SECTION 261330 - LOAD CENTER UNIT SUBSTATION

See information at end of section

1. GENERAL
	* + 1. REFERENCES

If less-flammable cooling liquids are used add UL (or FM if FM listing is used instead of UL).

* + - * 1. NEMA, ANSI/IEEE, UL.
			1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Waiver of Submittals: The “Waiver of Certain Submittal Requirements” in Section 013300 does not apply to this Section.
				5. Submittals Package: Submit the product data, shop drawings, and quality control submittals (except transformer certified test report required for final approval) specified below all at the same time as a package.

Include subparagraph only when electric utility company approval is specifically required.

Electric Utility Company Approval:

Also submit shop drawings and product data to the electric utility company for approval. Send to:

Insert name and address of utility company, also name of person who is to receive data.

After shop drawings and product data have been approved by the electric utility company, forward two copies with utility company letter indicating approval.

* + - * 1. Shop Drawings; include:

Front and plan view with overall dimensions.

Details showing type of construction and available conduit space.

High voltage section cubicle enumeration.

For the low voltage section:

Use subparagraph below if section 262413 is used.

Voltage rating, and continuous current rating of the through bus and distribution sections.

Voltage rating, continuous current rating, and thermal rating of the horizontal and vertical bus.

Short-circuit current rating.

Enumeration of each circuit breaker including frame size, ATE, number of poles, and interrupting capacity.

A statement indicating if the low voltage section will, or will not, bear a UL label. If a section cannot bear a UL label, state the specific reasons why it is not qualified to bear the UL label.

Wiring and schematic diagrams.

A coordinated selective scheme between the high voltage power fuses, main breaker and feeder breakers so that under fault conditions the feeder device clears the fault while the main device remains closed.

* + - * 1. Product Data:

Catalog sheets, specifications, and installation instructions.

For circuit breakers equipped with ground fault protection, include information sheets describing system testing instructions and a test form.

Proof that enclosure integrity and finish meets latest ANSI C57.12.28, or C57.12.29 (as specified).

Include subparagraph below if less-flammable cooling liquids are used. Change UL to FM if FM listing is used instead of UL.

For Less-Flammable Liquid-Insulated Transformers: Proof of UL or FM listing, including details required for the installation to comply with the listing.

Bill of materials.

Name, address, and telephone number of nearest fully equipped service organization.

* + - * 1. Quality Control Submittals:

Transformer Certified Test Reports:

Preliminary Data: Submit certified report of the Company’s standard tests for the transformer. Test report format shall be NEMA “Transformer Test Report”.

Final Approval: After approval of preliminary data and after construction of transformer, make routine commercial ANSI/IEEE tests at the factory on the actual transformer and submit certified test report. Test report format shall be NEMA “Transformer Test Report”.

Company Field Advisor Data: Include:

Name, business address and telephone number of Company Field Advisor secured for the required services.

Certified statement from the Company listing the qualifications of the Company Field Advisor.

Services and each product for which authorization is given by the Company listed specifically for this project.

* + - * 1. Contract Closeout Submittals:

Test Report: System acceptance test report.

Certificate: Affidavit, signed by the Company Field Advisor and notarized, certifying that the system meets the Contract requirements and is operating properly.

Operation and Maintenance Data: Deliver two copies, covering the installed products to the Director’s Representative. Include name, address and telephone number of nearest fully equipped service organization.

Photographs:

After completion of the work take color photographs of the completed Work of this Section, as follows:

3 of the load center unit substation from different positions.

1 overall view of load center unit substation.

Nameplate(s)

Use a digital camera.  Use wide angle lens for overall view.  Use electronic flash capable of supplying sufficient light to evenly illuminate the overall subject.

Minimum digital requirements:

Format shall be .jpg or .tif

The resolution shall be 12 Megapixels or greater.

Submit photographs to electronic submittal website for approval and record.

* + - 1. QUALITY ASSURANCE
				1. Equipment Qualifications For Products Other Than Those Specified:

At the time of submission provide written notice to the Director of the intent to propose an “or equal” for products other than those specified. Make the “or equal” submission in a timely manner to allow the Director sufficient time to review the proposed product, perform inspections and witness test demonstrations.

If products other than those specified are proposed for use furnish the name, address, and telephone numbers of at least 5 comparable installations that can prove the proposed products have performed satisfactorily for 3 years. Certify in writing that the Director’s Representative of the 5 comparable installations will allow inspection of their installation by the Director's Representative and the Company Field Advisor.

* + 1. Make arrangements with the Director’s Representative of 2 installations (selected by the Director) for inspection of the installations by the Director's Representative. Also obtain the services of the Company Field Advisor for the proposed products to be present. Notify the Director a minimum of 3 weeks prior to the availability of the installations for the inspection, and provide at least one alternative date for each inspection.
		2. Only references from the actual Director’s Representative or Director’s Representative (Security Supervisor, Maintenance Supervisor, etc.) will be accepted. References from dealers, system installers or others, who are not the actual Director’s Representative of the proposed products, are not acceptable.

Verify the accuracy of all references submitted prior to submission and certify in writing that the accuracy of the information has been confirmed.

The product manufacturer shall have test facilities available that can demonstrate that the proposed products meet the contract requirements.

Make arrangements with the test facility for the Director's Representative to witness test demonstrations. Also obtain the services of the Company Field Advisor for the proposed product to be present at the test facility. Notify the Director a minimum of 3 weeks prior to the availability of the test facility, and provide at least one alternative date for the testing.

Provide written certification from the manufacturer that the proposed products are compatible for use with all other equipment proposed for use for this system and meet all contract requirements.

* + - * 1. Company Field Advisor: Secure the services of a Company Field Advisor for a minimum of 8 working hours for the following:

Render advice regarding the load center unit substation installation, and final adjustment and testing of the load center unit substation devices.

Witness final system test and then certify with an affidavit that the load center unit substation is installed in accordance with the contract documents and is operating properly.

Train facility personnel on the operation and maintenance of the load center unit substation devices (minimum of two 1 hour sessions).

Explain available service programs to facility supervisory personnel for their consideration.

* + - * 1. Service Availability: A fully equipped service organization shall be available to service the completed Work.
			1. DELIVERY, STORAGE AND HANDLING
				1. Protection: Provide supplemental heating devices, such as incandescent lamps or low wattage heaters within the enclosure or under a protective cover to control dampness. Maintain this protection from the time equipment is delivered to the site until it is energized.
1. PRODUCTS
	* + 1. GENERAL

Revise paragraph below if load center unit substation must stay within space limitation indicated on the drawings.

* + - * 1. Number of Cubicles:

Determine from the manufacturer, the exact number of cubicles required to carry out all the functions of the substation.

The number of cubicles indicated on the drawings are the minimum number to be provided.

Provide additional cubicles if required by the characteristics of the proposed load center unit substation.

Use paragraph below for indoor enclosure.

* + - * 1. Indoor type enclosures (general purpose, ventilated).

Use paragraph below and its subparagraphs for outdoor installation.

* + - * 1. Outdoor Type Construction:

The complete enclosure shall consist of a number of cubicles assembled to form one complete rigid, free standing outdoor weatherproof assembly.

Doors and panels shall have flanged edges, 1 inch deep minimum, with corners welded for stiffness.

Steel for doors and panels minimum 11 gage.

Top: Sloping sheet steel weatherproof roof with roof beams, capable of withstanding snow loading.

Replaceable dust filters over air intake and exhaust openings in the assembly.

Use subparagraph below for standard application.

Enclosure Integrity: ANSI C57.12.28 1999 Pad Mounted Equipment-Enclosure Integrity.

Use subparagraph below for outdoor installation, coastal environment.

Enclosure Integrity: ANSI C57.12.29 1999 Pad-Mounted Equipment-Enclosure Integrity for Coastal Environments.

* + - 1. HIGH VOLTAGE SECTION

High voltage section specified is switch and fuse. Vacuum circuit breaker metal-clad switchgear is available.

* + - * 1. Fusible Air Interrupter Switches: S & C Electric Co.’s Metal Enclosed Switchgear, or SqD Co.’s Power Zone HVL Load Interrupter Switchgear:

Quick-make, quick-break, stored energy, switch operating mechanism. (Manual or motor operated as enumerated).

Fuses: See Section 262813.

Rating of \_\_\_\_\_\_\_\_KV (nominal \_\_\_\_\_\_\_\_KV), \_\_\_\_\_\_\_\_KV BIL.

Fill in ratings in subparagraphs above and below.

Continuous current rating \_\_\_\_\_\_\_\_A, contact interrupting rating \_\_\_\_\_\_\_\_A, fault closing and momentary rating \_\_\_\_\_\_\_\_A (asym).

Doors allowing access to fused interrupter switches key interlocked to prevent:

Opening the door if the interrupter switch is closed.

Closing the interrupter switch if the door is open.

Key interlocks, where required, flush mounted in the doors. Padlock type key interlocks not acceptable.

* + - * 1. Cubicle Enumeration:

The following cubicle enumerations are general examples for outdoor type construction. Refer to manufacturers’ catalogs for equipment which can be specifically accommodated by each cubicle.

Cubicle No. 1:

1 - Metal-enclosed unit.

1 - 3 phase bus, \_\_\_\_\_\_\_\_ amps.

1 - Fusible air interrupter switch, single throw, manually operated, 3 pole, 600 amps.

Motor operated switches are available.

3 - \_\_\_\_\_\_\_\_KV fuses.

3 - Lightning arresters.

1 - Space heater of wattage as required.

Provisions for terminating cables. Necessary small wiring, terminal blocks, ground bus, etc.

Key Interlocking between switch mechanisms supplied by 2 primary feeders, so that only one switch can be in the closed position.

Cubicle No. 2 (Metering).

Use Cubicle No. 2 and modify to suit only where project requirements warrant use of primary metering instead of secondary metering.

1 - Metal-enclosed unit.

1 - 3 phase bus, \_\_\_\_\_\_\_\_ amps.

3 - Potential transformers with current limiting fuses.

3 - Current transformers \_\_\_\_\_\_\_\_/5 ratio.

1 - Ammeter, indicating type 0 to \_\_\_\_\_\_\_\_ ampere range.

1 - Ammeter transfer switch.

1 - Voltmeter, indicating type 0 to \_\_\_\_\_\_\_\_KV range.

1 - Voltmeter transfer switch.

1 - Indicating KW meter 0 to \_\_\_\_\_\_\_\_KW with demand register.

1 - Space heater of wattage as required.

Necessary small wiring, terminal blocks, ground bus, etc.

Cubicle No. 3 (Auxiliary):

1 - Metal-enclosed unit.

1 - 3 phase bus, \_\_\_\_\_\_\_\_ amps.

1 - Control power transformer with current limiting fuses.

1 - AC panel of capacity to serve load requirements with main circuit breaker and required number of branch circuit breakers, plus 4 spare single pole branch circuit breakers.

1 - Space heater of wattage as required.

* + - * 1. Equipment Features:

Control Power Transformer: Transformer shall provide power at the secondary voltages required by the substation, and contain a secondary circuit breaker key interlocked with transformer primary current limiting fuses. Furnish transformer of capacity required to serve all load requirements.

Omit reference to phase to neutral voltage if not applicable.

Voltmeter Transfer Switch: Switch shall cause voltmeter to read phase to phase voltages, phase to neutral voltage. Switch shall also have an “off” position.

Ammeter Transfer Switch: Switch shall cause ammeter to read current in each phase. Switch shall also have an “off” position.

Ammeters and Voltmeters: Flush mounted switchboard instruments, 4-1/2 inches square, 250 degree scale, ANSI C39.1, 1 percent accuracy class.

Edit characteristics of meters to suit.

Kilowatt Meter: Semi-flush mounted switchboard meter, indicating type with demand register.

Lightning Arresters: Metal-oxide varistor, heavy duty, intermediate class (Tested in accordance with ANSI/IEEE C62.11 and IEC 99-4 for heavy duty arresters):

Porcelain: Cooper Power Systems’ VariSTAR Type AZF.

Polymer: Joslyn Corp.’s ZIP Series, General Electric Co.’s Tranquell Type 9L12, or Ohio Brass Co.’s DynaVar PVI.

Silicone: Cooper Power Systems’ VariSTAR UltraSIL.

Rating: As recommended by arrester manufacturer.

* + - 1. TRANSFORMER SECTION
				1. ABB Power T & D Company Inc.’s Unit Substation Transformer, Cooper Power Systems’ Unit Substation Transformer, General Electric Co.’s Unit Substation Liquid Filled Transformer, Niagara Transformer Corp.’s Unit Substation Transformer, or Square D Co.’s Liquid Filled Substation Transformer:

Low Voltage Rating: \_\_\_\_\_\_\_\_ volts, 3 phase wye, 60 Hz, insulation class \_\_\_\_\_\_\_\_KV, \_\_\_\_\_\_\_\_KV BIL.

Fill in required data. See ANSI c57.l2.00 & c57.l2.l0 for data on insulation class and BIL voltage levels. Edit delta and wye connections to suit.

High Voltage Rating: \_\_\_\_\_\_\_\_ volts, 3 phase delta, 60 Hz, insulation class \_\_\_\_\_\_\_\_KV, \_\_\_\_\_\_\_\_KV BIL.

Use one of the two following subparagraphs and edit KVA to suit. If fans are required, modify first subparagraph to include fans and run circuits from the nearest available source.

KVA Rating: 1000/1120 future FA KVA, 65 degrees C. average winding temperature rise with provision for future addition of cooling fans. Future fan control to be from top liquid temperature thermometer.

KVA Rating: 500 KVA, 65 degrees C. average winding temperature rise.

Use subparagraph below for an outdoor installation when transformer is located far enough away from buildings so that it cannot become a fire hazard in the event of a failure (also consider fire characteristics of the exterior of the building). See information at end of section for spacing guide.

Cooling liquid, transformer mineral oil as recommended by the transformer Company.

Use less-flammable cooling liquid subparagraph below for an outdoor installation when transformer is located closer to buildings, equipment, etc. Than allowed by applicable codes and standards for use of mineral oil.

Use less-flammable cooling liquid for indoor installations.

UL & FM approach listing of less-flammable liquid-insulated transformers in different manners. If one method is preferred, specify only that method and design accordingly. Change UL to FM, and change parameters to meet FM requirements if FM listing is used instead of UL. See information at end of section, which highlights the differences.

There are several different types of less-flammable liquids on the market. If a specific type is desired, modify subparagraphs below and specify only the desired type. (verify that all specified parameters meet the liquids’ listing requirements). See information at end of section, which lists the types available.

Less-Flammable Cooling Liquid: A type listed by UL. Transformer construction, electrical requirements, and physical installation shall be in accordance with the listing for the type of fluid being furnished, including:

Transformer tank capable of withstanding an internal pressure of 12 psig without rupture.

Transformer equipped with pressure relief devices having pressure relief capacity per the UL Classification Marking.

Integral primary fusing in accordance with the transformer manufacturer’s protection scheme, which limits I²T to the value required by the transformers’ UL Classification marking for the type of less flammable fluid being used.

High Voltage and Low Voltage Windings: Copper.

Use subparagraph below for delta primary.

Five-legged core/coil construction.

Use subparagraph below for wye primary. (see information at end of section concerning wye primaries).

Five-legged core/coil construction suitable for wye/wye connection.

Variations are available, also utility company may have specific connection requirements, when applicable.

High voltage neutral internally grounded and brought out to a ground pad or busing.

Secondary neutral ungrounded inside the transformer to prevent unintentional grounding.

Primary and secondary neutrals not connected internally.

Two 2-l/2 percent FCAN and two 2-l/2 percent FCBN primary taps.

Externally operated tap changer for operation when the transformer is de-energized.

Verify impedance value for project requirements. Omit 2nd sentence if not applicable.

6-l/2 percent impedance. Transformers shall have identical electrical characteristics suitable for parallel operation.

Copper busses, transitions, and accessories as required to integrate transformer into load center unit substation.

* + - 1. LOW VOLTAGE SECTION

Use Part 2 from section 262413 as an insert to complete the specification requirements for the low voltage section. Include 16. Below if a double ended unit substation is used, and each transformer is capable of carrying the entire substation load.

* + - * 1. Bus Tie Interlocking: Key interlock all main and bus tie circuit breakers in double ended load center unit substation so that one main circuit breaker must be opened before the bus tie circuit breaker is closed.
1. EXECUTION
	* + 1. INSTALLATION
				1. Install the Work of this Section in accordance with the manufacturer’s printed instructions.

Set and program the load center unit substation devices in accordance with the approved coordinated selective scheme.

* + - * 1. Install foundation channels for anchoring and leveling of the load center unit substation.
				2. Identification:

Install on the front of each circuit breaker, a phenolic nameplate indicating load served by circuit breaker.

Stencil on front the load center unit substation with white paint in l/2 inch lettering”, “LOAD CENTER UNIT SUBSTATION”, etc. corresponding to load center unit substation designations on the drawings, and electrical parameters (phase, wire, voltage).

* + - 1. FIELD QUALITY CONTROL
				1. Preliminary System Test:

Preparation: Have the Company Field Advisor adjust the completed load center unit substation devices and then operate them long enough to assure that they are performing properly.

Run a preliminary test for the purpose of:

Determining whether the load center unit substation is in a suitable condition to conduct an acceptance test.

Checking instruments and equipment.

Training facility personnel.

* + - * 1. System Acceptance Test:

Preparation: Notify the Director’s Representative at least 3 working days prior to the test so arrangements can be made prior to the test to have a Facility Representative witness the test.

Make the following tests:

Test devices that have ground fault protection in accordance with the approved information sheets and test form.

Test programmable solid state trip devices in accordance with the manufacturer’s recommendations.

Supply all equipment necessary for system adjustment and testing.

Submit written report of test results signed by the Company Field Advisor and the Director’s Representative. Mount a copy of the final report in a Plexiglas enclosed frame assembly in a conspicuous location on the load center unit substation.

END OF SECTION261330

The remainder of this section is for information only. Not to be included in project specifications.

1. There are many options available for load center unit substations. Consult manufacturers’ catalogs.

2. Show details of concrete pad, grounding, etc.

3. Indicate on drawings the transformer KVA, primary and secondary voltage.

4. Indicate type of coil connections required for 3 phase transformers (for specific applications of various type connections refer to ANSI/IEEE c57.105 “guide for application of transformer connections in three-phase distribution systems”). In general:

a. Connect 3 phase transformer primaries in delta. Do not use wye primaries except in special cases because of “problem connections”. When wye primaries are used, special consideration must be given to the grounding connections and the type of core/coil construction to prevent tank overheating, voltage and load balance problems.

5. Listing of less flammable transformer fluids and less-flammable liquid-insulated transformers:

a. Factory mutual approved transformer: listing is based upon the use of a FM approved less-flammable liquid in a transformer tank that meets certain FM criteria.

1) Cylindrical tank must be capable of withstanding an internal pressure of 20 psi, rectangular tanks, 15 psi.

2) Pressure-relief devices must be provided.

3) Use of enhanced electrical protection. (transformers are equipped with electrical protection for clearing of high and low current faults).

4) FM approved transformer fluid.

5) Spacing from adjacent combustibles must be provided, based on the fluid capacity of the transformer tank.

6) A liquid confinement area is intended to prevent the fluid from spreading beyond the vicinity of the transformer.

7) FM approved nameplate is required.

8) BIL testing at a minimum tilt of 1.5 degrees from vertical.

9) Depending on transformer ratings; ground fault relay protection, pressure relief alarm contacts, rapid rise relay, oil level gage, liquid temperature indicator, pressure-vacuum gage.

10) Manufacturer’s quality assurance program.

11) As of July, 2000, only cooper power systems has factory mutual approved transformers.

12) For recommended electrical protection for each transformer (fusing, relaying) refer to factory mutual property loss prevention data sheet 5-4/14-8.

13) Refer to factory mutual approval standard 3990 for details.

b. Factory mutual approved less-flammable transformer fluids (transformer not FM approved):

1) FM approved transformer fluid.

2) Minimum separation distance per FM listing.

3) Fluid containment requirements as detailed in FM loss prevention data 5-4/14-8 section 2.4.3.

4) For recommended electrical protection for each transformer (fusing, relaying) refer to factory mutual property loss prevention data sheet 5-4/14-8.

c. UL listing is based on UL requirements that no tank rupture or noted fluid leakage occur during low-and high-current arcing fault tests.

1) Transformers be equipped with tanks capable of withstanding 12 psig minimum without rupture.

2) Transformers be equipped with pressure relief devices with minimum pressure relief capacity per the UL classification marking.

3) Transformer primaries be protected with overcurrent protection options per the UL classification marking.

4) UL listed less-flammable transformer fluid.

6. Types of less-flammable transformer fluids approved by FM & UL as of July, 2000:

a. Factory mutual (refer to approval guide 2000 - electrical equipment - transformer fluids):

1) Biotemp less-flammable transformer fluid; ABB Power T&D Co. Inc. 1021 Main Campus Dr. Raleigh NC 27606.

2) Envirotemp fr3 natural ester-based less-flammable transformer insulating fluid, and r-temp fluid; Cooper Power Systems, Fluids Products 1900 E North St. Waukesha WI 53188.

3) Alpha-1, and beta fluid; Dielectric Systems, Inc. 1320 Commerce St. Box 420 Tyler TX 75702.

4) Dow Corning 561 silicone transformer fluid; Dow Corning Corp. Midland MI 48686.

5) Midel 7131; M&I Materials Ltd. Box 136 Manchester M60 1an England.

6) Transformer fluid l-305, and y-7582 silicone transformer fluid; Union Carbide Chemicals & Plastics Co. Inc. Specialty Chemicals Div 39 Old Ridgebury Rd. Danbury CT 06817.

b. UL: refer to UL gas and oil equipment directory under transformer fluids (EOVK).

1) Envirotemp fr3 natural ester-based less-flammable transformer insulating fluid, and r-temp fluid; Cooper Power Systems, Fluid Products 1900 E. North St. Waukesha, WI 53188.

2) Dow Corning 561 silicone transformer fluid; Dow Corning Corp. Midland MI, 48640.

7. Codes, standards and references applicable to load center unit substations:

a. For the high voltage section: see information at end of section 16432.

b. For the low voltage section: see information at the end of section 262413 and 16434.

c. National Electrical Safety Code - section 15.

 d. National Electrical Manufacturers Association (NEMA):

1) tr-1 1993, transformers, regulators and reactors.

e. American National Standards Institute (ANSI):

1) C57.12.00 1993, general requirements for liquid-immersed distribution, power, and regulating transformers. (now listed under IEEE C57.12.00 12/00/99 4th draft).

2) C 57.12.10, requirements for transformers 230000 volts and below 833/958 through 8333/10417 KVA, single phase, and 750/862 through 60000/80000/100000 KVA, three-phase.

3) C57.12.28 1999, pad-mounted equipment-enclosure integrity.

4) C57.12.29 1999, pad-mounted equipment - enclosure-integrity for coastal environments.

5) C57.12.70 1993, terminal markings and connections for distribution and power transformers. (also IEEE C57.12.70 draft 1996).

6) C57.12.80 1992, terminology for power and distribution transformers. (also IEEE c57.12.80 draft 1996).

7) C57.12.90 1987, test code for liquid-immersed distribution, power, and regulating transformers and guide for short-circuit testing of distribution and power transformers. (now IEEE c57.12.90 1999).

8) C57.92 1992, guide for loading mineral-oil-immersed power transformers up to and including 100 MVA with 55 degrees c or 65 degrees c winding rise.

9) C57.98 1986, guide for transformers impulse tests. (also IEEE c57.98 rev. 1993).

10) C57.105 1992, guide for application of transformer connections in three-phase distribution systems.

f. Factory mutual:

1) Loss prevention data sheet 5-4/14-8.

2) Approved standard for less or nonflammable liquid-insulated transformers - class number 3990.

3) Approval standard - less flammable transformer fluids - class number 6933.

 4) Approval guide 2000 - electrical equipment - transformer fluids.

g. Underwriters laboratories:

1) Gas and oil equipment directory - transformer fluids (EOVK).

2) UL 340 tests for comparative flammability of liquids.

h. IEEE:

1) IEEE 979 1994, substation fire protection guide.

END OF INFORMATION 261330