

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
441 G Street, NW
Washington, DC 20314-1000

ER 1110-2-4401

CECW-CE

Regulation
No. 1110-2-4401

28 February 2021

Engineering and Design
CLEARANCES FOR ELECTRIC POWER SUPPLY LINES AND COMMUNICATION
LINES OVER RESERVOIRS

1. Purpose. This regulation defines the minimum vertical clearances to be provided when relocating or replacing existing or when constructing new power and communication lines over waters of reservoir projects. Definitions are provided in paragraph 6.
2. Applicability. This regulation applies to all U.S. Army Corps of Engineers (USACE) Commands having civil works responsibilities for USACE reservoir projects.
3. Distribution Statement. Approved for public release; distribution is unlimited.

FOR THE COMMANDER:

JOHN P. LLOYD
COL, EN
Chief of Staff

*This regulation supersedes ER 1110-2-4401, dated 30 May 1997.

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4. References.

a. 10 U.S. Code (USC) 2668, Easements for Rights-of-Way.

<https://www.govinfo.gov/content/pkg/USCODE-2010-title10/pdf/USCODE-2010-title10-subtitleA-partIV-chap159-sec2668.pdf>

b. 33 Code of Federal Regulations (CFR) Parts 320-330, Regulatory Program Regulations.

<https://www.govinfo.gov/content/pkg/CFR-2012-title33-vol3/pdf/CFR-2012-title33-vol3-part330.pdf>

c. Engineer Manual 385-1-1, Safety and Health Requirements Manual.

<https://www.publications.usace.army.mil/USACE-Publications/Engineer-Manuals/>

d. Institute of Electrical and Electronics Engineers, National Electrical Safety Code C2 (NESC). <https://standards.ieee.org/products-services/nesc/products.html>

e. National Fire Protection Association 70, National Electrical Code (NEC).

<https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70>

5. Records Management (Record Keeping) Requirements. Records management requirements for all record numbers, associated forms, and reports required by this regulation are included in the Army's Records Retention Schedule - Army. Detailed information for all record numbers, forms, and reports associated with this regulation are located in the Army's Records Retention Schedule - Army at <https://www.arims.army.mil/arims/default.aspx>.

6. Definitions.

a. Reservoir project. A USACE federally authorized Civil Works reservoir project, including those operated and/or maintained by USACE and those operated and maintained by a non-federal sponsor. A Reservoir project includes the land and water areas of any water resource development project administered by the Chief of Engineers.

b. Reference Pool Elevation. The reservoir level that would be attained for routine storage of water for flood control and other authorized storage uses. This reservoir level corresponds to the "total design capacity" of the reservoir, excluding surcharge storage.

c. **Low Point of Line.** The low point of the line must be the least vertical clearance between a line and the earth's surface below it at final sag as outlined in Rule 232 of the NESC.

d. **Minimum Vertical Clearance.** The minimum vertical clearance must be the distance from the reference pool elevation to the low point of the line. This minimum vertical clearance must be based upon the "reference vessel height" as defined in paragraph 6.h.

e. **Transmission Lines.** Power lines having a nominal operating voltage of 69 kV and above.

f. **Primary Distribution Lines.** Power lines having a nominal operating voltage within the range of 750 volts to less than 69 kV.

g. **Secondary Distribution Lines.** Power lines having a nominal operating voltage of less than 750 volts.

h. **Reference Vessel Height.** The term, as used here, is the vessel's total height above the water including mast and all appurtenances. It is based upon a vessel height of 14.63 m (48 ft), including mast, plus a 1.22 m (4 ft) antenna or other appurtenances to the mast, and it must replace each Water areas-sailboats Reference component of Rule 232 in Table A-2a of Appendix A of NESC.

7. **General.** This regulation applies to relocating, replacing, or constructing elevated power and communication lines over navigable and non-navigable waters of reservoir projects. Lines not compliant with this regulation may be buried, removed, rerouted, or elevated. 10 USC 2668 provides the Secretaries of military departments authority to grant power and communication line right-of-way easements. Minimum clearances for electric power transmission lines crossing navigable waters of the United States are also found at 33 CFR 322.5(i)(2). Per 33 CFR 322.5(i)(4), when both 33 CFR 322.5(i) and this ER apply, the greater minimum clearance is required. Power and communication line projects may require permission under 33 U.S.C. 408 (Section 408), Section 10 of the Rivers and Harbors Act of 1899, or Section 404 of the Clean Water Act.

8. Clearance Requirements.

a. **Application.** The vertical clearances specified apply under the following conductor temperature and loading conditions, whichever produces the largest final sag:

1. 50° C (120° F), no wind displacement
2. The maximum conductor temperature for which the line is designed to operate, if greater than 50° C (120° F), with no wind displacement
3. 0° C (32° F), no wind displacement, with radial thickness of ice, if any, specified in NESC Table 230-1 for the zone concerned.

Note: The phase and neutral conductors of a supply line are normally considered separately when determining the sag of each due to temperature rise.

b. Upstream Lake Areas. Minimum vertical clearances over lake areas, where sailboats are commonly operated, must be no less than the following:

(1) Power line clearances must be calculated with 15.85 M (52 ft) Reference Vessel Height substituted for Reference components in NESC Table A-2a. The required clearance must also include the mechanical and electrical components in NESC Table A-1. The minimum vertical clearance in NESC Table 232-1 item 7 must not be used.

(2) Low voltage communication lines, as defined in Section 2 of the NESC, must have a minimum vertical clearance of 15.85 m (52 ft).

(3) Where feasible, install primary and secondary distribution lines underground.

(4) Sailboat rigging and launching areas must have clearances 1.524 m (5 ft) greater than those given in paragraph 8.b.(1) and (2) above.

(5) In water areas where it is not reasonable or normal for sailboats to be rigged, launched, or operated, consideration will be given to installing power and communication lines with a minimum vertical clearance of not less than that required in the current edition of the NESC, Rule 232, Table 232-1, item 6. NESC clearances must be those above the reference pool elevation as defined above. This consideration must be reviewed and approved by the District Commander.

c. Downstream/Tailwaters. In those areas where sailboating can reasonably be expected, minimum vertical clearances must be as required in paragraph 8.b.(1) and (2). Clearances must be measured from the maximum water level that makes sailboating feasible. In other areas where sailboating cannot reasonably be expected, minimum vertical clearances must not be less than that required in paragraphs 8.b.(5). These clearances must be provided above a maximum tailwater elevation based on discharges that can reasonably be anticipated during the life of the project.

d. Service Lines to Public Facilities.

(1) Overhead secondary distribution lines serving marinas/concession facilities, to include boat docks, piers, etc., must be installed parallel to and over the edge of walkways according to the NEC. A minimum vertical clearance of 3.66 M (12 ft) above the walkway must be maintained. In other areas of the arena or public floating facility where a sailboat is physically prevented from entering the area, the overhead secondary distribution line may be installed with a minimum vertical clearance of 3.66 m (12 ft).

(2) A service disconnect for de-energizing these lines must be provided and installed on a permanent structure where the base elevation is above the top of the reference pool elevation. The responsibility for de-energizing service lines prior to inundation of electrical equipment and/or when the reference pool elevation is reached must rest with the lessee. All overhead lines

on public lands not susceptible to inundation must have a minimum vertical clearance above ground according to the NEC.