall have the right to reject any or all bids and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

Should I/We be awarded this contract, I/We pledge to achieve substantial completion of all the work within _____calendar days of the Notice to Proceed.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

(State of Corporation)

Business Address: _____

Witness: _____ By: _____
(SEAL) (Authorized Signature)

(Title)
Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Affidavit of Employee Drug Testing Program
Bid Security
(Others as Required by Project Manuals)

QUARANTINE SUPPORT BUILDING

BRANDYWINE ZOO

1101 N. PARK DRIVE, WILMINGTON, DELAWARE 19802

DIVISION OF PARKS AND RECREATIONS CONTRACT No. 2020-WBZ-100

BID FORM**SUBCONTRACTOR LIST**

In accordance with Title 29, Chapter 69, Section 6962(d)(10)b of the Delaware Code, the following subcontractor listing must accompany any bid submittal. The bidder must list **in each category** the full name and address (City & State) of the sub-contractor that the bidder will be using to perform the work and provide material for that subcontractor category. Should the bidder's listed subcontractor intend to provide any of their subcontractor category of work through a third-tier contractor, the bidder shall list that third-tier contractor's full name and address (City & State). **If the bidder intends to perform any category of work itself, it must list its full name and address.** For clarification, if the bidder intends to perform the work themselves, the bidder **may not** insert "not applicable", "N/A", "self" or anything other than its own full name and address (City & State). To do so shall cause the bid to be rejected. In addition, the failure to produce a completed subcontractor list with the bid submittal shall cause the bid to be rejected. If you have more than three (3) third-tier contractors to report in any subcontractor category, print out the additional page(s) containing the appropriate category, complete the rest of your list of third-tier contractors for that category, notate the addition in parentheses as (CONTINUATION) next to the subcontractor category and an asterisk (*) next to any additional third-tier contractors, and submit it with your bid.

<u>Subcontractor Category</u>	<u>Subcontractor</u>	<u>Address (City & State)</u>	<u>Subcontractors tax-payer ID # or Delaware Business license #</u>
1. Sitework	_____	_____	_____
A.	_____	_____	_____
B.	_____	_____	_____
C.	_____	_____	_____
2. Paving	_____	_____	_____
A.	_____	_____	_____
B.	_____	_____	_____
C.	_____	_____	_____

3.	Hardscape	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>
4.	Landscape	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>
5.	Masonry	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>
6.	Doors, Frames, & Hardware	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>

7.	Painting	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>
8.	Concrete	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>
9.	Roofing	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>
10.	Mechanical	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>

11.	Plumbing	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>
12.	Electric	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>
13.	Site Utilities	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>
14.	Caging	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>

15.	Fencing	<hr/>	<hr/>	<hr/>
	A.	<hr/>	<hr/>	<hr/>
	B.	<hr/>	<hr/>	<hr/>
	C.	<hr/>	<hr/>	<hr/>

QUARANTINE SUPPORT BUILDING
BRANDYWINE ZOO
1101 N. PARK DRIVE, WILMINGTON, DELAWARE 19802
DIVISION OF PARKS AND RECREATIONS CONTRACT No. 2020-WBZ-100

BID FORM
NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date *(to the Office of Management and Budget, Division of Facilities Management)*.

All the terms and conditions of *(Project or Contract Number)* have been thoroughly examined and are understood.

NAME OF BIDDER: _____

**AUTHORIZED REPRESENTATIVE
(TYPED):** _____

**AUTHORIZED REPRESENTATIVE
(SIGNATURE):** _____

TITLE: _____

ADDRESS OF BIDDER: _____

E-MAIL: _____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

QUARANTINE SUPPORT BUILDING
BRANDYWINE ZOO
1101 N. PARK DRIVE, WILMINGTON, DELAWARE 19802
DIVISION OF PARKS AND RECREATIONS CONTRACT No. 2020-WBZ-100

**AFFIDAVIT
OF
EMPLOYEE DRUG TESTING PROGRAM**

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors implement a program of mandatory drug testing for employees who work on Large Public Works Contracts funded all or in part with public funds.

We hereby certify that we have in place or will implement during the entire term of the contract a Mandatory Drug Testing Program for our employees on the job site, including subcontractors, that complies with this regulation:

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

QUARANTINE SUPPORT BUILDING
BRANDYWINE ZOO
1101 N. PARK DRIVE, WILMINGTON, DELAWARE 19802
DIVISION OF PARKS AND RECREATIONS CONTRACT No. 2020-WBZ-100

**AFFIDAVIT
OF
CONTRACTOR QUALIFICATIONS**

We hereby certify that we will abide by the contractor's qualifications outlined in the construction bid specifications for the duration of the contract term.

In accordance with Title 29, Chapter 69, Section 6962(d)(10)b.3 of the Delaware Code, after a contract has been awarded the successful bidder shall not substitute another subcontractor whose name was submitted on the Subcontractor Form except for the reasons in the statute and not without written consent from the awarding agency. Failure to utilize the subcontractors on the list will subject the successful bidder to penalties as outlined in the General Requirements Section 5.2 of the contract.

Contractor Name: _____

Contractor Address: _____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

EFFECTIVE FOR BIDS ADVERTISED
BEGINNING JUNE 7, 2020

QUARANTINE SUPPORT BUILDING
BRANDYWINE ZOO
1101 N. PARK DRIVE, WILMINGTON, DELAWARE 19802
DIVISION OF PARKS AND RECREATIONS CONTRACT No. 2020-WBZ-100

**AFFIDAVIT OF
CRAFT TRAINING COMPLIANCE**

We, the contractor, hereby certify that we and all applicable subcontractors will abide by the contractor and subcontractor craft training requirements outlined below for the duration of the contract. Craft training is defined as “an apprenticeship program approved by and registered with any State apprenticeship agency or the United States Department of Labor.”¹ A list of crafts for which there are approved and registered training programs is maintained by the Delaware Department of Labor and can be found at <https://det.delawareworks.com/documents/Apprenticeship/Apprenticeship%20Occupations.pdf?20190215>. Information pertaining to subcontractor craft training programs shall be provided by the contractor prior to contract execution.

In accordance with Title 29, Chapter 69, Section 6962(d)(13) of the Delaware Code, contractors and subcontractors must provide craft training for journeyman and apprentice levels if **all** of the following apply:

- A. A project meets the prevailing wage requirement under Title 29, Chapter 69, Section 6960 of the Delaware Code.
- B. The contractor employs 10 or more total employees.
- C. The project is not a federal highway project

Failure to provide required craft training on the project may subject the successful contractor and/or subcontractor(s) to penalties as outlined in Title 29, Chapter 69, Section 6962(d)(13) of the Delaware Code.

Craft(s)

Contractor Name:

Contractor Address:

Contractor/Subcontractor Program

Registration Number

On this line also indicate whether DE, Other State (identify) or US Registration Number

Authorized Representative (typed or printed):

Authorized Representative (signature):

Title:

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

¹ Title 29, Chapter 69, Section 6902(7) of the Delaware Code.

SECTION 26 32 13 - GENERATORS, WEATHER-PROTECTED

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Packaged engine generator set for standby, emergency power application including the following:
 - 1. Liquefied-petroleum (LP) gas engine with electronic generator set controls, governor, and voltage regulator.
 - 2. Located in outdoor, weather-protected, sound-attenuated enclosure.
 - 3. Complete with remote annunciator and generator accessories.

1.2 RELATED SECTIONS

- A. Liquefied-petroleum (LP) gas piping: Section 23 11 26.
- B. Grounding and bonding: Section 26 05 26.
- C. Equipment foundations: Section 26 05 28.
- D. Transfer switches: Section 26 36 00.

1.3 REFERENCES

- A. ANSI/NECA/EGSA 404: Standard for Installing Generator Sets.
- B. CFR Title 40, Protection of Environment.
- C. IEEE 115: Test Procedures for Synchronous Machines.
- D. IEEE 446: Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
- E. NECA/EGSA 404: Standard for Installing Generator Sets.
- F. NEMA MG 1: Motors and Generators.
- G. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- H. NFPA 30: Flammable and Combustible Liquids Code.

- I. NFPA 37: Installation and Use of Stationary Combustion Engines and Gas Turbines.
- J. NFPA 70: National Electrical Code.
- K. NFPA 110: Emergency and Standby Power Systems.
- L. UL 1236: Battery Chargers for Charging Engine Starter Batteries.
- M. UL 2200: Stationary Engine Generator Assemblies.

1.4 DEFINITIONS

- A. CFR: Code of Federal Regulations.
- B. EPA: Environmental Protection Agency.
- C. NIST: National Institute of Standards and Technology
- D. NSPS: New Source Performance Standards.

1.5 SUBMITTALS

- A. Product data: For each type of packaged generator set indicated. Include rated capacities, operating characteristics, manufacturers' technical data on features and functions, finishes, and furnished accessories. Include product data for each of the following:
 - 1. Engine generator set.
 - a. Thermal damage curve for generator.
 - b. Time-current characteristic curves for generator protective device.
 - c. Documentation proving that generator(s) provided have sufficient starting kVA to start the loads under any load sequence.
 - 2. Generator accessories including batteries and battery charger, silencer, and jacket heater.
 - 3. Remote alarm annunciator panel.
 - 4. Enclosure components and accessories.
- B. Bill of materials: Provide detailed list of components.
- C. Shop drawings: For each type of generator set and related equipment, detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Design calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for designing vibration isolation bases.
3. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring diagrams: Power, signal, and control wiring.
5. Piping schematics for fuel system, lubricating oil, jacket coolant, and cooling water.

D. Source quality-control test reports.

1. Certified summary of performance tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
2. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
3. Report of sound generation.
4. Report of exhaust emissions showing compliance with applicable regulations.

- a. Factory certification of compliance with EPA emissions regulations.

E. Field quality-control test reports.

F. Operation and maintenance data: For packaged engine generator sets, accessories, and remote annunciator panel to include in operation and maintenance manuals. In addition to items specified in Division 01, include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
2. Detailed operating instructions for event conditions.
3. Fuel adjustment procedures and maximum tolerances of wear on bearings and other rubbing surfaces that will require corrective measures.

G. Warranty: Certificate of special warranty.

H. Air quality permits: Submit air quality construction and operational permits for Owner record.

1.6 QUALITY ASSURANCE

- A. Generator accessories, appurtenances, and installation of the same, shall comply with referenced codes and standards listed in Part 1 and applicable federal, state, and local codes and regulations.
- B. Emissions: Equipment shall be certified to U.S. EPA Stationary Emission Regulation, 40 CFR, Part 60.

- C. Permits: Serve as the Owner's representative during the application process. Collect generator information, prepare and submit required applications for air quality construction and operational permits required by the State of Delaware Department of the Environment in compliance of state environmental regulations. Include payment for applicable permit costs. Approved permits and registration shall be issued to the Owner.
- D. Equipment shall bear UL label, and shall be locally tested by an electrical testing specialist, acceptable to local authority having jurisdiction where required.
- E. Source limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- F. Installer qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this project.
 - 1. Installer has training in electrical safety as required by NFPA 70E and is qualified as defined in NEMA PB 2.
- G. Testing agency qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.
 - 1. Testing agency's field supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- H. Service and maintenance agency qualifications: Manufacturer's authorized service and maintenance representative characteristics shall include the following:
 - 1. Located in the Wilmington, DE metropolitan area.
 - 2. Staff is factory employed and trained.
 - 3. Service available 24 hours a day, seven days a week, 365 days a year.
 - 4. Maintains an adequate stock of manufacturer's genuine or approved parts to service this equipment.
 - 5. Service and maintenance contracts available.

1.7 COORDINATION

- A. Obtain interconnection diagrams, interface hardware, accessory components, and installation manual for generator, and other components of the system. Coordinate installation to provide a complete, integrated, operating generator system.

1. Coordinate installation and interface connections with other emergency power supply system equipment.
- B. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- C. Coordinate terminations of generator exhaust and fuel piping outside of generator enclosure.

1.8 PROJECT CONDITIONS

- A. Environmental conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 1. Ambient temperature: Minus 15 to plus 40 deg C.
 2. Relative humidity: 0 to 95 percent.
 3. Altitude: Sea level to minimum 1000 feet (300 m).

1.9 WARRANTY

- A. Special warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period:
 1. Warranty period: Five years from date of substantial completion.
 2. Warranty shall include all parts and labor with no deductible.

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fuses: One for every ten of each type and rating, but no less than one of each.
 2. Indicator lamps: One for every five of each type used, but no fewer than two of each.
 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
- B. Provide fuel required for testing, re-testing, and demonstrations.

1.11 MAINTENANCE SERVICE

- A. Initial maintenance service: Beginning at Substantial Completion, provide 12 months, full maintenance by skilled employees of manufacturer's designated service organization.

Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-design product: Subject to compliance with requirements, provide products manufactured by Kohler Power Systems, or comparable product by one of the following:
1. Caterpillar; Power Generation
 2. Cummins Power Generation/Onan
 3. MTU
 4. Generac
 5. Kohler Power Systems Co.; Generator Division

2.2 GENERATOR SET

- A. Generator set characteristics: The generator set system shall comprise of a package of equipment including:
1. A liquefied-petroleum (LP) gas engine and alternator assembly to provide emergency electric power.
 2. Generator-mounted start-stop control system.
 3. Mounted accessories as specified.
 4. Factory-assembled and -tested, engine-generator set.
- B. Generator set ratings:
1. Duty rating shall be based on emergency/standby service.
 2. Operate at 1800 rpm and 208/120 volts AC, 3-phase, 4-wire, 60 hertz.
 3. The generator set shall be rated at values indicated on the drawings at 0.8 pf based on the project conditions listed in Part 1.
- C. Performance characteristics:
1. The engine-generator set shall be able to handle the starting step load effects of the connected equipment, where each transfer switch represents a step. Details on load size and quantity are shown on drawings.
 2. Generator set characteristics shall not exceed the following:
 - a. Starting voltage dip: 30 percent.
 - b. Peak voltage dip: 15 percent.

- c. Frequency dip: 10 percent.
 - d. Voltage regulation (no load to full load): Plus or minus 1 percent of rated output voltage.
 - e. Voltage regulation (random): Plus or minus 0.5 percent of rated output voltage.
 - f. Transient Voltage: 20 percent variation for 50 percent step load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
 - g. Frequency regulation (steady-state): Isochronous.
 - h. Frequency regulation (random): Plus or minus 0.25 percent of rated frequency from no load to full load.
 - i. Transient frequency: Less than 5 percent variation for 50 percent step load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
3. AC output waveform: Distortion at no load measured line-to-line or line-to-neutral.
- a. Total harmonic distortion (THD): Less than 5 percent
 - b. Single harmonic: Less than 3 percent.
 - c. Telephone influence factor (TIF): Less than 50, as determined by NEMA MG 1.
 - d. Telephone harmonic factor (THF): Less than 3, as determined by IEC 60034.
4. Steady-state frequency stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Sustained short-circuit current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
6. Start time: Comply with NFPA 110, Type 10, Level 1, system requirements.
7. Excitation system: Performance shall be unaffected by voltage distortion caused by nonlinear load.

D. Engine:

- 1. Liquefied-petroleum (LP) gas engine: Four-cycle, with liquefied-petroleum (LP) gas backup (vapor-withdrawal) system, and with fan and water pump. It shall have the number cylinders and minimum displacement to achieve required brake horsepower rating at 1800 rpm.
 - a. Carburetor.
 - b. Fuel-shutoff solenoid valves: One for each fuel source.
 - c. Flexible fuel connectors: One for each fuel source.
 - d. Liquefied-petroleum (LP) gas source pressure shall be 7 to 11 inches H₂O for proper operation.

- E. Generator: Three-phase, single bearing, synchronous type built to NEMA MG 1 standards.
1. Alternator: Brushless, 4-pole, 2/3 pitch windings, 150 degrees C standard temperature rise. Class H insulation shall be used on the stator and rotor, and both shall be further protected with 100 percent epoxy impregnation and an overcoat of resilient insulating material on end coils to protect against fungus or abrasion. The alternator shall incorporate a resettable thermal protector for exciter/regulator protection. The alternator shall be twelve lead, wye connected.
 2. Regulator: Permanent magnet excitation for power source to voltage regulators, solid-state controlled, exciter/regulator, matching the characteristics of the alternator and engine. Voltage regulation with adjustable electronic isochronous governor. Readily accessible voltage droop, voltage level, and voltage gain controls shall be provided. The solid state regulator module shall be shock mounted and epoxy encapsulated for protection against vibration and atmospheric deterioration.
 3. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.
- F. Mounting:
1. Structural steel sub-base and provided with suitable vibration isolators. Unit shall be capable of installation on concrete equipment foundation.
 - a. Factory-mount engine-generator set and its auxiliary components and accessories, except the day tank and exhaust silencer, on a common base fabricated of structural steel sections. The structural base shall be of the heavy-duty skid type and shall have adequate strength and rigidity to maintain alignment of the equipment without a concrete foundation. Field-erect exhaust silencer as required. Piping to make a complete installation shall be provided as specified in Division 23. Steel used in fabrication of the mounting base shall be free from sharp bends and corners. Provide base and components with suitable lifting attachments. Locate attachments so that when the slings and lifting cables are attached, they will not harm exterior parts of the equipment.
- G. Cooling system: Closed loop, liquid-cooled system with engine mounted radiator and blower type fan, sized to maintain safe operation at 104 degrees F (40 degrees C) maximum ambient temperature. The radiator shall be equipped for a duct adapter flange connected to exterior cabinet with flexible connection.
1. Centrifugal jacket water pump: Built on the engine and driven from the engine crankshaft or camshaft, ample capacity to circulate the required flow of engine jacket water through the radiator to remove the total heat rejected from the engine to the jacket water and lubricating oil at 110 percent rated load in 104 degrees F (40 degrees

- C) ambient while maintaining the optimum jacket water temperature leaving and entering the engine recommended by the engine manufacturer.
- 2. Thermostatic control valve: Shall maintain constant water temperature to the engine. Provide modulating type thermostatic valves using self-contained thermostats without external bulbs. Provide valves with one or more interchangeable thermostatic elements. Provide nonadjustable type thermostat with operating temperature factory set at the temperature recommended by the engine manufacturer. Design valve so that in event of thermostatic element failure it will fail safe, permitting water flow through the engine.

H. Fuel system: Liquefied-petroleum gas (LP).

- 1. Fuel system shall consist of the following tanks and fuel supplies:
 - a. Liquefied-petroleum (LP) gas fuel supply specified in Section 23 11 26.

I. Exhaust system:

- 1. Provide a silencer, including flexible exhaust fitting, properly sized and installed according to the manufacturer's recommendation. Mounting shall be provided by the installing contractor. The silencer shall be mounted so that its weight is not supported by the engine.
 - a. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - (1) Minimum sound attenuation of 25 dB at 500 Hz.
 - (2) Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 85 dBA or less.
- 2. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the generator set manufacturer.

J. Automatic starting system:

- 1. Starting motor: DC electric starting system with positive engagement drive. The motor voltage shall be as recommended by the engine manufacturer.
- 2. Automatic controls: Fully automatic generator set start-stop controls in the generator control panel. Controls shall provide shutdown for low oil pressure, high water temperature, overspeed, and overcrank; and one auxiliary contact for activating accessory items. Controls shall include a multi-cycle, cranking limit with lockout contacts for starting by switch on remote panel.

K. System accessories:

1. Jacket water heater: Unit mounted thermal circulation type water heater incorporating a thermostatic switch, capable of maintaining engine jacket water to 90 degrees F in ambient temperature of minus 10 degrees F. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
2. Starting and station batteries: Lead-acid or nickel-cadmium storage battery set of the heavy-duty starting type. 24Vdc battery voltage shall be compatible with the starting system. The battery set shall be of sufficient capacity to provide for 1 1/2 minutes total cranking time without recharging. Include a battery rack and necessary cables and clamps.
3. Battery charger: UL 1236 listed. Engine starting, current limiting battery charger to automatically recharge batteries. The charger shall have adjustable float and equalize voltage. DC amperage output shall be no less than 10 amperes. Output voltage shall be compatible with starting system. AC input voltage shall be 120V. Charger shall include fused overload protection; circuit breaker overcurrent protection; solid-state, silicon diode full wave rectifiers; voltage surge suppressors; DC voltmeter and AC ammeter; temperature voltage regulator; relays indicating AC power failure, low-, and high-battery voltage.

L. Generator control panel:

1. Type: Generator mounted NEMA 250 Type 1, vibration isolated, dead front, made of sheet metal gauge steel, with lockable hinged door.
2. Panel shall contain, but not be limited to, the following equipment:
 - a. Voltmeter, 2 percent accuracy.
 - b. Ammeter, 2 percent accuracy.
 - c. Ammeter voltmeter, phase selector switch.
 - d. Frequency meter, dial type. (45 - 65 Hz)
 - e. Automatic starting controls.
 - f. Voltage level adjustment rheostat.
 - g. Dry contacts for remote alarms wired to terminal strips.
 - h. Fault indicators for low oil pressure, high water temperature, overspeed, and overcrank.
 - i. Three position selector switch with the following functions: auto, manual, off/reset.
 - j. Emergency stop switch.
 - k. Panel light.
 - l. Running time meter
 - m. Oil pressure and water temperature gauges

3. Remote outputs for monitoring.

M. Generator output circuit breaker:

1. Type: Molded-case electronic trip type, 100 percent rated size as indicated on drawings. Circuit breaker shall conform to standards established by UL 489, and NFPA 70. Circuit breaker shall have long-time and short-time pick-up and delay, and instantaneous adjustable trip settings.
2. The circuit breaker trip curve shall be coordinated with alternator thermal damage curve as required by generator manufacturer data.
 - a. Generator/exciter field circuit breakers do not meet the specified electrical standards and are unacceptable for line protection.
3. Shunt trip device: The shunt trip shall open the generator circuit breaker in the event of an engine shutdown signal, and shall operate from the cranking battery voltage.
4. Circuit breakers shall be lockable in the open position.

2.3 GENERATOR ENCLOSURE

- A. Manufacturer's standard enclosure: Prefabricated weather-resistant, sound attenuated enclosure sized to house the generator, ~~sub-base fuel tank~~, battery charger, batteries, and required accessories. Enclosure shall be factory-assembled by the generator manufacturer.
- B. Sheet metal steel enclosure primed with corrosion protection and painted with electrostatically-applied powder coat finish of manufacturer's standard color. Enclosure shall include roof, side walls, and end walls. Hardware shall be stainless steel.
 1. Lifting provisions: Capacity to support total assembly weight during rigging.
 2. Access doors: Provide sufficient access for maintenance and operation from outside the enclosure.
 - a. Handles key lockable, all doors keyed alike.
 3. Air intake and sound attenuation louver openings shall be screened to limit entry of rodents.
 4. Roof shall be designed to prevent collection of rainwater.
 5. Provide factory-mounted exhaust silencer inside the enclosure. Exhaust shall exit the enclosure through a rain collar and terminate at a rain cap. Exhaust connections to the generator set shall be made with seamless flexible connections.
- C. Sound attenuation: Enclosure shall be constructed to mitigate noise level to 85 dBA maximum at 23 feet (7 m) from enclosure at rated generator output.
- D. Accessories:
 1. Enclosure manufacturer shall provide the hardware required to mount the exhaust silencers while maintaining the enclosure's weather resistance.

2.4 EXTERNAL VIBRATION ISOLATION DEVICES

- A. Elastomeric isolator pads: Oil- and water-resistant elastomer, arranged in single or multiple layers, molded with a non-slip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - 1. Material: Double layer, standard neoprene.
- B. Restrained spring isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4 inch (6 mm) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Outside spring diameter: Not less than 80 percent of compressed height of the spring at rated load.
 - 3. Minimum additional travel: 50 percent of required deflection at rated load.
 - 4. Lateral stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- C. Location: Isolators shall be provided between rails of generator set and supporting pad or structure.

2.5 REMOTE ALARM ANNUNCIATOR PANEL

- A. Surface-mounted panel, complying with the requirements of NFPA 110, Level 1 equipment, providing visible and audible alarm signals powered by the storage battery of the generator. Unit enclosure: Fabricated of sheet steel, with removable front panel. The front panel shall contain LED type indicating lamps (visible signals) as listed below. The enclosure shall contain the required printed circuits, internal wiring, terminal block and battery voltage sensors. Provide knockouts for external wiring through bottom of box.
- B. Provide on face of panel the following switches:
 - 1. Lamp test pushbutton.
 - 2. Audible alarm: Silence switch.

(See table, next page)

LAMP LEGEND	GENERATING SET CONDITION INDICATED	DERANGEMENT SIGNALS	
		Audible	Visible
EXERCISING	Generator exercising	No	Yes
GENERATING	Generating Power to Load	Yes	Yes
OVERCRANK	Failed to Start	Yes	Yes
LOW ENG TEMP	Low Lube Oil Pressure	Yes	Yes
HI ENG TEMP PRE	Excessive Engine Temperature Pre-Alarm	Yes	Yes
HI ENG TEMP	Excessive Engine Temperature	Yes	Yes
LOW OIL PRESS PRE	Low Lube Oil Pressure Pre-Alarm	Yes	Yes
LOW OIL PRESS	Low Lube Oil Pressure	Yes	Yes
OVERSPEED	Engine Overspeed	Yes	Yes
LOW FUEL	Low Fuel Supply	Yes	Yes
LOW COOLANT	Low Engine Coolant Level	Yes	Yes
AUTO SWITCH	Control Switch Not in Automatic Position	Yes	Yes
LOW CRANK VOLT	Low Engine Cranking Voltage	Yes	Yes
LOW BATT VOLT	Low Battery Voltage	Yes	Yes
HI BATT VOLT	High Battery Voltage	Yes	Yes
ALARM CONTACT	Contacts for Common Alarm	Yes	Yes

2.6 MONITORING SYSTEM

A. Monitoring system: Provide contacts from each generator for monitoring by the power monitoring system for the following functions:

1. Generator off.
2. Generator running.
3. Generator exercising.
4. Generator alarms: Overcrank, low oil pressure, high or low engine temperature, overspeed, batteries.

- B. Provide control interface at the generator for monitoring the generator status through the building fire alarm system and building automation system.

2.7 SYSTEM OPERATION

A. Loss of normal power:

1. System is given signal to start by one of the automatic transfer switches or a remote device. Loss of power can occur at any automatic transfer switch, which can cause the generator to start. On receipt of this signal, generator shall automatically start, accelerate to rated frequency and build up to rated voltage.
2. Priority shall be set to actuate the automatic transfer switch designated in the following order:
 - a. ATS-1: Life safety.
 - b. ATS-2: General building stand-by.
 - c. ATS-3: Mechanical stand-by.
3. After the first transfer switch closes to the bus, subsequent transfer switches shall close to the bus after pre-determined time delays.

B. Failure of generator to start:

1. If a unit fails to start, after the overcrank time delay (in the generator set control) has expired, the unit will be shut down, and an alarm will sound.

C. Return of normal power:

1. When normal power has been restored to the normal power system bus and sensed at each transfer switch, the loads shall be transferred back to normal source.
2. The generator shall operate until all transfer switches have returned to normal power switch position and operate at no load for a cool-down period. When the cool-down period has been completed, the generator shall shut down.
3. If a system start signal is received during the cool-down period, generator shall remain online and operate as described in "Loss of Normal Power" above.

D. Load bank testing: Provide an auxiliary distribution output circuit breaker as indicated on drawings for portable load bank testing of the generator. The circuit breaker shall be locked in the normally open position until a portable load bank is connected to the system.

1. Load bank test under normal power:

- a. A keyed pushbutton device located adjacent the generator output breakers shall send a control signal to first open the main line circuit breaker and then close the auxiliary circuit breaker.
2. Loss of normal power:
 - a. In the event the normal power source is lost, a signal shall be sent to the shunt trip operator to first open the auxiliary circuit breaker, immediately disconnecting the load bank, and then close the main line circuit breaker.
 - b. The auxiliary circuit breaker will require manual resetting after the outage and restoration of normal operation.

2.8 SOURCE QUALITY CONTROL

- A. Prototype testing: Perform factory performance tests using prototype generator of same engine model and alternative configuration, and assembled with like components and accessories. Provide three certified copies of the successful test reports.
 1. Tests: Comply with NFPA 110, Level 1, energy converters in Paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2.
 2. Alternator tests: Comply with IEEE 115.
 3. Equivalent components and accessories: Submit evidence that items furnished with the unit, but that are not identical to those on the prototype, are reliable and compatible with the application.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine rough-in requirements for connecting piping and wiring for the generator and verify conditions. Verify actual sizes and locations of connections are correct before packaged engine-generator installation.

3.2 PREPARATION

- A. Battery equalization: Equalize charging of battery cells according to manufacturer's written instructions.

3.3 INSTALLATION - GENERATORS

- A. Install generators, complete with controls, accessories, enclosures, as indicated on the drawings and in accordance with manufacturer's recommendations.
- B. Comply with generator manufacturer's written installation and alignment instructions and with NFPA 37 and 110.

- C. Install the remote alarm annunciator panel where directed by the Owner unless otherwise indicated on drawings.
- D. Set generators plumb and level on concrete base with vibration isolators. Secure to anchor bolts installed in the concrete base.
- E. Install generators so as to provide access for maintenance and service, including removal of drivers and accessories.
- F. Install piping, wiring, accessories, and appurtenances in accordance with the applicable specifications and manufacturers' recommendations. Ground equipment.
- G. Comply with applicable portions of NECA 404.
- H. Generator and enclosure accessories shall be connected to the building electrical distribution system via branch circuits and feeders as indicated on drawings.
- I. Verify proper fuel pressure for liquefied-petroleum (LP) gas engines.

3.4 IDENTIFICATION

- A. Materials: Refer to Section 26 05 53 for requirements on identification of electrical systems. Identify units, devices, fuse blocks, relays, controls, and wiring. Identify equipment ratings.
- B. Nameplates: Refer to Section 26 05 53 for requirements on identification of electrical systems. Provide nameplate for each unit and associated components located on front of assembly.
- C. Control components mounted within the assembly shall be identified with tags and other identification materials, and correspond to designations on manufacturer's drawings.
- D. Operating instructions: Provide fabricated frame on side of unit to house operating instruction manuals.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's field service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections; and to assist the Contractor in testing.
- B. Tests and inspections:

1. Perform tests recommended by manufacturer. Perform electrical tests and visual and mechanical inspection for “AC Generators and or Emergency Systems” specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. NFPA 110 acceptance tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 3. Battery tests: Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer’s specifications.
 4. Battery-charger tests: Verify specified rates of charge for both equalizing and float charging conditions.
 5. System integrity tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks. Retain subparagraph below for long, restricted exhaust systems.
 6. Voltage and frequency transient stability tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 7. Harmonic-content tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 8. Noise level tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
 9. Exhaust emissions test: Comply with applicable government test criteria.
- C. Coordinate generator testing with tests for transfer switches and run them concurrently.
- D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- E. Leak test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- F. Operational test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units; retest and reinspect as specified above.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- J. The unit shall operate without undue noise or vibration, or excessive heating. Correct defects and retest until unit is operating satisfactorily.
- K. Demonstrate satisfactory operation of each feature required of the generator set and accessories.
- L. Test emergency power system: After completion and acceptance of the generator tests, perform an operational test of the emergency power system. Perform a power failure test on the emergency electrical system. This shall be performed by interrupting the normal power source and verifying proper generator start and transfer switch operation.
- M. Report results of tests and inspections in writing. Record adjustable device settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 ACCEPTANCE TESTING

- A. In addition to the factory and field tests required in Part 2, perform a scheduled on-site test and demonstration of the completely installed generator before making final electrical connections.
- B. Test shall be witnessed by the Architect, Owner's representative, and manufacturer's representative. Manufacturer's representative shall conduct demonstrations.
- C. Provide and utilize load bank for testing. Load banks shall be capable of providing full load at 0.8 power factor.
- D. Test procedures: Test the generator in accordance with NFPA 110 and as follows:
 - 1. Test the generator for at least two hours under full load, starting and stopping at least five times.
 - a. The unit shall operate without undue noise or vibration, or excessive heating. Correct defects and retest until unit is operating satisfactorily.
 - b. Demonstrate satisfactory operation of each feature required of the generator set and accessories.

3.7 CLEANING

- A. Upon completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Clean components internally using methods and materials recommended by the manufacturer.

3.8 OPERATING INSTRUCTIONS

- A. As specified in Section 26 05 00, provide operating instructions.
- B. Provide at least two sessions of four consecutive hours of additional instruction time for each system specified in this section.

END OF SECTION

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SECTION 26 36 00 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Automatic transfer switches rated 600 V and less, including:
 - 1. Automatic transfer switch with open transition operation and microprocessor-based controls.

1.2 RELATED SECTIONS

- A. Equipment Foundations: Section 26 05 28.
- B. Identification of Electrical Systems: Section 26 05 53.
- C. Overcurrent Protective Device Coordination Study: Section 26 05 73.
- D. Generators: Section 26 32 13.

1.3 REFERENCES

- A. NFPA 110: Emergency and Standby Power Systems.
- B. UL 1008: Transfer Switch Equipment.

1.4 SUBMITTALS

- A. Product data: Include assembly ratings and dimensioned plans, sections, and elevations showing minimum clearances, cable termination sizes, conductor entry, gutter space, installed features and devices, and material lists for each switch.
- B. Bill of Materials: Provide detailed list of components.
- C. Shop drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each transfer switch specified. Wiring diagrams showing detail wiring for transfer switch, differentiating between manufacturer-installed and field-installed wiring, and including power and control wiring.
 - 1. Single-Line Diagram: Show connections between transfer switch.
- D. Source quality-control test reports.

E. Field quality-control test reports.

F. Certifications:

1. Product certificate signed by manufacturer certifying that products furnished comply with requirements and that switches have been tested for applicable load ratings and short-circuit closing and withstand ratings.
2. Manufacturer's test reports showing that controllers meet the specified requirements.
3. Evidence that manufacturer, installer, and equipment meet the requirements specified in "Quality Assurance" below.

G. Operation and Maintenance Data: For transfer switches and associated components, provide product data, shop drawings, and test reports in operation and maintenance manual. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual

1.5 QUALITY ASSURANCE

A. Transfer switches shall comply with UL 1008. Where specified requirements exceed requirements of UL 1008, switch shall meet the stricter requirements.

B. Automatic transfer switch and bypass/isolation switch shall be manufactured by the same manufacturer. Design shall have been in production for not less than 10 years, with at least 100 installations operating successfully.

1. Manufacturer shall maintain records of each switch, by serial number, for no less than 20 years.

C. Qualifications of manufacturer: Maintain a factory-authorized service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

D. Qualifications of supplier/installer:

1. Staff factory-trained and -authorized in the installation, testing, and operation of the specified equipment.
2. Provides emergency service on call 24 hours a day, seven days a week.
3. Maintains an adequate stock of manufacturer's genuine or approved parts to service this equipment.
4. Has service contracts available which can meet requirements specified for the equipment of this project.

1.6 COORDINATION

- A. Coordinate layout and installation of switches and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.
- B. Coordinate size and location of concrete bases.
- C. Coordinate location of underslab conduit.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store switches indoors in clean dry space with uniform temperature to prevent condensation. Protect switches from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.8 WARRANTY

- A. Special warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of transfer switch and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty period: Five years from date of substantial completion.
 - 2. Warranty shall include all parts and labor.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Basis-of-design product: Subject to compliance with requirements, provide products manufactured by Kohler Power Systems, or comparable product by one of the following:
 - 1. General Electric / Zenith Controls, Inc.
 - 2. Onan/Cummins Power Generation
 - 3. Russelectric, Inc.

2.2 GENERAL TRANSFER SWITCH REQUIREMENTS

- A. Equipment shall be based on the following: 208/120 volts, 3-phase, 4-pole; Level 1 equipment according to NFPA 110; rated in accordance with UL 1008 for continuous loading and total system transfer; suitable for motor, resistance heating, electric-discharge lighting, and tungsten filament lamp loads. Unit ratings involving ampacity, number of poles, and withstand close rating are indicated on drawings.

- B. Tested Fault-Current Closing and Withstand Ratings (3 cycles): Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Provide transfer switches with withstand ratings based on available fault current determined by Short-Circuit Analysis performed under Section 26 05 73 or as indicated on one-line diagram, whichever is larger.
- C. Neutral Switching. Provide neutral pole switched simultaneously with phase poles on four-pole transfer switches.
- D. Oversize Neutral: Ampacity and switch rating of neutral path through units shall be double the nominal rating of the switch.
- E. Enclosure: NEMA 250, Type 1; NEMA ICS 6; and UL 508.
- F. Terminal block: Termination of all auxiliary contacts, switches, pilot lights, and appurtenances mounted in transfer switch enclosure.
- G. Clearly label and identify each indicating light and switch as to its purpose or function.

2.3 AUTOMATIC TRANSFER SWITCH

- A. Ratings: Unit ratings involving ampacity, number of poles, and withstand close rating are indicated on drawings.
- B. Switching arrangement:
 - 1. Delayed, Open Transition Transfer Operation: Double-throw design, with break-before-make capability. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs.
 - a. External manual operator switch.
 - 2. Switch Characteristics:
 - a. Designed for continuous-duty, repetitive transfer of full-rated current between active power sources.
 - b. The contact driving system shall be mechanically held and electrically operated by a single motor operator.
 - c. Contacts: Silver alloy, capable of making or breaking any load within the rating of the switch.

- (1) Contacts that close to start the engine generator: Include a time delay of transfer switch and engine starting signals, factory set at 5.0 seconds (adjustable from 0-5 minutes).
 - d. Interlocked, molded case circuit breakers or contactors are not acceptable.
- C. Controls: Microprocessor-based controller integrally mounted in the transfer switch with all components and wiring accessible from the front.
 1. Tested and rated as follows:
 - a. For storage at temperatures from minus 25 to plus 85 degrees C.
 - b. For operation:
 - (1) At minus 20 to plus 70 degrees C.
 - (2) At 0 to 99 percent humidity, non-condensing.
 - (3) Withstands infinite power interruptions.
 - (4) Withstands surges when tested in accordance with ANSI/IEEE C37.90.1.
 2. Include a real-time clock with nickel-cadmium battery backup.
 3. Monitoring: On both normal and emergency sources, include three-phase over or under voltage, over or under frequency, and phase sequence detection, and phase differential monitoring.
 4. Communications: Industry standard open-architecture communication protocol for high-speed serial communications via multidrop connection to other controllers and to a master terminal with up to 4000 feet of cable, or farther with the addition of a communication repeater.
 - a. Serial communication port: RS422/485 compatible
 5. Self-diagnostics: Shall perform periodic checks of the memory I/O and communications circuits, with a power failure circuit.
 6. Password protection shall limit access to designated personnel.
 7. Operation: Keypad with multi-character liquid crystal display.
 8. Memory / Flash-backup: Accessible both locally and from remote controller, including:
 - a. Number of hours transfer switch has been in the emergency position (total since reset).
 - b. Number of transfers in either direction (total since reset).
 - c. Date, time, and description of the last 4 source failures.
 - d. Date of the last exercise period.
 - e. Date the record was reset.

- D. Provide close differential voltage sensing of all phases of both the normal and alternate sources of power. Factory settings preset for:
1. Dropout at 87 percent of nominal voltage (adjustable 75-98 percent)
 2. Pickup at 95 percent of nominal voltage (adjustable 85-100 percent).
- E. The transfer of the load shall occur only if the alternate source has attained factory setting of 95 percent of nominal voltage (adjustable 85-100 percent) and 95 percent of nominal frequency (adjustable 90-100 percent) and the transfer to alternate time delay has expired. The time delay shall be factory set for 5 seconds and adjusted in the field to comply with system priority requirements outlined in Part 2 below. (Field adjustable range of 0 to 2 minutes.)
1. Upon return of the normal source to within the limits of the voltage sensor, the switch shall retransfer to the normal source after a retransfer to normal time delay. The time delay shall be factory preset for 15 minutes. (Field-adjustable range of 0.5 to 30 minutes.) Retransfer shall be a closed-transition operation. A synch-check function shall confirm synchronization prior to retransfer.
- F. Time delay for engine generator cooldown: Unloaded, running, factory-set at 5 minutes (adjustable 0-5 minutes).
- G. Indicating lights: LED type. Green, indicating that the normal source is connected to the load, and red, indicating that the alternate source is connected to the load.
- H. Test switch: Simulates a normal source outage.
- I. Reset switch: To manually retransfer the automatic transfer switch to the normal source, except that retransfer shall occur automatically if alternate source fails.
- J. In-phase monitor control for transfer and retransfer of motor loads.
- K. Automatic exerciser with load for 0.5 hour monthly. The automatic exerciser function shall be enabled in one transfer switch selected by the Owner.
- L. Relay protection:
1. Full-phase voltage on normal side.
 2. Three-phase voltage frequency on generator side.
- M. Auxiliary contacts: Provide number of sets of auxiliary contacts necessary to initiate generator starting and interface with Owner monitoring system.
- N. The transfer switch shall have the following programming functions available:

1. Block transfer to emergency source.

- ~~2. Load shedding.~~

- ~~3. Peak shaving.~~

O. The transfer switch shall control the load functions.

2.4 MONITORING SYSTEM

A. Provide contacts from each automatic transfer switch for monitoring by the power monitoring system for each of the following functions.

1. Switch in normal position.

2. Switch in emergency position.

- ~~3. Switch in maintenance bypass position.~~

4. Normal power available.

5. Emergency power available.

2.5 TRANSFER SWITCH OPERATION AND EMERGENCY SYSTEM PRIORITY

A. Priority Status: Transfer switch priority shall apply as follows:

1. ATS-1: Life safety.

2. ATS-2: General building standby.

3. ATS-3: Mechanical standby.

B. Transfer to Generator Source: Switches shall transfer to emergency power source in order of priority status listed above. In the event that the emergency source cannot generate enough capacity to carry the total emergency system load, switches shall transfer in decreasing order of priority until system capacity is reached. Switches can later be transferred to the emergency source if additional capacity is available. Field adjust the time delay settings to achieve system transfer of loads as follows:

1. ATS-1: Use factory setting or 5 seconds, whichever is less. Total system transfer time shall not exceed 10 seconds per NFPA 110.

2. ATS-2: General building standby: Time delay: 20 seconds.

3. ATS-3: Mechanical standby: Time delay: 45 seconds.

C. Generator Failure: In the event generator system power is not sufficient to carry the loads of each emergency branch, transfer switches shall open and shed load in reverse priority order.

D. Transfer Back to Normal Source: Switches shall transfer back to normal source in reverse priority order as follows:

1. Delayed, Open Transition Operation – When the normal source has been restored and is within the pre-selected ranges for voltage and frequency, and after an adjustable time delay to ensure the integrity of the normal power source, the load shall be transferred back to normal source in a break-before-make transfer scheme. The generator set will continue to run for a user adjustable time to allow the generator set to run unloaded for cool down, after which the engine will be shut down. Upon completion, the system will then be ready for automatic operation.

2.6 SOURCE QUALITY CONTROL

- A. Factory-test components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test in accordance with NEMA ICS 1.
- B. As a condition of approval, the manufacturer of the automatic transfer switches shall verify that their switches are listed by Underwriters Laboratories, Inc., Standard UL-1008 with 3-cycle short circuit closing and withstand as follows:

RMS Symmetrical Amperes 480 VAC

<u>Amperes</u>	<u>Closing and Withstand</u>	<u>Current Limiting Fuse Rating</u>
100-400	42,000	200,000
600-800	65,000	200,000

Where available fault current levels, as determined by Short-Circuit Analysis, exceed closing and withstand ratings listed above, provide integrally mounted current-limiting fuses to meet this rating.

- C. During the 3-cycle closing and withstand tests, there shall be no contact welding or damage. The 3-cycle tests shall be performed without the use of current limiting fuses. The test shall verify that contacts separation has not occurred, and there is contact continuity across all phases. Test procedures shall be in accordance with UL-1008, and testing shall be certified by Underwriters' Laboratories, Inc.
- D. When conducting temperature rise tests to UL-1008, the manufacturer shall include post-endurance temperature rise tests to verify the ability of the combination transfer bypass/isolation switch to carry full rated current after completing the overload and endurance tests.
- E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install transfer switches on concrete equipment foundations (housekeeping pad).
 - 1. Anchor equipment to concrete housekeeping pad according to manufacturer's written instructions, and requirements in other sections of Division 26.
 - 2. Install each unit level and plumb.
- B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- C. Install in accordance with national, state, and local codes, and manufacturer's instructions.
- D. Include items not specifically mentioned but necessary for proper operation.
- E. Connect wiring as indicated on the drawings and in accordance with manufacturer's recommendations.
- F. Identify components.

3.2 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Wiring to Remote Components: Provide type and number of cables and conductors in raceway as recommended by manufacturer between emergency distribution system components for control and communication requirements.

3.3 IDENTIFICATION

- A. Materials: Refer to Division 26 Section "Identification of Electrical Systems." Identify units, devices, fuse blocks, relays, controls, and wiring. Identify equipment ratings.
- B. Nameplates: Refer to Division 26 Section "Identification of Electrical Systems" for additional requirements. Provide nameplate for each switch and major control or display component located on front of assembly.
 - 1. Furnish master nameplate, stamped metal, listing standard manufacturer information including voltage, ampere, frequency, and short-circuit ratings; manufacturer's model and project designations.

- C. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be identified corresponding to designations on manufacturer's drawings using tags and other identification materials.

3.4 FIELD QUALITY CONTROL

- A. Test transfer switches and components by operating them in all modes. Perform tests recommended by manufacturer under supervision of manufacturer's factory-authorized representative. Tests shall include simulation of building power outages to verify coordination of transfer timing sequences with switchgear.
- B. Correct deficiencies and report results in writing. Record adjustable relay settings.
- C. Coordinate tests with tests of generator plant and run them concurrently.

3.5 CLEANING

- A. Inspect and clean surfaces and repair damaged finishes to match original finish.
- B. Clean interior of equipment according to manufacturer's instructions.

3.6 OPERATING INSTRUCTIONS

- A. As specified in Section 26 05 00, provide operating instructions.
- B. Provide a period of 4 hours for equipment instruction to operating personnel.
- C. Coordinate this instructional training with that for generator equipment.

END OF SECTION

SECTION 10 14 00 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Room and door signs.
- B. Emergency evacuation maps.

1.2 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- B. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, including the drawing room number on schedule.
 - 2. When the content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to the start of fabrication; upon request, submit a preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- C. Maintenance Materials: Furnish the following for the Owner's use in the maintenance of the project.
 - 1. Curved Sign Media Suction Cups: One for every 100 signs; for removing media.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with a minimum of three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.6 FIELD CONDITIONS

- A. Do not install tape adhesive when the ambient temperature is lower than recommended by the manufacturer.
- B. Maintain this minimum temperature during and after the installation of signs.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Flat Signs:
 - 1. Best Sign Systems, Inc: www.bestsigns.com.
 - 2. Cosco Industries (ADA signs); ADA Series 1: www.coscoarchitecturalsigns.com.
 - 3. FASTSIGNS: www.fastsigns.com.
 - 4. Mohawk Sign Systems, Inc: www.mohawksign.com.
 - 5. Or approved equal.

2.2 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 - 1. Sign Type: Flat signs with engraved panel media as indicated on drawings.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 - 3. Character Height: 1 inch.
 - 4. Sign Height: 6 inches, unless otherwise indicated.
 - 5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
 - 6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.

7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers indicated on the drawings, and braille.

C. Emergency Evacuation Maps:

1. Map content to be provided by the Owner.
2. Use clear plastic panel silk-screened on the reverse, in brushed aluminum frame, screw-mounted.

2.3 SIGN TYPES

A. Flat Signs: Signage media without frame.

1. Edges: Square.
2. Corners: Square.
3. Wall Mounting of One-Sided Signs: Tape adhesive.

B. Color and Font: Unless otherwise indicated:

1. Character Font: Helvetica, Arial, or other sans serif font.
2. Character Case: Upper case only.
3. Background Color: Clear.
4. Character Color: Contrasting color.

2.4 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:

1. Total Thickness: 1/16 inch.

2.5 NON-TACTILE SIGNAGE MEDIA

A. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:

1. Sign Color: Clear.
2. Total Thickness: 1/8 inch.

2.6 ACCESSORIES

A. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Substantial Completion; repair or replace damaged items.

3.3 SIGNAGE SCHEDULE

ROOM NUMBER	ROOM NAME	SIGN SIZE	MOUNTING HEIGHT
100	Quarantine Support Building	6 3/8" x 6"	Mount center of sign 60-inches AFF on exterior wall adjacent
100A	Keeper Work Area	6 3/8" x 6"	Mount center of sign 60-inches AFF on exterior wall adjacent
101	Keeper	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
101D	Medium Animal Yard	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
102	Exam/Surgery	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
102A	Exam/Surgery	6 3/8" x 6"	Mount center of sign 60-inches AFF on exterior wall adjacent
103	Keeper	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
103D	Large Animal Yard	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
104	Lab	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
104A	Lab	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
104B	Lab	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
105	Keeper	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
106	All-Gender Restroom	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
107	Necropsy	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent

107A	Necropsy	6 3/8" x 6"	Mount center of sign 60-inches AFF on exterior wall adjacent
108	Storage	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
109	All-Gender Showers	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
201	Mechanical	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
201A	Life Safety Closet	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
201B	I.T. Closet	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent
201C	Roof Access	6 3/8" x 6"	Mount center of sign 60-inches AFF on wall adjacent

END OF SECTION 10 14 00