USDA

United States Department of Agriculture
Rural Development

Rural Business–Cooperative Service • Rural Housing Service • Rural Utilities Service
Washington, DC 20250

OCT 12 2001

SUBJECT: Summary of Items of Engineering Interest - October 2001

TO: All Electric Borrowers

FROM: BLAINE D. STOCKTON
Assistant Administrator
Electric Program

The attached October 2001, Summary of Items of Engineering Interest continues the practice of furnishing annually, on an informal basis, engineering information and developments related to the rural electrification program.

The Rural Utilities Service (RUS) engineering staff has included in the attached material some new ideas and techniques developed for the purpose of encouraging further thought when designing, purchasing, or operating certain facilities. It should be noted, however, that nothing in this summary should be construed to change existing policies and procedures as set forth in RUS regulations or bulletins, the National Electrical Safety Code, or other publications.

Comments or suggestions regarding any of the items in this summary are welcome and should be sent to George J. Bagnall, Director, Electric Staff Division, Rural Utilities Service, Stop 1569, 1400 Independence Avenue SW., Washington, D.C. 20250-1569.

Attachment

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UNITED STATES

DEPARTMENT OF AGRICULTURE

RURAL UTILITIES

SERVICE

SUMMARY OF

ITEMS OF ENGINEERING INTEREST

OCTOBER 2001

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ABBREVIATIONS

AAAC	All Aluminum Alloy Conductor
ACSR	Aluminum Conductor Steel Reinforced
AMR	Automated Meter Reading
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
BIL	Basic Impulse Insulation Level
CD	Compact Disc
CFR	Code of Federal Regulations
CPR	Continuing Property Records
CWP	Construction Work Plan
ESD	Electric Staff Division
FCB	Formal Competitive Bidding
FERC	Federal Energy Regulatory Commission
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IEI	Items of Engineering Interest
Kip	1000 Pounds
kV	Kilovolt
kVA	Kilovolt-Amperes
LDU	Local Distribution Utility
M&E	Mechanical and Electrical
MOSA	Metal-Oxide Surge Arresters
NEHRP	National Earthquake Hazard Reduction Program
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NRECA	National Rural Electric Cooperative Association
POC	Point of Contact
PSC	Public Service Commission
PUC	Public Utility Commission
QTY	Quantity
REA	Rural Electrification Administration
RTB	Rural Telephone Bank
RUS	Rural Utilities Service
RUS List of Materials	RUS Informational Publication 202-1, "List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers"
T&D	Transmission & Distribution
TVI	Television Interference
UBC	Uniform Building Code

ENGINEERING and DESIGN

2002 National Electrical Safety Code (NESC) Availability

The 2002 NESC is now available. The Institute of Electrical and Electronics Engineers (IEEE) approved the document on February 5, 2001. The American National Standards Institute (ANSI) approved this document as an American National Standard on June 14, 2001. The NESC covers the basic provisions for safeguarding of persons from hazards arising from the installation, operation, or maintenance of (1) conductors and equipment in electric supply stations, and (2) overhead and underground electric supply and communications lines. The NESC also includes work rules for the construction, maintenance, and operation of electric supply and communications lines and equipment. The document is applicable to all systems and equipment operated by utilities. In 7 CFR 1724.50, RUS requires all electric borrowers to observe the provisions of the latest version of the NESC.

The actual effective date for mandatory use of a new version of the NESC can make for a lively conversation in some parts of the country. NESC Rule 016 specifies that the NESC becomes effective no later than 180 days following its publication date. (Since the 2002 NESC was published on August 1, 2001, the effective date for the 2002 NESC will be January 28, 2002). However, the effective date for mandatory use of a particular version of the NESC is usually established by the state authorities having jurisdiction over utilities, e.g., public utility or service commissions, electric boards, etc. Some states have legislation in place to switch to the latest NESC version commensurate with the NESC Rule 016 established effective date. Other states must establish the effective date via enacting legislation which may take considerable time. You can visit IEEE's WEB site (www.ieee.org) and find a listing of the various state practices regarding the NESC. RUS recommends that borrowers switch to using the latest NESC version as soon as practical after the RULE 016 established effective date.

Copies of the 2002 edition of the NESC may be ordered on the internet at:

http://shop.ieee.org/store/product.asp?prodno=SH94911

For further information, contact George Bagnall, Director of the Electric Staff Division, at 202-720-1900 or Harvey Bowles, Chairman of Technical Standards Committee "A", at 202-720-0980.

Revisions to the 1997 National Electrical Safety Code (NESC), Sections 25 and 26

In the 1999 Items of Engineering Interest, RUS discussed possible changes to the 1997 NESC for Sections 25 and 26, Safety Rules for Overhead Lines--Loadings for Grades B and C and Strength Requirements, respectively.

Some of these proposed changes and their final outcome with respect to the 2002 NESC approved by ANSI are summarized below:

1. There was a proposal to remove the 60 ft. height limit in Rule 250C. The 1997 code requires one to consider extreme winds for structures over 60 feet. NESC Subcommittee 5 was considering removal of this exclusion, thus requiring designers to consider extreme winds for all structures regardless of their height. If this proposal passed, distribution lines would have been required to have the same strength as transmission lines in situations where extreme winds control the design.

    - **Outcome**: In Rule 250C, the 60 ft. exclusion limit remains when considering extreme winds. However, keep in mind that NESC Rule 261A1c requires that all structures including those below 60 ft shall be designed to withstand, without conductors, the extreme wind load in Rule 250C applied in any direction on the structure.

2. Subcommittee 5 proposed including a new combined ice and wind 50-year map in Section 25, Loadings for Grades B and C. This map appeared in the RUS 1998 Items of Engineering Interests. Subcommittee 5 proposed to allow utilities to meet current requirements of Light, Medium, or Heavy Loading District loads, or to meet the new combined ice and wind map.

    - **Outcome**: This new combined ice and wind map will not appear in the 2002 code at this time.

3. For Rule 250C, there was a change proposal to replace the current 50-year extreme wind map (based on fastest mile speeds) with the new ASCE 7, 50-year wind map based on 3-second gust wind speeds. (ASCE 7 is the American Society of Civil Engineers Standard for Minimum Design Loads for Buildings and Other Structures).

    - **Outcome**: The new extreme wind map will replace the old map. Initially this change appears as a rather benign change. However, use of this wind information involves equations and tables, which must be used to calculate the wind pressure on an overhead line. The general equation used to determine the load on a line will be:

        $$\text{Load} = .00256 * V^2 * k_z * G_{RF} * I * C_d * A$$

        Where:

        V = basic wind speed, 3-second gust wind speed in miles per hour

        k_z = velocity pressure exposure coefficient (Table 250-2)

        G_{RF} = Gust Response Factor (Table 250-3)

        I = Importance factor (1.0 for utility structures and their support facilities.)

C_d = Shape Factor (Rule 252B)

A = projected wind area (ft^2)

4. Fiber reinforced composite structures and crossarms were proposed to be added to the strengths and loading sections.

    - **Outcome**: Fiber reinforced composite structures and crossarms are not included in this edition of the NESC

5. One proposal concerned Table 253-1 for the Grade C transverse overload factor for steel and prestressed concrete structures. The proposal suggested changing the overload factor from 2.2 to 1.75.

    - **Outcome**: The overload factor for transverse loads from wind is reduced to 1.75 for all structures including steel and prestressed concrete when the span being supported is **not** 'at a crossing'. For spans 'at a crossing', the transverse overload factor remains 2.2.

6. Subcommittee 5 considered a complete rewrite of Sections 24, 25,and 26. This proposal would eliminate Light, Medium, and Heavy Loading District loads and replaced these loads with construction, extreme wind, and extreme wind and ice loads.

    - **Outcome**: The complete rewrite is deferred for consideration in the 2007 edition of the NESC.

If you would like more information or have any questions, please contact Donald Heald, Structural Engineer, Transmission Branch, at 202-720-9102 or dheald@rus.usda.gov.

Guidelines for RUS Approval to Use Steel Distribution Poles

RUS will again be updating its guidelines for RUS approval for borrowers' request to use steel distribution poles on a case-by-case basis based on the 2002 Edition of the NESC. These new guidelines, will be "Version 6" and will take into account the new 2002 NESC overload factors for grade B and C construction. The new guideline will provide borrowers the latest wood vs. steel pole design loads and the proper use and selection of steel distribution poles and associated pole-top assemblies. The new guidelines also provide more information on who and how to contact certain individuals at RUS to answer specific questions regarding steel poles. Presently, RUS only asks that borrowers address the 9 issues, if applicable, listed on the last page of the guidelines in their requests to RUS. Until the 2002 NESC goes into effect, version 5 will be followed. There have also been some changes in the Point of Contact (POC) within RUS in regard to steel poles and this has been incorporated below.

RUS Guidelines and Approval for the Use of Steel Distribution Poles

Version 5

The Rural Utilities Service (RUS) will consider a borrower's written request to use steel distribution poles for site specific projects on a case-by-case trial basis to gain experience. Before granting approval, RUS needs sufficient information to assure that the application of steel poles will result in safe and reliable construction and meet RUS requirements.

Borrowers requesting RUS approval to use steel distribution poles are asked to read the following guidelines and design information and to furnish RUS with the information requested in Part II.

Part I: RUS Guidelines and Design Information for Using Steel Distribution Poles

A: MATERIALS

Except for various miscellaneous material items, RUS regulations require that borrowers use materials that RUS has fully, conditionally or technically accepted. A compilation of fully and conditionally accepted materials may be found in Informational Publication 202-1, "List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers" (List of Materials). This List of Materials can be accessed through the internet at http://www.usda.gov/rus/electric/listof.htm. For information on technically accepted items and other questions regarding materials, please contact:

Mr. Harvey Bowles, Chair
Technical Standards Committee "A" (Electric)
Rural Utilities Service, Stop 1569
1400 Independence Avenue SW
Washington DC 20250-1569
Phone: 202-720-0980
Fax: 202-720-7491
Email: hbowles@rus.usda.gov

Borrowers requesting RUS approval of materials not presently accepted, for use with steel poles or any other application, are asked to provide: a description of the material, catalog sheets, test results, and the name and address of the manufacturer. Such requests should be sent to the appropriate regional Engineering Branch Chief. (See Section G)

B: LIGHTNING IMPULSE WITHSTAND STRENGTH and SURGE PROTECTION

A lightning impulse withstand strength, often called Basic Impulse Insulation Level or BIL, of less than 300 kV on distribution pole top assemblies will usually facilitate flashovers of lightning strikes to or near distribution lines. A recloser operation, which will cause lights to flicker, is usually required to clear the resulting arc. RUS advocates a minimum of 300 kV withstand strength (dry flashover, phase-to-phase and phase-to-ground) to minimize recloser operations and

thus improve the quality of service. This level is especially important on deadends where voltage doubling can occur.

A withstand strength of 300 kV (dry flashover) can be achieved on steel poles by using many of the standard RUS pole-top assemblies and installing a fiberglass-reinforced plastic pole-top pin (item "b (2)" in the List of Materials) on the phase conductor attached to the very top of the pole.

A 300 kV lightning impulse withstand strength (dry flashover) can be attained on a steel pole deadend structure by installing a 24 inch (minimum length) insulated extension link (item "eu" in the List of Materials) between the primary deadend suspension insulators and the steel pole.

Borrowers do not need additional RUS approval to use the above two material items or the resulting modified standard pole top assemblies.

The designated maximum transverse load on fiberglass-reinforced plastic pole-top pins is 500 pounds. The maximum line angles for this loading limitation can be found in Table I of RUS Bulletin 1728F-803, "Specifications and Drawings for 24.9/14.4 kV Line Construction."

RUS recommends the installation of surge arresters at 800-foot to 1,200-foot intervals and at deadends on all distribution lines which are exposed to frequent lightning strikes. This recommendation is especially applicable to distribution lines built with steel poles because of their generally lower lightning impulse withstand strengths. An adequate number of installed surge arresters minimizes the number of lightning flashovers and the resulting momentary outages and damaged insulators.

C. GROUNDS, GROUNDING

The National Electrical Safety Code (NESC) requires that all non current-carrying metallic members on a line support structure be effectively grounded. Thus, each steel pole needs to be effectively bonded to all primary and secondary neutrals, down guys, messengers, and all other metallic attachments to the pole. Other NESC grounding requirements may also apply.

A steel pole may be used as a grounding conductor if the pole meets the sufficient conductivity and low impedance requirements of the NESC.

Since a directly embedded steel pole is not recognized in the NESC as a grounding electrode, separate driven ground rods or grounding electrodes need to be used for all equipment, surge arresters and other required system grounds. The use of stainless steel or galvanized steel ground rods and non-copper ground wires in the soil near steel pole distribution lines will help to mitigate the corrosive effects of dissimilar metals buried in close proximity.

D: COSTS AND ECONOMIC STUDIES

RUS does not require borrowers to provide any economic studies or cost comparisons to justify the use of steel distribution poles instead of wood poles. However, borrowers are encouraged to compare the initial and long-term estimated installed cost of equivalent distribution structures or

lines constructed with steel poles versus wood poles. Borrowers may, at their discretion, furnish the results of their cost estimates to RUS.

Questions or comments regarding Sections B through D above are welcomed by and should be sent to:

John B. Pavek, Chief
Distribution Branch
Rural Utilities Service, Stop 1569
1400 Independence Avenue SW
Washington DC 20250-1569
Phone: 202-720-5082
Fax: 202-720-7491
Email: jpavek@rus.usda.gov

E: RAPTOR PROTECTION USING STEEL POLES

RUS advocates that distribution lines be designed and constructed in a way that will minimize the electrocution of raptors. Distribution construction with steel poles need extraordinary consideration because of the short distances between the bare energized phase conductors and the grounded steel pole.

On single-phase lines, the installation of 24-inch long fiberglass-reinforced plastic pole-top pins ("item b (2)" in the List of Materials) will minimize the electrocution of small raptors. On three-phase lines, some raptor protection can be achieved in an economical manner by installing fiberglass-reinforced pole-top pins and perch guards on the crossarms as shown on assembly VP3.3G in Bulletin 1728F-803.

Good raptor protection can be achieved on both single-phase and three-phase structures by:

- Installing 24-inch long fiberglass-reinforced plastic pole-top pins;
- Using non-metallic crossarms and covering the pole, from the neutral up to and including the top of the pole, with an insulating coating that has a dielectric strength of at least 15,000 volts; and,
- Using 36-inch (minimum length) fiberglass-reinforced plastic guy strain insulators (item "w") and extension links (item "eu") for all connections to the pole above the neutral position. (See Bulletin 1728F-803, assemblies VA5.4 and E5.1G)

Any questions or comments regarding raptor protection can be directed to:

Dennis Rankin
Rural Utilities Service, Stop 1571
1400 Independence Avenue SW
Washington DC 20250-1569
Phone: 202-720-1953
Fax: 202-720-1820
Email: drankin@rus.usda.gov

F: SELECTION OF STEEL DISTRIBUTION POLES

Generally, a wood pole cannot be replaced with a steel distribution pole of the same class because of NESC strength requirements. After the selection of the NESC grade of construction, certain "design load" calculations are required to determine the minimum class of a steel distribution pole that can be used in lieu of a wood pole for standard RUS pole-top assemblies. The calculations involve the overload factors and strength factors, for both wood and steel poles, as found in Tables 253-1 and 261-1A of the 1997 edition of the NESC. RUS has performed the calculations for steel pole "design loads" for various poles and the results are shown in the tables below. (Note that some of these values will be changed in the 2002 edition of the NESC.)

RUS regulations require a minimum of NESC Grade C construction in the design and construction of distribution lines and structures. Section 24, Grades of Construction, of the NESC, and thus RUS, may require higher grades of construction for certain conditions.

Deadend structures and line angle structures where the transverse loads are more than 500 pounds per conductor involve additional calculations (such as loading trees) to determine the required minimum steel pole strength and pole class. Thus, ***RUS advocates*** that these types of structures (and steel pole selection) be designed (1) under the direction of a registered professional engineer, and (2) to meet NESC Grade B strength requirements.

The design of unguyed angle and dead-end steel pole structures should consider pole deflection and greater embedment depths. Extreme ice conditions and appropriate high winds should be considered in the design loads.

Questions or comments regarding proper selection and installation of steel poles should be sent to:

Robert Lash, Chief
Transmission Branch
Rural Utilities Service, Stop 1569
1400 Independence Avenue SW
Washington DC 20250-1569
Phone: 202-720-0486
Fax: 202-720-7491
Email: blash@rus.usda.gov

or

John B. Pavek, Chief
Distribution Branch
Rural Utilities Service, Stop 1569
1400 Independence Avenue SW
Washington DC 20250-1569
Phone: 202-720-5082
Fax: 202-720-7491
Email: jpavek@rus.usda.gov

Required **Steel Pole Design Loads**

(Columns 1 and 2 from American National Standards Institute (ANSI) 0.51)
(Design loads 2 feet from top of pole)

TABLE 1 - 1997 NESC GRADE C STRUCTURES
(RUS Tangent and Small Angle Assemblies) (Not at a Crossing)
(For New and Replaced Grade C Structures)

ANSI 0.51 Wood Pole Class	Wood Pole Design Load (lbs.)	Steel Pole Design Load (lbs.)
H1	5400	5800
1	4500	4800
2	3700	4000
3	3000	3200
4	2400	2600
5	1900	2000
6	1500	1600
7	1200	1300

TABLE 2 - 1997 NESC GRADE B STRUCTURES
(RUS Deadend and Large Angle Assemblies) (Not at a Crossing)
(For New and Replaced Grade B Structures)

ANSI 0.51 Wood Pole Class	Wood Pole Design Load (lbs.)	Steel Pole Design Load (lbs.)
H1	5400	3500
1	4500	2900
2	3700	2400
3	3000	2000
4	2400	1600
5	1900	1200

TABLE 3 - 1997 NESC GRADE B STRUCTURES
(RUS Deadend and Large Angle Assemblies) (Not at a Crossing)
(For Existing Grade C Wood Structures to be Replaced with Grade B Steel Structures)

ANSI 0.51 Wood Pole Class	Wood Pole Design Load (lbs.)	Steel Pole Design Load (lbs.)
H1	5400	6600
1	4500	5500
2	3700	4500
3	3000	3600
4	2400	2900
5	1900	2300

G: REQUEST FOR RUS APPROVAL TO USE STEEL DISTRIBUTION POLES

Borrowers requesting RUS approval to use steel distribution poles should send their written request and supporting information to the appropriate regional Engineering Branch Chief at the address given below.

Charles M. Philpott
Chief, Engineering Branch
Northern Regional Division
Rural Utilities Service, Stop 1566
1400 Independence Avenue SW
Washington DC 20250-1566
Phone: 202-720-1432
Fax: 202-720-1411
Email: cphilpot@rus.usda.gov

or

Louis Riggs
Chief, Engineering Branch
Southern Regional Division
Rural Utilities Service, Stop 1567
1400 Independence Avenue SW
Washington DC 20250-1567
Phone: 202-720-0848
Fax: 202-720-0097
Email: lriggs@rdmail.rural.usda.gov

Part II: Information Needed by RUS for Case-by-Case Approval of Steel Distribution Poles

Before granting approval, RUS needs all of the information requested below to determine if the steel pole application will result in safe and reliable construction and meets all of RUS' requirements.

1. Indicate the maximum number of steel poles to be used.

2. Indicate the name of the steel pole manufacturer.

3. Define the project or location(s) where the steel poles will be installed.

4. In addition to "experimental purposes to obtain experience", furnish sound reason(s) for using steel poles.

5. Indicate that only RUS accepted materials are to be used. *(Otherwise, see Section A of steel pole guidelines.)*

6. Indicate that only RUS standard construction is to be used. *(Otherwise, see Sections A and B of steel pole guidelines. Please furnish sufficient dimensioned drawings and other technical information for RUS' evaluation of the design.)*

7. *(If, and only if, the design has less than a 300 kV withstand strength [see guidelines, Section B], then briefly describe assemblies and materials to be used and anticipated impact [if any] on reliability and materials.)*

8. Describe raptor protection measures, if any, that are to be incorporated into the design. *(See guidelines, Section D.) (Note that RUS recommends that raptor protection be considered in distribution line designs, especially lines using steel poles, even though neither all lines nor all areas may require raptor protection.)*

9. Indicate that the determination of the class of the steel poles for each application is based on the proper engineering calculations performed by a competent person. *(See guidelines, Section F.)*

If your have any questions or need additional information regarding RUS approval or the use of steel distribution poles, please feel free to contact any of the persons identified in the above guidelines.

The MultiSpeak Initiative and Software Integration

Electric cooperatives have relied on computer software to address business and operations needs for many years. Such systems can revolutionize the way that co-ops conduct their business by reducing operating costs, improving customer service, and increasing employee efficiency.

Historically, it has been difficult to smoothly merge or integrate the operations of multiple computer applications. A number of approaches have been employed over the years to address this lack of integration. Often co-ops have attempted to solve the problem by relying on one vendor to supply an integrated suite of applications. In other cases, co-ops have relied on expensive vendor-supplied custom interfaces. Neither of these approaches is the complete answer.

In pursuit of a better solution, NRECA's Cooperative Research Network sponsored the development of a specification for standard interfaces between software packages called MultiSpeak. Two MultiSpeak-compliant software packages can exchange information without the need for expensive custom interfaces. Currently, five application types are supported: (i) customer information systems, (ii) geographic information systems, (iii) engineering analysis, (iv) interactive voice response, and (v) automated staking. The MultiSpeak Initiative plans to

expand the specification to include automated meter reading (AMR), outage management systems, work management systems, and SCADA.

MultiSpeak is not a product; rather co-ops should ask software vendors about their plans to incorporate MultiSpeak-compliant interfaces in their products. At present over sixty vendors support the MultiSpeak effort and ten software applications have passed compliance testing of at least one interface. More vendors are expected to develop interfaces for their software in the near future.

For more information on the MultiSpeak specification, see the project web site (www.multispeak.org). You can also contact Martin Gordon of NRECA's Cooperative Research Network (meg0@nreca.org) or Gary McNaughton, of Cornice Engineering, Inc., the MultiSpeak Project Coordinator, at (970) 264-6121 or by e-mail at gmcnaughton@frontier.net.

OPERATIONS

Upgrading Substation Voltage Can Save Time and Money

Submittals of substation plans by RUS borrowers for RUS review and approval indicate that there is a large increase in the upgrading and modification of existing substations in lieu of undertaking completely new substation construction. Converting existing substation voltages to higher ratings without a complete rebuild can lead to substantial savings, especially if some of the original foundations, structures, and equipment can be used with minimal modification.

Utility planners need to develop effective methods and procedures for analyzing the technical applicability and cost feasibility associated with upgrading an existing substation construction to operate at higher voltage and rating. For more information, planner should refer to Section 21.5, "Planning For Uprating Or Expansion", Section 21.6, "Comparisons-New vs. Upgrading or Expansion", and Section 21.7, "Substation Upgrading" in RUS' new Bulletin 1724E-300, "Design Guide for Rural Substations."

The objective in uprating is to keep the original Basic Insulation Level (BIL) of the equipment and to maintain existing clearances in the substation. The planner's design guide should focus on the following issues:

- Insulation Coordination,
- Safety,
- Environmental Performance (noise, TVI, etc.,) and
- Short Circuit Withstand.

The critical aspect for voltage uprating is an insulation coordination issue. Generally, if the insulation coordination criteria can be satisfied, the safety and environmental constraints usually also can be met. One method used to evaluate insulation coordination is the statistical one in

which the probability of overvoltage occurrence is calculated and matched with the probability of insulation flashover, so that an acceptable risk of failure is obtained.

These electrical characteristics are used to determine protective margins for the insulation levels in use. The protective margin is calculated using the following formula:

$$Margin\ \% = \left(\frac{Insulation\ Level}{Protective\ Level} \right) - 1 \times 100$$

The Insulation and Protective Levels are obtained from the manufacturer of the equipment being protected.

Safety consideration is the critical issue, as opposed to sparkover, within the substation. Minimum electrical clearances for personnel safety, based on BIL factors, are those defined by the National Electrical Safety Code (NESC), Rule 124 and Table 124-1.

The proper application of metal-oxide surge arresters (MOSA) is a key factor in substation voltage uprating. New MOSA have superior protective levels and capabilities of withstanding temporary overvoltage. This better performance, together with good grounding practices, makes it possible to substantially decrease the maximum overvoltage, maintain required BIL, and achieve clearance requirements.

If you like more information or have any question, please contact Ted Pejman, Electrical Engineer, Transmission Branch, at 202-720-0999 or tpejman@rus.usda.gov.

Keep Testing Your Underground Power Cable

The Underground Subcommittee of the NRECA's T&D Engineering Committee highly recommends that electric utility operators test underground cable they purchase. The Subcommittee recommends that the following tests be conducted at a minimum:

1. Dimensional analysis of all cable components;

2. Microscopic examination for voids, contaminants and protrusions; and

3. Insulation shield stripping test.

The Subcommittee also recommends that optional testing of Tree-Retardant Cross-Linked Polyethylene and Cross-Linked Polyethylene insulated cables include a Hot Oil Test to identify contaminant. To minimize cost, the Subcommittee does <u>not</u> recommend conductor shield and insulation shield resistivity tests because they consistently test well below maximum specifications.

Subcommittee recommended typical sampling rates are to test one sample, each, from the first and last reel on orders of 50,000 feet (15 km) or less and one sample for each additional 50,000 feet of cable ordered.

The Subcommittee recommends that purchasers instruct manufacturers to cut samples and send them to the selected testing laboratory, or the purchaser can cut the samples upon arrival of the shipment. The Subcommittee further recommended that purchasers notify suppliers in advance that cable testing will be conducted and purchasers should establish responsibilities and procedures in case of a failure, such as: Any evidence of noncompliance with the enclosed specifications shall be justification for:

1. Further testing at manufacturer's expense (each shipping reel);

2. Rejection of the tested reel and possibly the reels preceding and following in the manufacturing process; and

3. Rejection of the entire order, depending on the severity and frequency of noncompliance.

A list of possible independent testing laboratories provided by the Subcommittee includes:

Cable Technology Laboratories, Inc.
P.O. Box 708
690 Jersey Ave.
New Brunswick, NJ 08903
(908) 846-3220

Forster Electrical Engineering, Inc.
550 North Burr Oak Ave.
Oregon, WI 53575
(608) 835-9009

NEETRAC
62 Lake Mirror Road, Building 3
Forest Park, GA 30050
(404) 675-1817

All of these laboratories participate in the Cable Acceptance Testing Program promoted by NRECA's T&D Underground Subcommittee. The inclusion of a laboratory in this list does not imply endorsement by RUS. The testing laboratories listed above have voluntarily agreed to collect electric cooperative test data and provide it to the NRECA Underground Subcommittee annually for information and publication. To have your data included, note on your purchase order "INCLUDE IN COOPERATIVE DATA FILE." Cooperative names will not be published and participation is voluntary. The results of the Cable Acceptance Testing Program are included as Exhibit 1.

If you would like more information or have any questions, please contact Trung Hiu, Electrical Engineer, Distribution Branch, at 202-720-1877 or thiu@rus.usda.gov.

CableCURE

Several cooperatives have used the silicone injection rehabilitation product called CableCURE to prolong the life of URD cable. CableCURE is designed to be injected into either energized or de-energized cables. After injection (approximately forty-eight hours), CableCURE will polymerize with water presently in the cable and cure into a solid dielectric gel that prevents future water entry that causes splices and other components to fail. The product displaces water contamination and the production of hydrogen gas produced by electrolysis by filling and inhibiting existing water trees and diffuses into the insulation to retard future growth of water trees.

CableCURE may be applied to any primary insulated cable regardless of size or voltage rating. Due to its liquid property, CableCure's application and performance are most effective on insulated cables with stranded (rather than solid) conductors.

On January 18, 2000, the Federal Energy Regulatory Commission (FERC) approved the capitalization of CableCURE based upon the authentication provided by the distributor that CableCURE "… extends the service life of URD cable by at least 20 years." In addition, the licensed distributor, Utilx Corporation, guarantees the life extension function with a 20-year full money back warranty that runs from the date the cable is injected. The FERC concluded that this injection rehabilitation process meets the requirement of a substantial addition and, therefore, the cost is properly capitalized.

On May 22, 2000, based on the actions of the FERC, the Rural Utilities Service authorized the capitalization of the cost of CableCURE injected into underground cable. The labor and material costs incurred in the process should not, however, be recorded as a separated retirement unit in the Continuing Property Records (CPR's). The cost should be added to the existing cost of the cable units in the CPRs being injected with CableCURE. The cost of the injected cable should then be segregated into separate cable retirement units. In addition, RUS borrowers should consider the 20-year life extension of the injected cable when setting its depreciation rates.

RUS encourages cooperatives to share their experience applying this innovative product. If you would like more information or have any questions, please contact Mr. Trung Hiu, Electrical Engineer, Distribution Branch at (202) 720-1877 or thiu@rus.usda.gov. If you have any questions regarding the accounting for CableCURE, please contact the Technical Accounting and Auditing Staff at (202) 720-5227.

Magnesium Chloride as a De-Icing Agent

A number of state highway departments throughout the country have decreased the use of rock salt and sand on roadways and have increased the use of liquid magnesium chloride as a de-icer or anti-icer. The liquid magnesium chloride is sprayed on dry pavement prior to precipitation or wet pavement prior to freezing temperatures in the winter months to prevent snow and ice from adhering and bonding to the roadway. The application of anti-icers is utilized in an effort to improve highway safety. The use of this product seems to show an improvement in driving conditions during and after freezing precipitation yet it seems to be negatively affecting electric utilities.

Two main issues have been raised regarding the anti-icer magnesium chloride as it relates to electric utilities: contamination of insulators causing tracking and arcing across them, and corrosion of steel and aluminum poles and pole hardware.

The first issue in regard to magnesium chloride relates to the possible increase of outages and pole fires due to tracking and arcing across insulators. There are three cooperatives in Colorado that have seen an increase in outages and pole top fires that have been attributed to insulators becoming coated with magnesium chloride. The insulators become coated as vehicle traffic churns up the magnesium chloride into a fine mist that rises and settles on the pole hardware and insulators. As the solution builds up on the insulators the probability of tracking and arcing increases. An additional safety concern that borrowers should watch for is the possible effects on buckets and booms coated with this material as they may loose their dielectric integrity. Rain assists in removing some of the buildup but utilities have been forced to inspect and clean insulators with a soap and water mixture in certain areas where heavy buildup has occurred. This same inspection and cleaning method may be required for buckets and booms that have been exposed to the magnesium chloride anti-icer.

This is a costly and time-consuming process. In the March 23, 2001, issue of Electric Co-op Today, Jerry Lipson's article “New Winter Road Salt 'Burns' Colorado Co-op Lines” addresses this issue. In an effort to determine whether other cooperatives are experiencing similar problems, RUS asks borrowers to let RUS know whether they have any evidence of increased outages or pole fires in proximity to highways in areas where magnesium chloride is used.

The second issue, corrosion, may also be of concern to cooperatives. In the past, sodium chloride (rock salt) has been used as a de-icer and is known to be a corrosive product. Magnesium chloride is also known as a corrosive agent, but when utilized as a de-icer, other chemical agents are added to reduce and minimize this potential, but the corrosive attributes cannot totally be removed. State Highway departments indicate that they are seeing less evidence of corrosion to their trucks and equipment as well as the steel reinforcing bars inside concrete on roads and bridges when the magnesium chloride de-icer is used in comparison to sodium chloride. A concern still remains on its reaction with aluminum and galvanized steel poles, metal hardware and conductors. There has been some feedback from truckers stating that aluminum components and electrical systems in their vehicles are showing an increased corrosion rate. In an effort to determine whether the magnesium chloride de-icer is creating

corrosion problems on electrical equipment, RUS is requesting assistance by asking cooperatives to identifying whether any evidence of corrosion on electrical equipment used in proximity to highways is apparent in areas where this product is used. The amount of corrosion may depend upon the type of anti-corrosive agents added to the magnesium chloride de-icer as well as the chemical reaction to the material utilized by electric utilities.

RUS is requesting any information and experiences that the cooperative can share in regard to magnesium chloride and its effects upon their electric systems. If you have any information to share, would like more information or have any questions, please send the information or contact John Pavek, Chief, Distribution Branch, at 202-720-5082 or jpavek@rus.usda.gov.

Net Metering Considerations for Small-Scale, Consumer-Owned Generation

Currently, there are at least 30 states that allow some form of Net Metering for small-scale, consumer-owned, electrical generators. **Net Metering** in this instance means measuring the difference between the electricity supplied by an electric utility and the electricity generated by a consumer-owned generator that is fed back to the electric utility. Consumer interest in these states has also gone beyond the stage of deciding what type of self-generation to use to what type of credit can be obtained for producing ones' own electricity. These issues are being raised not only by consumers in remote areas, but also by those already connected to the local utility grid. All of this interest has caught the attention of state utility regulators.

Whether the subject is renewable energy resources (such as solar power, wind power, or small hydropower units) or the use of new technologies (such as microturbines or fuel cells), electric utility regulators around the country are being asked about Net Metering as a way of promoting energy independence. Many electric utilities are being requested to review their policies and to streamline the application process for Net Metering on behalf of residential and small commercial users of electricity. Getting credit at the meter and "spinning the meter backwards" are becoming popular slogans for this movement, even though standard kWh meters are not normally tested for accuracy when operating in the reverse direction.

For rural electric cooperatives, special inquiries on Net Metering are still infrequent. However, it is expected to be just a matter of time before additional residential and commercial members start asking the same questions. In that light, RUS is currently drafting some "preliminary" guidelines for rural electric cooperatives who have residential and/or small commercial members wishing to connect an electrical power generating source, rated **10 kW or less**, single-phase or rated **30 kW or less**, three-phase to a radial distribution feeder circuit in a rural area. These guidelines are being developed to provide a common starting point for discussions between a **Local Distribution Utility (LDU)**, who owns the electric distribution lines and the consumer or member requesting permission to interconnect and operate its own small, electric generating facility (**Consumer-Generator**).

The guidelines being developed will be based upon the following conditions:

1. The physical facilities of the specific **Consumer-Generator** must be located on the consumer's premises;

2. The electrical power, to be self-generated, must be intended by written agreement to offset part or all of the specific consumer's electrical requirements;

3. The technical requirements for satisfactory parallel operation of the facilities must be agreed upon and certified by both parties prior to initial operation; and

4. The proposed Net Metering installation should abide by those regulations that may be imposed by the state's Public Utility Commission (PUC) or Public Service Commission (PSC) in regards to electric utility deregulation and other issues concerning wholesale power providers.

The technical guidelines under development will not establish any commercial or cost-sharing agreement as such agreements which will be up to each rural electric utility to decide.

For those cases where the **LDU** is not the consumer's designated energy supplier, the **Consumer-Generator** would most likely be responsible for notifying its current energy supplier of its proposed installation. Those parties may then decide to sign a contract to sell any excess or surplus power under such conditions that may already be established by the state's PUC or PSC. Whether there is a monthly or an annual true-up of energy supplied or energy credited to the **Consumer-Generator** is another aspect of Net Metering installations to be decided by the appropriate state commission. In any case, rural electric utilities should closely coordination their requirements for Net Metering with those being established by the state utility regulators.

Each rural electric utility is encouraged to research, develop and standardize on technical guidelines (with due consideration given to any national or state standards being developed) on Net Metering, Distributed Generation, and other requirements of interconnecting consumer-owned generation to a local power grid. All that these draft guidelines are intended to do is to help identify key technical issues and important procedures that are necessary to interconnect small-scale, electrical power generation on radial distribution lines operating under 25 kV or below. In this case, small-scale would be defined as units being rated 30 kW or less. Unique applications of self-generation or interconnections of larger units directly to transmission facilities would be beyond the scope of these proposed guidelines.

Some of the common principles being used in developing guidelines on Net Metering, Distributed Generation, and all proposed interconnections of **Consumer-Generators** include the following:

1. The interconnection shall not pose any safety hazard to other consumers, the general public, or utility operating personnel.

2. The interconnection shall not compromise the reliability of the local power system, shall not restrict normal operations, and should not degrade power quality below acceptable levels.

3. The interconnection process should provide fair and equitable access for all **Consumer-Generators** and should be no more costly or complicated, as is necessary, to address the concerns of each party.

4. The development of **IEEE P1547**, Draft Standard for Distributed Resources Interconnected with Electric Power Systems, should be followed to help define common terms and requirements that are universally needed to insure technically sound interconnections.

From our tentative review of Net Metering requirements in California, Texas, Montana, Arizona, Maine, New York, Pennsylvania and other states, it appears that a standardized application, a written agreement between the consumer and the utility, and a specific technical requirements addendum for interconnections are being developed to expedite Net Metering requests. Certain state utility regulators are also suggesting that timetables be established for documenting and processing such applications in a timely manner.

As more information becomes available, we will keep you informed. If you would like more information on the draft guidelines for Net Metering or have any questions, please contact Ray Secosky, Electrical Engineer, Northern Regional Division at 202-720-1379 or rsecosky@rus.usda.gov.

RUS PUBLICATIONS

RUS Bulletin 1724E-300, Design Guide for Rural Substations.

RUS published Bulletin 1724E-300, "Design Guide for Rural Substations," on June 7, 2001. This bulletin is the only comprehensive publication of its kind in the industry specifically oriented toward rural substations. It is an excellent reference of fundamental engineering guidelines, minimum requirements and basic recommendations. The subject area includes electrical, mechanical, and structural aspects of substation construction as well as sections on layout, major equipment and maintenance.

This Bulletin has been distributed to the RUS borrowers and general public in compact disc (CD) format. Hard copy version will not be offered.

The new substation manual is now available on the Electric Program Bulletins page at:

http://www.usda.gov/rus/electric/bulletins.htm

This bulletin replaces REA Bulletin 65-1, "Design Guide for Rural Substations," that was published in 1978. All sections of the manual have been updated in accordance with equipment and design concepts in use today. It covers updated references to the latest standards, including the National Electrical Safety Code (NESC), Institute of Electrical and Electronics Engineers (IEEE), American National Standards Institute (ANSI), National Electrical Manufacturers Association (NEMA), American Society of Civil Engineers (ASCE), International Conference of Building Officials (ICBO), and American Society for Testing Materials (ASTM). Also updated are references to the latest RUS Bulletins and Regulations.

This revision also includes new material discussing recent advances in substation automation, data acquisition, and communications systems for application inside the substation environment. New material included discusses how modern substation automation options affect the choice of substation instrumentation, transducers, metering, relaying, and wiring. The manual provides sufficient information for the engineer to choose wisely among various combinations of transducers, meters, relays, intelligent electronic devices, remote terminal units, data concentrators, programmable logic controllers, various substation communications media, such as copper wires, fiber-optics, and wireless options, and substation local area network options.

Additional information is also included on topics such as low-profile construction techniques, improved insulation materials, alternative grounding methods, and modern protective relaying. Also included are discussions on various updates to equipment, such as SF6 breakers, metal oxide arresters, capacitors, and transformers. Also discussed is the concept of reliability-centered maintenance.

If you like more information or have any question, please contact Mike Eskandary, Electrical Engineer, Transmission Branch, at 202-720-9098 or meskanda@rus.usda.gov.

RUS Bulletin 1724E-214, Guide Specification for Standard Class Steel Transmission Poles.

In July 2001, RUS published Bulletin 1724E-214, "Guide Specification for Standard Class Steel Transmission Poles." This guide specification provides a basis for procuring direct embedded standard class steel poles for transmission lines. If poles are competitively bid, use of this specification will help to eliminate ambiguities, which might arise in the evaluation process.

This purchase specification covers the technical aspects of design, materials, manufacturing, inspection, testing, and delivery of direct embedded standard class steel poles. It is recommended

that this specification be limited to poles that are not guyed, not subjected to unbalanced lateral loads, or do not have deflection limitations or other special limitations. While this standard class steel pole specification does not prohibit the application to poles that are guyed, that are subjected to unbalanced lateral loads, or have deflection or other special limitations, the owner must be prudent in this type of application. For steel pole applications that will include these design concerns, it is recommended that the owner use Guide Specification for Steel Pole and H-Frame Structures, RUS Bulletin 1724E-204.

Standard Class Poles

In some cases, utilities prefer to specify certain steel poles to be designed according to a standardized loading criterion, much like the classifications for wood poles.

RUS Bulletin 1724E-214 and the specifications it includes was developed to establish a standard classification system and to assist the owner in procuring a standard class steel pole that is properly designed for the intended loading criteria. Since it has become a widespread practice in the industry to design and manufacture poles that are based on the wood pole classification system of the American National Standards Institute (ANSI 05.1), the steel pole classifications developed in this specification generally follow the wood pole classification system. However, to avoid confusion with the wood pole classifications, the steel pole classifications have been assigned a unique naming system. The standard classes of steel poles are found in Table 1, which follows.

TABLE 1
Strength Requirements

Standard Class Designations For Steel Poles	Minimum Ultimate Moment Capacity At Five Feet From Pole Top (Ft.-Kip)	Tip Load (Lbs.)
S-12.0	96	12,000
S-11.0	88	11,000
S-10.0	80	10,000
S-09.0	72	9,000
S-08.0	64	8,000
S-07.1	57	7,125
S-06.2	50	6,250
S-05.4	44	5,450
S-04.7	38	4,700
S-04.0	32	4,000
S-03.4	27	3,375
S-02.8	23	2,825
S-02.3	19	2,325
S-01.9	15	1,875

In some cases, the owner may design a transmission line based on wood pole classifications as described in ANSI 05.1 and then wish to order steel poles which meet the wood pole equivalent loadings. Because of the differences in overload factors applied to wood poles in comparison to steel poles, the owner must be sure that the overload factors are properly accounted for in the design of the steel poles.

"Wood pole equivalency" is a term that may be defined in a number of ways. For purposes of this commentary, the term "wood pole equivalent" is defined as a standard class steel pole, which is equated by the required ultimate loading to an ANSI 05.1 standard class wood pole. The equation is made by a ratio of the overload factors applicable for each pole type and loading criteria.

For further information concerning wood pole equivalency and for design examples, see the 2000 Items of Engineering Interest or Bulletins 1724E-214 or 1724E-216. In general when using the concept of standard class steel poles, the designer may avoid the confusing concept of wood pole equivalency by using the procedure below to select the standard class pole from the table above:

- Calculate the design moment expected to be induced in the pole from the applied loads (with overload factors applied).
- Determine the equivalent tip load for this moment; and
- Select the pole from Table 1 of the Specifications. (Remember: In utilizing standard class steel poles, a complete structural analysis is still required for all structures. All appropriate loading criteria are considered in the analysis. Once the required steel pole strength is determined, a standard class steel pole that meets the actual loading conditions can be selected).

RUS Recognition and Acknowledgment Issuance of RUS Bulletin 1724E-214 is the result of considerable effort of the Transmission Subcommittee of the NRECA T&D Engineering Committee. Committee members include:

1. Dominic Ballard, **East Kentucky Power Coop.,** Winchester, KY
2. John Burch, **Florida Keys Electric Coop.,** Tavernier, FL
3. Doug Emmons, **Hoosier Energy REC,** Bloomington, IN
4. Donald Heald, U.S.D.A, **Rural Utilities Service,** Washington, D.C.
5. Bill Hetherington, **Lee County Electric Coop.,** North Fort Myers, FL
6. Robert Johnson, **Arkansas Electric Coop.,** Little Rock, AR
7. Charles Lukkarila, **United Power Association,** Elk River, MN
8. Charles McCall, **Georgia Transmission Company,** Tucker, GA
9. Norris Nicholson, U.S.D.A, **Rural Utilities Service,** Washington, D.C.
10. Robert Oldham, **Southern Maryland Electric Coop.,** Hughesville, MD
11. Art Smith, **Patterson & Dewar Engineers,** Decatur, GA
12. John Twitty, **Alabama Electric Coop.,** Andalusia, AL
13. David Turner, **Lower Colorado River Authority,** Austin, TX

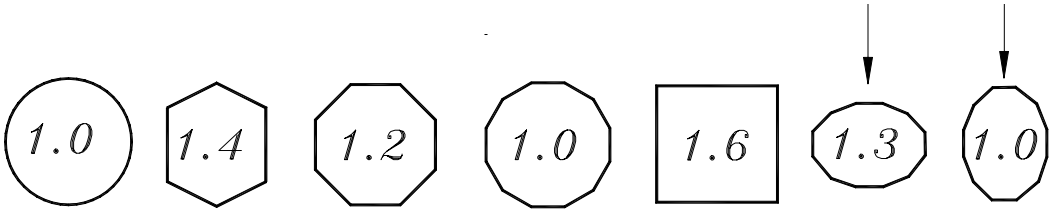
RUS wishes to express special thanks to the following persons of the working group of the Transmission Subcommittee:

- Bob Oldham
- John Twitty
- Charles ‘Bubba’ McCall
- Art Smith

If you would like more information or have any questions, please contact Don Heald, Structural Engineer, Transmission Branch, at 202-720-9102 or dheald@rus.usda.gov.

Revision to RUS Bulletin 1724E-204, Guide Specifications for Steel Single Pole and H-Frame Structures

RUS will be revising Bulletin 1724E-204, Guide Specifications for Steel Single Pole and H-Frame Structures. The drag coefficients defined on Page 3 of this bulletin will be changed to reflect Rule 252.B.2 of the National Electrical Safety Code. For poles composed of numerous narrow relatively flat panels that combine to form a total cross section that is circular or elliptical in shape, wind loads are to be computed using a shape factor of 1.0. As such, the following drag coefficients will be shown for the shapes shown below:



If you would like more information or have any questions, please contact Donald Heald, Structural Engineer, Transmission Branch, at 202-720-9102 or dheald@rus.usda.gov.

Drawing Number Conversion for RUS Bulletin 1728F-803 (D803)

In December 1998, RUS published Bulletin 1728F-803, "Specifications and Drawings for 24.9/14.4 kV Line Construction." Since the first printing of this bulletin, users have identified several errors and raised questions about some provisions that were in need of RUS comment. RUS addressed the errors and provided comments in the 1999 and 2000 issues of the Summary of Items of Engineering Interest (IEI). The "Errata and Comments to Bulletin 1728F-803" in the July 1999 issue of the IEI can be found on Pages 4 and 5 and 41 through 53. Additional Bulletin 1728F-803 corrections can be found in the August 2000 issue of the IEI on Pages 16, 17 and 53. Past issues of the IEI can be found at the RUS web-site at:

http://www.usda.gov/rus/electric/engineer.htm

RUS received additional comments since the last IEI publication in regard to the new drawing numbering system used in this revised bulletin. Most comments received were related to the burden the numbering system places on current computer systems borrowers maintain.

In response to these numbering concerns, RUS issued a March 7, 2001, memorandum to all electric borrowers. The memorandum provided a conversion chart that detailed some approximately 140 new Bulletin 1728F-803 drawings that carried over from old Bulletin 50-5. The purpose of the memorandum was to announce that borrowers could opt to use either the new drawing number or to continue using the old drawing number for these approximately 140 drawings, providing borrowers incorporated some minimal materials updates. The conversion

chart in the earlier memorandum was identified as Table A, "Allowed Dual Numbered Construction Assemblies and Guide Drawings for RUS Bulletin 1728F-803." This numbering elective was in the hopes of easing the burden of changing files, records, computer programs and allowing borrowers and their employees to more gradually learn the new construction assembly units, their numbering, and the updated RUS assembly numbering scheme.

RUS has subsequently received numerous requests for clarifications of a number of the drawings in Table A and for development of another conversion chart that thoroughly detailed the disposition of all the old Bulletin 50-5 drawings with respect to the new Bulletin 1728F-803 drawings. Borrowers reflected that the additional information was needed to ease the burden of changing from the old system to the new system and maintain the proper categorization for retirement accounting.

In response to all these requests, RUS revised and re-titled "Table A-Conversion Table: 25 kV Drawings in RUS Bulletin 50-5 vs. RUS Bulletin 1728F-803." This revised table supercedes the Table A included with our March 7, 2001, memorandum. This new table accounts for each old assembly number with respect to the new bulletin drawings and includes, in bolded font, clarified details of the approximate 140 drawings for which borrowers can use the new drawing number or the old drawing number, subject to implementing the indicated material additions.

RUS sent the new Table A to all borrowers and borrowers' consultants in a July 2, 2001, memorandum. For your convenience and information, the new Table A is repeated here as Exhibit 2.

If you would like more information or have any questions, please call Jim Bohlk, Electrical Engineer, Distribution Branch, at (202) 720-1967 or email at jbohlk@rus.usda.gov.

Errata and Corrections to RUS Bulletin 1728F-803 (D-803)

Table AN and Table VII, attached as Exhibits 3 and 4, respectively, provide corrections that RUS borrowers need to make in the December 1998, issuance of RUS Bulletin 1728F-803 entitled, "Specifications and Drawings for 24.9/14.4 kV Line Construction."

Table AN (Exhibit 3) designates the assembly number and, in the column to the right of the assembly number, lists corrections required with informative comments provided in italics. These corrections include all corrections of which RUS is presently aware. Table AN aggregates new corrections and corrections provided in the 1999 and 2000 issues of RUS' "Items of Engineering Interest."

The second table (Exhibit 4), "TABLE VII, Maximum Line Angles on Spool Insulator Assemblies," replaces and corrects Table VII, which is located at the beginning of Index N of Bulletin 1728F-803. The original table used an unintended value (1,500 lbs. per conductor) for the designated maximum transverse load for ANSI Class 53-4 spool insulators. The maximum transverse load value for ANSI Class 53-4 spool insulators is 2,250 lbs. per conductor, which is

fifty percent of the mechanical/electrical (M&E) strength for this class of insulators. Thus, all of the line angles listed in the original table are incorrect; the angles are smaller than they need to be. The attached Table VII has the correct designated maximum transverse load value entered and the correct resulting (larger) calculated line angles. Please make copies of the attached table and replace TABLE VII in each copy of Bulletin 1728F-803.

If you would like more information or have any questions, please call Jim Bohlk, Electrical Engineer, Distribution Branch, at (202) 720-1967 or email at jbohlk@rus.usda.gov.

RUS Technical Publications

RUS has issued a number of technical publications recently. These publications include:

RULES:

- **7 CFR 1710, Subpart E, "Load Forecasts and Market Analysis."** This final rule, published March 20, 2000, changed RUS' load forecasting regulations. The changes are intended to reduce the overall administrative burden of reporting load forecasts to RUS. The changes will also allow RUS to accept less detailed analysis for smaller borrowers.

  For more information, please contact Georg Shultz of ESD at 202-720-1920 or gshultz@rus.usda.gov.

- **7 CFR 1710, Subpart H, "Demand Side Management and Renewable Energy Systems."** This proposed rule, dated April 25, 2001, would eliminate Subpart H in its entirety . The existing subpart H details separate policies and requirements for loans for renewable energy systems and demand side management. Many of these requirements overlap provisions found elsewhere in part 1710. Others do not seem well suited for the smaller scale projects of the type that are becoming increasingly common in the industry. RUS believes that it is more appropriate to consider such small scale projects in this rapidly developing segment of the energy industry by proceeding on a case-by-case basis.

  For more information, please contact Georg Shultz of ESD at 202-720-1920 or gshultz@rus.usda.gov.

- **7 CFR 1724, "Electric Engineering, Architectural Services and Design Policies and Procedures."** This final rule, published October 23, 2000, revised the requirements regarding RUS approval of plans and specifications for buildings. The requirement for RUS approval of architectural plans and specifications for buildings has been eliminated and instead the borrower's architect or engineer is required to state that the design complies with certain specific standards.

  For more information, please contact Fred Gatchell at 202-720-1398 or fgatchel@rus.usda.gov.

- **Bulletin 1728F-806, "Specifications & Drawings for Underground Electric Distribution"** (incorporated by reference). The final rule covering the revision of this bulletin was published on May 26, 2000. This is an update of an existing bulletin, which was known as Bulletin 50-6 with the same title.

  This bulletin provides the specifications and drawings that are to be used by borrowers in the construction of underground distribution facilities. It is one of the RUS standards that help borrowers build safe, reliable, and economical electric facilities in rural America.

  We have made a number of changes to this bulletin, including the addition of two new drawings (UC2-1 and UC2-2) which provide alternative construction arrangements for the interface between overhead and underground facilities. We have also deleted 23 drawings and the URD Inspection Form, which are obsolete and no longer needed.

  We have also incorporated a number of design changes in the drawings, including some that were recommended by the Underground Subcommittee of the NRECA T & D Committee and some suggestions that we received through the public comment process. We have also revised some of the clearances to conform to the latest code requirements.

  We have updated the references to the referenced codes, specifications and standards to reflect the latest editions of these documents. Changes to a number of drawings showing caution, warning, and danger signs were needed to reflect the latest codes and standards concerning signs. Finally, we have revised or redrawn a number of drawings for greater clarity and ease of use.

  For more information, please contact Trung Hiu of ESD at 202-720-1877 or thiu@rus.usda.gov.

- **7 CFR Part 1792, Subpart C, "Seismic Safety of Federally Assisted New Building Construction."** This final rule, published December 8, 2000, revised the existing regulations concerning seismic safety. This revision updated and simplified the seismic safety requirements for new building construction using RUS or Rural Telephone Bank (RTB) loan, grant, or guaranteed funds or funds provided through lien accommodations or subordinations approved by RUS or RTB.

  The Earthquake Hazards Reduction Act of 1977 and its associated Executive Order require that federally assisted new building construction meet certain seismic safety standards. These requirements are intended to reduce risk of loss of life and property damage caused by earthquakes. The Interagency Committee on Seismic Safety in Construction and the National Earthquake Hazards Reduction Program (NEHRP) have been created to coordinate these efforts. 7 CFR Part 1792, Subpart C, which was originally issued in 1993, implements these requirements for RUS.

  This revision changes the list of acceptable model codes and standards that new buildings need to conform to in order to meet seismic provisions. In order for a model building code to be acceptable, the code must contain requirements equivalent to the 1994 NEHRP

Recommended Provisions. The 1997 ICBO Uniform Building Code (UBC) and ASCE 7-95, Minimum Design Loads for Buildings and Other Structures, have been found to be acceptable for seismic safety purposes.

This revision also eliminates the post-construction seismic certification and simplifies the requirements concerning the acknowledgement that the seismic safety provisions of the applicable model code are incorporated in the design of the building.

For more information, please contact Don Heald at 202-720-9102 or dheald@rus.usda.gov.

GUIDANCE DOCUMENTS:

- **RUS Bulletin 1724D-101B, "System Planning Guide, Construction Work Plans,"** dated October 31, 2000. This bulletin provides guidance to borrowers and engineers in the preparation of Construction Work Plans (CWP's) for electric distribution systems. A CWP is the documented results of an engineering study which has determined all of the new construction required to provide adequate and reliable electric service during the planning period. A CWP is used as an engineering support document for a loan application, as a component of ongoing integrated system planning, and as means for specifying and documenting plant requirements for the next 2 to 4 years.

  The following significant changes were made during the update of this bulletin:

  * The "Model Construction Work Plan", a simplified sample work plan included in the previous issue, was deleted so that writers of CWP's will not be influenced to limit the creativity, scope, content or format of their studies and reports.

  * Distribution system design criteria advocated by RUS relating to voltage, thermal loading, and reliability were added to this bulletin.

  * RUS advocates that alternative solutions to large, costly, construction projects recommended in CWP's be economically evaluated and compared using a procedure such as is described in RUS Bulletin 1724D-104, "An Engineering Economics Computer Workbook Procedure."

  For more information, please contact Jim Bohlk of ESD at 202-720-1967 or jbohlk@rus.usda.gov.

- **Bulletin 1724D-112, "The Application of Shunt Capacitors to the Rural Electric System,"** dated April 27, 2001. This bulletin examines the application of shunt capacitors on rural distribution systems and serves as a general guide for capacitor applications to RUS borrowers and others. The System Planning Subcommittee of NRECA's T&D Committee has been instrumental in the development of this bulletin.

This is an update of an existing bulletin, which was known as Bulletin 169-1 with the same title.

For more information, please contact Chris Tuttle of ESD at 202-205-3655 or ctuttle@rus.usda.gov.

- **Bulletin 1724E-153, "Electric Distribution Line Guys & Anchors,"** dated April 25, 2001. This guide bulletin provides information needed to properly design guying for conductors attached to wood distribution poles. To this end, the bulletin contains data, equations, and sample calculations. The bulletin also contains information regarding standard RUS anchor and guying assemblies and their component parts to assist the user in the proper selection and installation of these assemblies.

  For more information, please contact Jim Bohlk of ESD at 202-720-1967 or jbohlk@rus.usda.gov.

- **Bulletin 1724E-214, "Guide Specification for Standard Class Steel Transmission Poles,"** dated July 2, 2001. This guide specification provides a basis for procuring direct embedded standard class steel poles for transmission lines. For more information, see the article of the same title included in this issue of the Items of Engineering Interest.

  For more information, please contact Don Heald of ESD at 202-720-9102 or dheald@rus.usda.gov.

- **Bulletin 1724E-216, "Guide Specification for Standard Class Spun Prestressed Concrete Poles,"** dated July 6, 2000. This guide specification provides a basis for procuring direct embedded standard class spun prestressed concrete poles. If poles are competitively bid, use of this specification will help to eliminate ambiguities which might arise in the evaluation process.

  This purchase specification covers the technical aspects of design, materials, manufacturing, inspection, testing, and delivery of direct embedded standard class spun prestressed concrete poles. It is recommended that this specification (1724E-216) be limited to poles that are not guyed, not subjected to unbalanced lateral loads, or do not have deflection limitations or other special limitations. For concrete pole applications that are subject to these considerations, it is recommended that the owner use RUS Bulletin 1724E-206, "Guide Specification for Spun, Prestressed Concrete Pole and Concrete Pole Structures."

  For more information, please contact Don Heald of ESD at 202-720-9102 or dheald@rus.usda.gov.

- **Bulletin 1724E-300, "Design Guide for Rural Substations,"** dated June 7, 2001 This bulletin provides basic information for the design engineer concerning all aspects of substation design. This is an update of an existing bulletin, which was known as

Bulletin 65-1 with the same title. For more information, see the article of the same title included in this issue of the Items of Engineering Interest.

For more information, please contact Mike Eskandary of ESD at 202-720-5082 or meskanda@rus.usda.gov.

- **IP 100-1, "Rural Electrification Act of 1936,"** published in May, 2001. This document details the Rural Electrification Act, with amendments through December 31, 2000, along with sections giving the chronology of the Act and guidelines to the provisions of the Act.

  For more information, please contact Robin Meigel of ESD at 202-720-9452 or rmeigel@rus.usda.gov.

- **IP 202-1, "List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers,"** published in July, 2001, and its quarterly supplements. This document provides a convenient listing of the materials and equipment that have been accepted by RUS.

  For more information, please contact Harvey Bowles of ESD at 202-720-0980 or hbowles@rus.usda.gov.

If you need any of these publications, please contact RUS' Program Development and Regulatory Analysis staff at 202-720-8674. Many RUS publications are also available via the Internet at:

For Rules: **http://www.usda.gov/rus/electric/regs.htm**

For Bulletins: **http://www.usda.gov/rus/electric/bulletins.htm**

PUBLICATIONS IN PROGRESS

Timber Specifications: RUS is in the process of revising the following three bulletins that cover pressure treating of poles and crossarms, and their respective quality control:

- **Bulletin 1728F-700, "RUS Specification for Wood Poles, Stubs and Anchor Logs,"**

- **Bulletin 1728H-701, "RUS Specification for Wood Crossarms (Solid and Laminated) Transmission Timbers and Pole Keys"** (7 CFR 1728.201), and

- **Bulletin 1728H-702, "RUS Specification for Quality Control and Inspection of Timber Products"** (7 CFR 1728.202).

Topics currently being considered for revision include:

- Elimination of the requirement for borrowers to notify RUS of their timber product purchases during the previous year,
- Reinstatement of the acceptance and listing of inspection agencies in the RUS List of Materials,
- Requirement for a heat sterilization during kiln drying or steam conditioning of poles,
- Requirement for inspection agencies to have their company designation branded or tagged on the pole face,
- Requirement for all independent inspectors and plant quality control personnel to be trained and certified by x-ray fluorescence instrument manufacturer,
- Requirement for treating plants and inspection agencies to maintain certain levels of liability insurance and errors and omission insurance, and
- Include butt treating of cedar poles as an acceptable method of treatment for poles.

RUS is soliciting input from electric borrowers and others as to necessary changes to these bulletins. Comments or suggestions should be sent to H. Robert Lash, Chief, Transmission Branch, RUS, Stop 1569, 1400 Independence Ave SW, Washington, DC 20250-1569, E-mail: blash@rus.usda.gov. All comments are welcome.

RUS is also working on the following publications:

- **Bulletin 1724D-114, "Voltage Regulator Application on Rural Distribution Systems."** This bulletin will examine the application of voltage regulators on rural distribution systems and serve as a general guide for voltage regulator applications to RUS borrowers and others.

  For more information, please contact John Pavek of ESD at 202-720-5082 or jpavek@rus.usda.gov.

- **Standard Contract Forms.** RUS is planning to update, consolidate, and streamline our standard forms of contracts. This would include the elimination of unneeded forms, making forms suitable for "subject to" or "not subject to" RUS approval, making construction contract forms suitable for "labor only" or "labor and material," standardizing tables and information pages and incorporate them as separate attachments, maximizing consistency among forms, and updating and clarifying contract provisions as necessary. These changes are being made to improve the usefulness of the standard forms of contract.

  For more information, please contact Fred Gatchell of ESD at 202-720-1398 or fgatchel@dus.usda.gov.

If you would like more information or have any questions, please call Fred Gatchell, Deputy Director, Electric Staff Division at (202) 720-11398 or email at fgatchel@rus.usda.gov.

ADMINISTRATIVE and OTHER

RUS 2002 Electric Engineering Seminar

RUS is planning to hold its 2002 Electric Engineering Seminar on March 5 and 6, 2002, in Dallas, TX, in conjunction with NRECA's TechAdvantage 2002. The RUS Electric Engineering Seminar attracts engineers and other technical personnel from throughout the rural electric community. The seminar will explore the latest developments in the electric utility industry as they relate specifically to rural America and RUS' role. Some of the topics being considered include distributed generation from biomass as well as more conventional fuels, investigation and evaluation of various kinds of power quality problems, and applications of new materials (e.g., polymer insulators, fiberglass crossarms, etc.,) and equipment for rural electric systems. The seminar will also update participants concerning various RUS activities and the National Electrical Safety Code.

NRECA's TechAdvantage 2002 includes two broad topic areas - Engineering/Operations and Materials Management, so procurement personnel as well as the engineering and operations personnel are attracted to this multi-track conference. Some of the topics being considered include preparation and implementation of a technology plan to integrate and coordinate digital information into a viable enterprise-wide information system, e-commerce, and sessions covering some of the basics of rural electric utility engineering and procurement practices for those who are new to the program. Also included in this program is the Expo, a gathering of hundreds of vendors and suppliers where the participants can see, touch, and understand some of the latest equipment and services available.

If you would like more information or have any questions, please contact Fred Gatchell, Deputy Director, Electric Staff Division, at 202-720-1398 or fgatchel@rus.usda.gov.

The RUS Website

The World Wide Web is the gateway to the information highway. The use of a personal computer that is connected to the World Wide Web enables one to easily find and retrieve data, rules, regulations, periodicals and other publications. The Rural Utilities Service maintains a website that serves its borrowers and others interested in the rural utility infrastructures. The website is not static, but rather it is dynamic, sometimes changing almost daily, to provide up-to-date information. The RUS Website is found at:

http://www.usda.gov/rus

The Electric Staff Division has responsibility for the Electric Program portion of the website. This allows us to better respond to your needs and to post information to the webserver in a more timely fashion. The Electric Program home page is found at:

http://www.usda.gov/rus/electric

To help you navigate around the Electric Program web pages, the home page provides a description of the various pages.

Visit the Loans/Rates page which provides a "thumbnail sketch" of the Electric Program's loan offerings and includes a table showing municipal rates for the current quarter. This page is updated at the beginning of each quarter. Although this information is printed in the Federal Register, it is available first on the RUS website. The Treasury and FFB loan program rates are updated daily.

The Service page provides an overview of the Electric Program, its customer – oriented program delivery, outlines the various divisions and their roles, and provides "box scores" of the Electric Program's current Fiscal Year loan program. The box score is updated at the beginning of each month.

Have you wanted to contact RUS, but did not know where to start? The Contacts page starts off with the office of the Assistant Administrator. Each division – Northern Regional Division, Southern Regional Division, Power Supply Division, and the Electric Staff Division – has a listing of the staff within that division. You may also select a particular state to see a listing of the staff responsible for that state. These pages include staff names, titles, phone numbers, fax numbers, and E-mail and postal mail addresses.

The Regulations page contains RUS regulations affecting electric borrowers as well as proposed regulations that are open for public comment.

The Bulletins page contains RUS Electric Program bulletins in various formats – Word, PDF, text, and HTML. New bulletins are generally available on the website prior to the printed copies being distributed.

Looking for engineering information? Check out the Engineering page. It contains various items of interest to the rural electric engineering community.

A number of forms are available in Excel format on the Forms page thanks to the Southern Regional Division. Also available are various model documents used in your loan package. There are also links to the RUS Forms 7 and 12 data collection support and Frequently Asked Questions pages.

Do you need a copy of the latest List of Materials? Check out the List of Materials page. The List is available in Adobe Acrobat PDF format and is updated after every meeting of the Technical Standards Committees. The file includes bookmarks and links to help you find what you are looking for. We hope to convert the List to a database format in the near future. This will provide search and query capability and you should be able to link to it from other software.

Have you ever thought about putting your talents to use for RUS or know someone that would? Consider working for the Rural Utilities Service. Check the Employment Opportunities page for RUS vacancy announcements.

As you leave the Electric Program web pages, the Exit/Links pages provide you with a borrower directory, broken down by state, with links to a number of RUS electric borrowers, as well as electric industry and government resources, including state commissions, Federal agencies, and other sites of interest.

Do your kids know about RUS? Invite them to look at the RUS "kids page" - http://www.usda.gov/rus/educate.htm and meet Rus the Surfin' Squirrel. There are safety tips, games, as well as other information about the RUS programs.

Be sure to check out the rest of the RUS website for information about the other RUS programs - Telecommunications Program (including the RUS Distance Learning and Telemedicine Grant and Loan Program) and the Water and Environmental Programs.

The RUS Electric Program website is a work in progress. It is in a state of constant revision. Check it often. Also, check our "What's New" page to learn of recent changes to the website. If you have trouble finding what you want, send an e-mail to: electric@rus.usda.gov.

Please include your name, e-mail address, telephone number, and company affiliation in the body of your message so that we may be able to contact you for additional information, if necessary. The RUS website is your website and we want to provide the information you need. Please provide us with your suggestions.

If you would like further information or have any questions, please contact Harvey Bowles, Chair, Technical Standards Committee "A" (Electric), at (202) 720-0980 or hbowles@rus.usda.gov.

New T & D Engineering Subcommittee on Power Quality

In 1991, NRECA established its Transmission and Distribution Engineering Committee (T&D Committee) to work with RUS (then REA) in the development and maintenance of electric transmission and distribution standards and specifications, and the exchange of engineering information of mutual interest to rural electric utilities. Currently there are over 75 cooperative engineers, purchasing professionals, and consultants devoting time and energy on the seven active subcommittees. There is also an RUS representative on each subcommittee.

We want to use this opportunity to thank these individuals and the organizations that sponsor their participation. See Appendix B for the T&D Committee Roster.

The newest T&D Subcommittee is working on the topic of power quality. At the July subcommittee meeting in Tennessee, Harold Taylor of Georgia Transmission Corporation was selected as the Chair, Brian Coate of Tipmont REMC was selected as the Vice Chair, and Jim Newberg of Missoula Electric Co-op was selected as the Recording Secretary. John Pavek is the RUS Representative and Bob Saint is the NRECA representative.

Advances in technology, growing dependence on electronic equipment in both the business and individual consumer sector, has brought the necessity of utilities to deliver consistent, high quality power to its consumers. There are many challenges that the cooperatives must overcome to meet the consumer's expectations and this subcommittee is being developed to address the power quality issues.

The power quality subcommittee will cover areas in which power quality problems can occur covering reliability, voltage regulation and disturbances. These areas will cover faults, deviations in acceptable voltage magnitudes and waveform, harmonics, transients, surge suppression and other "electrical noise" reliability indices. The subcommittee may also examine issues such as benefits of AMR and the challenges on aging plants and its effects on power quality and reliability.

Volunteers on the subcommittee will be expected to participate in two meetings annually and the full committee will meet once a year. Each subcommittee will meet at least one other time during the year, most likely in conjunction with other meetings of interest. The initial Power Quality subcommittee meeting was conducted July 18-19 in Tennessee.

Initial slots for members of power quality subcommittee have been filled, but if there are areas in which there is concern, you can e-mail them to either John Pavek at jpavek@rus.usda.gov or Bob Saint at robert.saint@nreca.org. Although this subcommittee is filled, there are other subcommittees that could use members. The subcommittees are Materials, Overhead

Distribution Lines, Substation, System Planning, Transmission Lines and Underground Distribution. You can visit the TechNet web site for more information at NRECA's site:

http://technet.nreca.org

If you would like more information or have any questions, please contact John Pavek, at 202-720-5082 or jpavek@rus.usda.gov.

Effective Use of RUS Contracting Procedures for Distribution Construction

Congress and the American taxpayer expect RUS to see that RUS loan and loan guarantee funds are used efficiently, effectively and fairly. To this end, RUS issues policies and procedures that encourage competitive bidding as much as possible. Competitive bidding generally results in the lowest cost and treats contractors fairly, allowing equal opportunity where all qualified contractors can benefit from RUS program funds. RUS also issues standard contract forms to promote efficiency through uniformity and familiarity in contract documents. The RUS contracting procedures help ensure that the Government and the rural consumers are getting the maximum benefit from their investment in the rural infrastructure.

RUS' Electric Program construction contracting policies and procedures are included in the Code of Federal Regulations (CFR) under 7 CFR Part 1726. A tabular summary of some of the key provisions and dollar limits of 7 CFR 1726 follows this material. For answers to some of the frequently asked questions about 7 CFR 1726, see RUS Bulletin 1726-601, "Electric System Construction Policies and Procedures - Interpretations," available at:

http://www.usda.gov/rus/regs/bulls/1726-601.pdf

Bidding Distribution Construction

For many years, Formal Competitive Bidding (FCB) has been a mainstay of the rural electric distribution construction program. This procedure, which involves publicly opened bids from prequalified bidders, generally results in very competitive pricing. It is generally perceived as an open and fair system where all bidders are treated equally and the owner gets the benefit of the lowest cost for the work.

For most borrowers, FCB is the best choice for most of their construction work. A well planned and well managed construction program will include time for preparation of definitive bidding documents, time for identification of a reasonable number of qualified and interested bidders, and time for those bidders to prepare solid, competitive bids. Over the long haul, a well run FCB process can be expected to result in the lowest construction cost and a reputation for integrity in the bidding process.

Planning ahead can add flexibility even within the FCB process. For example, an owner can request bids for a certain time period (e.g., one year) as a base bid with an owner's option (exercisable near the end of the initial period) for an additional time period (e.g., a second year). If the owner is satisfied with the contractor's work during the first year and the prices offered under the option, the owner may accept the option without further bidding. Since all bidders had the opportunity to offer the second year's option, accepting the option is simply a continuation of the original bidding process.

However, even the best planning and management cannot anticipate all circumstances. Unexpected delays or new projects may necessitate schedules that are not compatible with a complete FCB process. The flexibility built into 7 CFR 1726 is intended for these circumstances.

Multiparty Unit Price Quotations can be used (up to the limits specified in 7 CFR 1726) when time is short. This is a very simple procedure with minimal requirements - three or more written quotations must be received and the award must be based on the lowest evaluated cost. Rapid communications methods (FAX, e-mail, etc.,) can be used effectively with this process to save time. Disadvantages of this method include possible misinterpretation of the bid request, resulting in non-comparable bids, and possible unequal treatment of bidders due to the private opening of the bids.

Sole-source negotiation should only be used as a last resort. This method puts the owner at the contractor's mercy and rarely results in the lowest cost. It also unfairly discriminates against all the other qualified bidders. Finally, sole-source negotiation establishes an environment where the possibility of bidding impropriety or the appearance of impropriety is increased.

RUS bidding requirements are basically just good business practice. The flexibility that they provide should cover nearly all legitimate bidding emergencies that a borrower may encounter. They are not intended to encourage poor business practices by allowing sole-source negotiation for most or all of a borrower's construction needs.

If you would like more information or have any questions, please contact Fred Gatchell, Deputy Director, Electric Staff Division, at 202-720-1398 or fgatchel@rus.usda.gov.

SUMMARY OF RUS ELECTRIC CONTRACTING PROCEDURES

This summary does not include all requirements. See 7 CFR 1726 for detailed requirements.

Facility or Contract Type	Bidding Procedure					Contract Approval
	Borrower Responsibility	Multiparty Quotations	Formal Competitive Bidding	Informal Competitive Bidding	Multiparty Negotiation	
Distribution Line Construction	≤$250,000 or 1% of NUP/CY	≤$350,000 or 1.5% of NUP/CY (Unit Price)	All Other	N/A	N/A	N/A
Substation and Transmission Line Construction	≤$250,000 or 1% of NUP/CY (NTE $2,000,000)	N/A	All Other	N/A	N/A	≥$250,000 or 1% of NUP/ Contract (NTE $500,000 for Dist; $1,500,000 for PS)
Generation Equipment and Construction	≤$1,500,000	N/A	Yes	Yes	RUS Approval Required	Specific Contracts
Buildings	N/A	≤$250,000 or 1% of NUP/CY (NTE $1,000,000) (Lump Sum)	All Other	N/A	N/A	N/A
Communications and Control	≤$250,000 or 1% of NUP/CY (NTE $2,000,000)	N/A	N/A	N/A	All Other	≥$250,000 or 1% of NUP/ Contract (NTE $500,000 for Dist; $1,500,000 for PS)

Note: All limits are exclusive of the cost of owner furnished materials

Abbreviations: CY - Calendar Year; Dist - Distribution Borrower; N/A - Not Applicable; NTE - Not To Exceed; NUP - Net Utility Plant; PS - Power Supply Borrower

ACCEPTANCE TESTING OF NEW CABLE - NUMBER OF SAMPLES

2000 - 109 COOPS	TRXLP 15KV	TRXLP 25KV	TRXLP 35KV	EPR 15KV	EPR 25KV	EPR 35KV	**TOTALS**
TOTAL TESTED	239	953	20	106	89	2	1409
FAILURES							
CONTAMINANTS	1	1					2
DIMENSIONAL		18					18
LOW STRIP TENSION	1			2	2		5
SHIELD RESISTIVITY				1			1
GELS & AGGLOMERATES					2		2
PROTRUSIONS	1	30					31
% FAILURES	1.3%	5.1%	0.0%	2.8%	4.5%	0.0%	4.2%
1999 - 95 COOPS	TRXLP 15KV	TRXLP 25KV	TRXLP 35KV	EPR 15KV	EPR 25KV	EPR 35KV	**TOTALS**
TOTAL TESTED	234	1712	10	120	127	4	2207
FAILURES							
CONTAMINANTS					1		1
DIMENSIONAL	1	5					6
SHIELD IRREGS-SKIPS	2	1					3
SHIELD RESISTIVITY	3						3
% FAILURES	2.6%	0.4%	0.0%	0.0%	0.8%	0.0%	0.6%
1998 - 104 COOPS	TRXLP 15KV	TRXLP 25KV	TRXLP 35KV	EPR 15KV	EPR 25KV	EPR 35KV	**TOTALS**
TOTAL TESTED	148	864	10	127	168	17	1334
FAILURES							
CONTAMINANTS	1	7			2		10
DIMENSIONAL	7	10				5	22
LOW STRIP TENSION		9		1			10
NEUTRALS TOUCHING				8			8
PROTRUSIONS	2			2	3		7
% FAILURES	6.8%	3.0%	0.0%	8.7%	3.0%	29.4%	4.3%
1997 - 50 COOPS	TRXLP 15KV	TRXLP 25KV	TRXLP 35KV	EPR 15KV	EPR 25KV	EPR 35KV	**TOTALS**
TOTAL TESTED	144	96	10	106	60	0	416
FAILURES							
CONTAMINANTS				1			1
DIMENSIONAL		1		3	4		8
SHIELD RESISTANCE				1			1
NEUTRALS TOUCHING		1		1			2
SHIELD PICKOFF	1						1
% FAILURES	0.7%	2.1%	0.0%	5.7%	6.7%	0.0%	3.1%

ACCEPTANCE TESTING OF NEW CABLE - NUMBER OF SAMPLES

1996 - 53 COOPS	TRXLP 15KV	TRXLP 25KV	TRXLP 35KV	EPR 15KV	EPR 25KV	EPR 35KV	**TOTALS**
TOTAL TESTED	146	74	4	132	42	0	398
FAILURES							
CONTAMINANTS	2			1			3
DIMENSIONAL					1		1
LOW STRIP TENSION	3						3
AMBERS		2					2
SHIELD PICKOFF				6	1		7
PROTRUSIONS	1						1
SHIELD RESISTANCE				2	2		4
% FAILURES	4.1%	2.7%	0.0%	6.8%	9.5%	0.0%	5.3%
1995 - 42 COOPS	TRXLP 15KV	TRXLP 25KV	TRXLP 35KV	EPR 15KV	EPR 25KV	EPR 35KV	**TOTALS**
TOTAL TESTED	116	137	0	141	7	0	401
FAILURES							
CONTAMINANTS				4			4
DIMENSIONAL	1	3		4			8
LOW STRIP TENSION	1	2		2			5
NEUTRALS TOUCHING	1						1
NEUTRAL INDENT				2			2
PROTRUSIONS		3					3
NO EXTERNAL MARKING	2						2
% FAILURES	4.3%	5.8%	0.0%	8.5%	0.0%	0.0%	6.2%
1994 - 30 COOPS	TRXLP 15KV	TRXLP 25KV	TRXLP 35KV	EPR 15KV	EPR 25KV	EPR 35KV	**TOTALS**
TOTAL TESTED	74	32	0	70	10	3	189
FAILURES							
CONTAMINANTS	2			1			3
DIMENSIONAL	1						1
LOW STRIP TENSION	2	1				1	4
NEUTRALS TOUCHING				1	2		3
% FAILURES	6.8%	3.1%	0.0%	2.9%	20.0%	33.3%	5.8%
1993 - 35 COOPS	TRXLP 15KV	TRXLP 25KV	TRXLP 35KV	EPR 15KV	EPR 25KV	EPR 35KV	**TOTALS**
TOTAL TESTED	277	71	2	61	20	7	438
FAILURES							
CONTAMINANTS				1		1	2
DIMENSIONAL	32			13		4	49
LOW STRIP TENSION		4		2	12		18
NEUTRALS TOUCHING	10			1			11
COND SHIELD FALL-IN				1			1
SCORE TEST				1			1
% FAILURES	15.2%	5.6%	0.0%	31.1%	60.0%	71.4%	18.7%

Source: NRECA's Cable Acceptance Testing Program

TABLE A

Conversion Table
25 kV Drawings in RUS Bulletin 50-5 vs RUS Bulletin 1728F-803

Old Assembly Number (Bulletin 50-5)	**New Assembly Number (1728F-803)**	**Material Changes Or Comments**
VA1	**VA1.1**	No material changes
VA1A	**VA1.2**	No material changes
VA1-1		Discontinued *(Combination of VA1.1 plus VA1.01)*
VA1-1A		Discontinued *(Combination of VA1.2 plus VA1.01)*
VA1-2		Discontinued *(Non-standard neutral)*
VA2	**VA2.1**	No material changes
VA2-3		Discontinued *(Non-standard neutral)*
VA3	**VA3.2**	Replace 2 washers abutting pole
VA4	**VA4.1**	Replace 4 washers abutting pole
VA5	**VA5.1**	Replace 2 washers abutting pole
VA5-1		Discontinued *(Material same as VA5.1; see VA5.5G)*
VA5-2	**VA5.2**	Replace 2 washers abutting pole
VA5-2A		Discontinued (Similar to VA5-2 and VA5.2)
VA5-3	**VA5.3**	No material changes
VA5-4		Discontinued *(Combination of VA5.3, VA1.01 and VA5.5G)*
VA6		Discontinued *(Replaced with VA6.1)*
VA7	**VA5.21**	No material changes
VA7-1	**VA5.31**	No material changes
VA8	**VA6.21**	No material changes
VA9	**VA2.21**	Add 2 washers under crossarm pins; delete two 3" washers
VA9-1	**VA1.11**	Add 1 washer under crossarm pin
VB1	**VB1.11**	No material changes
VB1A	**VB1.12**	No material changes
VB1-1		Discontinued *(Wrong neutral for line angle)*
VB1-1A		Discontinued *(Wrong neutral for line angle)*
VB2	**VB2.21**	Delete 4 washers under crossarm pins
VB3	**VB3.1**	Replace 2 washers abutting pole; Add eye bolt, curved 3" washer & anchor shackle.

BOLD TYPE: Denotes drawings for which borrowers may use new or old assembly numbering providing the material changes indicated are incorporated.

NORMAL TYPE: Denotes drawings where borrower may only use new assembly numbers.

TABLE A

Conversion Table
25 kV Drawings in RUS Bulletin 50-5 vs RUS Bulletin 1728F-803

VB3A		Discontinued
VB4-1	**VB4.1**	Replace 6 washers abutting pole
VB4-1A		Discontinued
VB5-1	**VB5.1**	Replace 3 washers abutting pole
VB5-1A		Discontinued
VB7	**VB5.21**	*(Neutral position and material slightly different)*
VB7-1	**VB5.31**	*(Neutral position and material slightly different)*
VB8	**VB6.21**	Different crossarm braces *(Either type is acceptable)*
VB9	**VB2.22**	Add 2 washers under crossarm pins; delete four 3" washers
VB9-2		Discontinued
VB9-1	**VB1.14**	Add 1 washer under crossarm pin
VB9-3		Discontinued
VC1	**VC1.11**	No material changes
VC1B	**VC1.12**	No material changes
VC1-1		Discontinued *(Wrong neutral for line angle)*
VC1-1A		Discontinued *(Wrong neutral for line angle)*
VC1-2	**VC1.11L**	No material changes
VC1-3	**VC2.21L**	No material changes
VC1-4	**VC1.13L**	No material changes
VC1-5		Discontinued
VC2	**VC2.21**	No material changes
VC2-1	**VC2.52**	Delete six 3" washers under pins
VC2-2	**VC2.52L**	No material changes
VC3	**VC3.1**	Replace 4 washers abutting pole; add neutral eyebolt *(Different neutral)*
VC3L		Discontinued
VC3-1	**VC3.2L**	Replace 8 washers abutting pole
VC4-1	**VC4.1**	Replace 8 washers abutting pole
VC4-1L	**VC4.2L**	Replace 8 washers abutting pole

BOLD TYPE: Denotes drawings for which borrowers may use new or old assembly numbering providing the material changes indicated are incorporated.

NORMAL TYPE: Denotes drawings where borrower may only use new assembly numbers.

TABLE A

Conversion Table
25 kV Drawings in RUS Bulletin 50-5 vs RUS Bulletin 1728F-803

VC5-1	**VC5.1**	Replace 4 washers abutting pole
VC5-1L	**VC5.2L**	Replace 4 washers abutting pole
VC7	**VC5.21**	Replace 1 washer abutting pole
VC7-1	**VC5.31**	Replace 1 washer abutting pole
VC8	**VC6.21**	Different neutral, minor material changes *(Optional)*
VC8-1		Discontinued
VC8-2		Discontinued *(Non-standard neutral assembly)*
VC8-3		Discontinued *(Non-standard neutral assembly)*
VC9	**VC2.51**	Add 2 washers under crossarm pins; add anti-split bolt
VC9-1	**VC1.41**	Add 1 washer under crossarm pin
VC9-2	**VC2.51L**	Replace 2 crossarm pins with clamp-type; add anti-split bolt
VC9-3	**VC1.41L**	Replace 1 crossarm pin with clamp-type
VDC-C1	**VD1.81**	No material changes
VDC-C1B		Discontinued
VDC-C1L	**VD1.83L**	Delete 4 crossarm bolts *(Different lower arm braces-optional)*
VDC-C2-1	**VD2.91**	Delete 2 washers under pins
VDC-C2-1L	**VD2.91L**	No material changes
VDC-C3		Discontinued *(Replaced by two VC3.1's and VD3.1G)*
VDC-C4-1		Discontinued *(Replaced by two VC4.1's and VD4.1G)*
VE1-1		Discontinued *(See E1.1)*
VE1-2	**E1.1**	Replace 1 washer abutting pole; Add guy marker
VE1-3	**E2.1**	Add guy marker
E2-1		Discontinued *(See E1.01)*
E2-2	**E1.01**	Different guy strand wire *(Different permitted loads)*
E2-3		Discontinued *(See E1.01)*
E3-2		Discontinued *(See E3.1)*
E3-3	**E3.1**	Add Guy Marker *(Different permitted loads)*
E3-10		Discontinued

BOLD TYPE: Denotes drawings for which borrowers may use new or old assembly numbering providing the material changes indicated are incorporated.

NORMAL TYPE: Denotes drawings where borrower may only use new assembly numbers.

TABLE A

Conversion Table
25 kV Drawings in RUS Bulletin 50-5 vs RUS Bulletin 1728F-803

E4-2		Discontinued *(See note 3 on E1.01)*
E4-3		Discontinued *(See note 3 on E1.01)*
VE5-1		Discontinued
VE5-2		Discontinued
VE6-2		Discontinued *(See E2.2G)*
VE6-3		Discontinued *(See E2.2G)*
VE7-2L		Discontinued *(See E2.3G)*
VE7-3L		Discontinued *(See E2.3G)*
VE8-2L		Discontinued *(See E4.4LG)*
VE8-3L		Discontinued *(See E4.4LG)*
E11		Discontinued *(See E3.1)*
E12		Discontinued *(See E3.1)*
F1-1	**F1.6**	No material changes
F1-2	**F1.8**	No material changes
F1-3	**F1.10**	No material changes
F1-4	**F1.12**	No material changes
F1-1C		Discontinued *(Not in List of Materials)*
F1-2C		Discontinued *(Not in List of Materials)*
F1-3C		Discontinued *(Not in List of Materials)*
F1-1P	**F3.6**	No material changes
F1-2P	**F3.8**	No material changes
F1-3P	**F3.10**	No material changes
F1-4P	**F3.12**	No material changes
F1-1S	**F2.6**	No material changes
F1-2S	**F2.8**	No material changes
F1-3S	**F2.10**	No material changes
F1-4S	**F2.12**	No material changes
F2-1		Discontinued
F2-2		Discontinued
F2-3		Discontinued

BOLD TYPE: Denotes drawings for which borrowers may use new or old assembly numbering providing the material changes indicated are incorporated.

NORMAL TYPE: Denotes drawings where borrower may only use new assembly numbers.

TABLE A

Conversion Table
25 kV Drawings in RUS Bulletin 50-5 vs RUS Bulletin 1728F-803

F2-4		Discontinued
F4-1E	**F4.1**	No material changes
F4-1S	**F4.2**	No material changes
F5-1	**F5.1**	No material changes
F5-2	**F5.2**	No material changes
F5-3	**F5.3**	No material changes
F6-1	**F6.6**	No material changes
F6-2	**F6.8**	No material changes
F6-3	**F6.10**	No material changes
VG10	**VG1.8**	No material changes
VG66		Discontinued
VG106	**VG1.3**	No material changes
VG19	**VG1.7**	No material changes
VG65		Discontinued
VG105	**VG1.2**	No material changes
VG39		Discontinued *(See VG1.7)*
VG67		Discontinued
VG136		Discontinued *(See VG1.2)*
G150		Discontinued *(See VY2.1)*
VG150		Discontinued *(See VY2.1)*
VG210	**VG2.1**	No material changes *(Drawing modified)*
VG310	**VG3.1**	Remove 1 crossarm and related material *(Optional)*
VG311	**VG3.2**	Remove 1 crossarm and related material *(Optional)*
VG312	**VG3.3**	Remove 1 crossarm and related material *(Optional)*
J5	**J1.2**	No material changes
J6	**J3.1**	No material changes
J7	**J2.2**	No material changes
J7C		Discontinued *(See J2.2)*
J8	**J1.1**	No material changes
J10	**J2.1**	No material changes

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TABLE A

Conversion Table
25 kV Drawings in RUS Bulletin 50-5 vs RUS Bulletin 1728F-803

J11		Discontinued *(See J3.1)*
J12	**J4.1**	No material changes
K10	**K2.1**	No material changes
K11	**K1.3**	No material changes
K14	**K1.1**	No material changes
K10C	**K2.2**	No material changes
K10L		Discontinued *(See K2.1)*
K11L		Discontinued *(See K1.3)*
K14L		Discontinued *(See K1.1)*
K11C	**K1.2**	No material changes
K14C		Discontinued *(See J2.1)*
K15C	**K1.4**	No material changes
K16C	**K3.2**	No material changes
K17	**K3.1**	No material changes
K17L		Discontinued *(See K3.1)*
VM2-11	**H1.1**	No material changes
VM2-11A		Discontinued
VM2-12	**P2.1**	No material changes
M2-15	**H4.1**	No material changes
VM2-12A	**P2.2**	No material changes
VM2-12A2	**P2.3**	No material changes
VM3-1A		Discontinued
VM3-4	**VS1.1**	No material changes
VM3-16	**VS2.32**	No material changes *(Different neutral materials-optional)*
VM3-2	**VS2.21**	Different materials (Optional)
VM3-3	**VS2.31**	Different materials (Optional)
VM3-10A	**VR1.1**	No material changes
VM3-19		Discontinued
VM3-20		Discontinued
VM3-19A	**VR2.1**	No material changes

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TABLE A

Conversion Table
25 kV Drawings in RUS Bulletin 50-5 vs RUS Bulletin 1728F-803

VM3-20A	**VR3.1**	No material changes
VM3-23		Discontinued
VM3-24		Discontinued
VM3-25		Discontinued
VM3-24A	**VR3.2**	No material changes
VM3-25A	**VR3.3**	No material changes
VM5-1		Discontinued
VM5-2	**VA1.01**	No material changes
VM5-4		Discontinued
VM5-5	**VA1.011**	No material changes
VM5-6	**VP1.01**	No material changes
VM5-7	**VA1.011P**	No material changes
VM5-8		Discontinued *(See VA5.2)*
M5-9	**VS1.01**	No material changes
M5-10	**VS1.02**	No material changes
M5-11		Discontinued
M5-12		Discontinued
M5-13	**W3.2**	No material changes
M5-14		Discontinued
M5-15		Discontinued
M5-16		Discontinued
M5-17	**W3.1**	No material changes
M5-18	**VA1.01P**	No material changes
M5-19	**N1.2**	No material changes
M5-20		Discontinued *(See VA5.3)*
M5-21		Discontinued
M5-22		Discontinued
M5-23		Discontinued
VM7-1		Discontinued *(Replaced with VY1.1)*
VM7-3	**VY1.3**	No material changes

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TABLE A

Conversion Table
25 kV Drawings in RUS Bulletin 50-5 vs RUS Bulletin 1728F-803

M8	**Q1.1**	*(Minor material changes)*
M8-6	**Q3.1**	*(Minor material changes)*
M8-9	**K4.4G**	*(Modified guide drawing; no material)*
M8-10	**K4.3G**	*(Modified guide drawing; no material)*
M8-11	**Q3.3**	*(Minor material changes)*
M8-12	**Q3.2**	*(Minor material changes)*
VM10-14		Discontinued
VM10-15		Discontinued
M19	**W2.1G**	*(Guide drawing; no materials)*
M20	**W1.1G**	*(Guide drawing; no materials)*
M21		Discontinued
M22-1		Discontinued
M22-2		Discontinued
M24	**K4.1G**	*(Guide drawing; no materials)*
M24-1		Discontinued
M24-10	**K4.2G**	*(Guide drawing; no materials)*
M26-5		Discontinued
M27		Discontinued
M27-1	**G1.1G**	*(Modified Guide drawing; no materials)*
M27-2		Discontinued
M28		Discontinued
VM29-1		Discontinued *(See guide drawings in Sections A and C)*
VM33-1		Discontinued
VM33-2		Discontinued
VM33-3		Discontinued
VM33-4		Discontinued
VM33-5		Discontinued
VM33-6		Discontinued
M40-6		Discontinued
M40-1A		Discontinued

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NORMAL TYPE: Denotes drawings where borrower may only use new assembly numbers.

TABLE A

Conversion Table
25 kV Drawings in RUS Bulletin 50-5 vs RUS Bulletin 1728F-803

M40-1A2		Discontinued
M40-8		Discontinued
M40-10		Discontinued
M40-16		Discontinued
M40-19		Discontinued
M40-11		Discontinued
M40-12		Discontinued
M40-13		Discontinued
M40-17		Discontinued
M41-1		Discontinued *(See L3.1G & VL1.1G)*
M41-10		Discontinued *(See L3.1G & VL1.1G)*
M42-3		Discontinued *(See L3.2G & VL1.2G)*
M42-11		Discontinued *(See L3.3G & VL1.2G)*
M42-13		Discontinued *(See L3.3G, L2.2G, VL1.2G)*
M42-21		Discontinued *(See L3.2G & VL1.2G)*
M43-4		Discontinued
M43-10		Discontinued
M45-20		Discontinued
M45-21		Discontinued
M45-22		Discontinued
M52-3		Discontinued
M52-4		Discontinued
R1	**M1.30G**	Increased ROW clearing to 30 feet

(End of Table)

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NORMAL TYPE: Denotes drawings where borrower may only use new assembly numbers.

TABLE AN

Corrections to Assembly Numbers in RUS Bulletin 1728F-803

ASSEMBLY NUMBER	**CORRECTIONS (***or comments***)**
VA1.1	*When double pole-top pins and insulators are needed, such as required by the NESC for Grade B road crossing, add a VA1.01 less the bolts and washers.*
VA1.12G **VA5.5G**	Pole-top assembly should be a VA1.01, not a VA1.1
VB2.1 *VC2.21* *VC2.21L*	*Straight pole top pins [b] may be used provided that a 2 inch minimum spacing between insulators is maintained.*
VA5.21 **VA5.31**	The neutral tying guide should be L2.2G and not LG-2G
VA5.21 **VA5.31** **VA6.21** **VA6.22G** **VB5.21** **VB5.31** **VB6.21** **VC5.21** **VC5.31** **VC6.21** **VC5.61** **VC6.51**	These assemblies are suitable for Grade B construction, but at a lesser tension than shown on the design parameters. The applicable notes on the drawings should say: "For Grade B construction, reduce allowable longitudinal loading or unbalanced tension by 25%."
VB3.1	Change the materials quantities (QTY) to: **3** washers (d), 3 bolts (o), and 3 locknuts **(ek).**
VB6.21	Change the materials quantities (QTY) to: **10** washers, 2 ¼ inch square (d), and add **2** square washers, 3 inch curved (d).
VC2.51	Change the materials quantities (QTY) to: **2** insulators, 15 kV pin type, white, (a).
VC4.2L	Change the materials quantities (QTY) to: **8** eye bolts, 5/8 inch (o).
VC5.21 **VC5.31**	Change the materials quantities (QTY) to: **10** square washers, 2 ¼ inch (d); add **1** washer, 3 inch square, curved (d). *(for neutral position).*
VC6.21 **VC5.61**	Change the materials quantities (QTY) to: 10 square washers, 2 ¼ inch (d); add 2 washers, 3 inch square, curved (d). *(for neutral position).*
VD1.81L	The outside pins and insulators should **be** installed 8 inches from the ends of the crossarms.
VD1.83L	Change the materials quantities (QTY) to: 4 machine bolts, 5/8 inch, (c). The arrangement (spacing) of the pins and insulators should be changed to be the same as on assembly VD2.91L.
VD1.83P	In the material list, add 4 machine bolts, 5/8 inch, (c)

TABLE AN

Corrections to Assembly Numbers in RUS Bulletin 1728F-803

ASSEMBLY NUMBER	**CORRECTIONS (***or comments***)**
E1.1	In the material list, replace the 2 ¼ inch square washer (d) with a 3 inch square, curved washer (d). *(The maximum working load may be increased to 6,600 pounds horizontal or the allowable guy wire tension.)*
E1.01	In the material list, replace the 2 ¼ inch square washer (d) with a 3 inch square, curved washer. *(The maximum working load may be increased to 6,600 pounds or the allowable guy wire tension.)*
E2.01	In the material list, replace the 3 inch square, curved washer (d) with a 4 inch square, curved washer (d).
E2.1	*In the material list, replace the 3 inch square, curved washer (d) with a 4 inch square, curved washer (d).*
G2.1G *G3.1G* *G3.2G* *G3.3G*	*The wiring schematics shown on these guide drawings are for transformers with ADDITIVE POLARITY. Transformers larger than 200 kVA have a subtractive polarity. Thus, for transformers larger than 200 kVA, change the phasing on the wiring schematics accordingly.*
VG2.1 **VG3.1** **VG3.2** **VG3.3**	The (lower) crossarm as shown on the drawings is mounted on the wrong (opposite) side of the pole. Also, the connections to the primary conductors are attached on the wrong (opposite) side of the pole. *These drawings show the use of separate cutouts (af) and arresters (ae). Combination cutout and arresters (ax) may be used in their stead. Mounting the arrester directly on the transformer (as shown in VG1.4) should significantly improve protection to the transformer.*
VY.1 **VY1.3**	Change the minimum clearance to ground, from the bottom of the tanks or platforms, to 15 feet, 0 inches.

(End of Table)

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TABLE VII

MAXIMUM LINE ANGLES ON SPOOL INSULATOR ASSEMBLIES
(ANSI Class 53-4 Spool Insulator)

Designated Maximum Transverse Load = 2,250 Lbs./Conductor

	WIND SPAN (feet)					
	150	**200**	**250**	**300**	**350**	**400**
CONDUCTOR SIZE						
	LIGHT LOADING DISTRICT					
4 ACSR (7/1)	60	60	60	60	60	66
2 ACSR (6/1)	57	57	56	55	55	54
2 ACSR (7/1)	44	43	43	42	42	41
1/0 ACSR (6/1)	36	35	35	34	34	33
123.3 AAAC (7)	35	35	34	34	33	33
2/0 ACSR (6/1)	35	35	34	34	33	33
3/0 ACSR (6/1)	28	28	27	27	26	26
4/0 ACSR (6/1)	28	27	27	26	25	25
246.9 AAAC (7)	27	26	26	25	25	24
336.4 ACSR (18/1)	26	26	25	24	24	23
336.4 ACSR (26/7)	18	18	17	17	16	16
	MEDIUM LOADING DISTRICT					
4 ACSR (7/1)	60	60	66	60	60	60
2 ACSR (6/1)	57	56	55	55	54	53
2 ACSR (7/1)	44	43	43	42	41	41
1/0 ACSR (6/1)	36	35	35	34	34	33
123.3 AAAC (7)	35	35	34	34	33	33
2/0 ACSR (6/1)	36	35	34	34	33	33
3/0 ACSR (6/1)	28	28	27	27	26	26
4/0 ACSR (6/1)	28	27	27	27	26	26
246.9 AAAC (7)	27	27	26	26	25	25
336.4 ACSR (18/1)	27	26	26	25	25	24
336.4 ACSR (26/7)	19	18	18	18	17	17
	HEAVY LOADING DISTRICT					
4 ACSR (7/1)	60	60	60	60	60	60
2 ACSR (6/1)	56	54	53	52	51	49
2 ACSR (7/1)	43	42	41	40	39	38
1/0 ACSR (6/1)	35	34	34	33	32	31
123.3 AAAC (7)	34	34	33	32	31	31
2/0 ACSR (6/1)	35	34	33	32	31	31
3/0 ACSR (6/1)	28	27	26	26	25	24
4/0 ACSR (6/1)	27	27	26	25	25	24
246.9 AAAC (7)	27	26	25	25	24	23
336.4 ACSR (18/1)	26	25	25	24	23	22
336.4 ACSR (26/7)	18	18	17	17	16	16

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Selected Metric Conversion Factors

TO CONVERT FROM:	TO:	MULTIPLY BY:
Inch (in)	Centimeter (cm)	2.54
Foot (ft)	Meter (m)	0.3048
Mile (mi)	Kilometer (km)	1.609
Kip (1000 lb)	Newton (N)	4,448
Pound (lb)	Newton (N)	4.448

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APPENDIX A

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APPENDIX B

NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

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Committee Chair		
Overt L. Carroll	Clark Energy Co-op	Winchester, KY
NRECA Staff Coordinators		
Steve Lindenberg	NRECA	Arlington, VA
Mike Pehosh	NRECA	Arlington, VA
Bob Saint	NRECA	Arlington, VA
Materials Subcommittee		
John Mitchell, Chair	Rappahannock EC	Fredericksburg, VA
Harvey Bowles	RUS	Washington, DC
Susan Brouse	Great River Energy	Elk River, MN
Bret Curry	Arkansas EC Corp.	Little Rock, AR
Tom Denison	Cobb EMC	Marietta, GA
Craig Dickson	La Plata Electric Association	Durango, CO
Charles Emerson	Trico EC	Tucson, AZ
Charlene Ham	Rusk County EC	Henderson, TX
George Keel	RUS	Washington, DC
Carl Liles	Western Farmers EC	Anadarko, OK
Peter Platz	Coast EPA	Bat St. Louis, MS
Terry Sherred	Northwestern RECA	Cambridge Springs, PA
Scott Wehler	Adams Electric Co-op	Gettysburg, PA
Overhead Distribution Lines Subcommittee		
Allan Glidewell, Chair	Southwest Tennessee EMC	Brownsville, TN
Jim Bohlk	RUS	Washington, DC
James Byrne	Poudre Valley REA	Fort Collins, CO
Jim Carter	NRECA – WQC	Spartanburg, SC
Tom Hoffman	Agralite Electric Co-op	Benson, MN
Gregory Lindsly	Dixie EMC	Baton Rouge, LA
Brian Nelson	Intercounty ECA	Licking, MO
Gene Smith	SGS Witter, Inc.	Lubbock, TX
Terry Rosenthal	Laclede EC	Lebanon, MO

APPENDIX B

NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
James Stewart	Stewart Engineering, Inc.	Anniston, AL
Tom Suggs	Middle Tennessee EMC	Murfreesboro, TN
Substation Subcommittee		
Bill Kahanek, Chair	Lower Colorodo River Auth.	Austin, TX
Jim Bardwell	SGS Witter, Inc.	Albuquerque, NM
George Chapman	Patterson & Dewar Engr.	Decatur, GA
Mike Eskandary	RUS	Washington, DC
Jerrod Howard	Central Electric Pwr. Co-op	Columbia, SC
Ken Malone	Middle Tennessee EMC	Murfreesboro, TN
Tom Myers	Berkeley EC	Moncks Corner, SC
Paul Rupard	East Kentucky Power Co-op	Winchester, KY
System Planning Subcommittee		
Ronnie Frizzell, Chair	Arkansas EC Corp.	Little Rock, AR
Robin Blanton	Piedmont EMC	Hillsborough, NC
Robert Dew	United Utility Supply	Louisville, KY
Mark Evans	Volunteer Electric Co-op	Decatur, TN
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Wayne Henson	East Mississippi EPA	Meridian, MS
Troy Little	Four County EPA	Columbus, MS
Bill Koch	Rural Elect. Magazine	Seattle, WA
Joe Perry	Patterson & Dewar Engr.	Decatur, GA
Georg Shultz	RUS	Washington, DC
Michael Smith	Singing River EC	Lucedale, MS
Brian Tomlinson	Conserv Electric	Corinth, TX
Chris Tuttle	RUS	Washington, DC
Kenneth Winder	Moon Lake Electric	Roosevelt, UT
Power Quality Subcommittee		
Harold Taylor, Chair	Georgia Transmission Corp	Tucker, GA
Ed Bevers	Rural Electric Co-op., Inc.	Lindsay, OK
Chris Brewer	Blue Grass Energy Co-op	Nicholasville, KY
Corbitt Clift	Cobb EMC	Marietta, GA
Brian Coate	Tipmont REMC	Linden, IN

APPENDIX B

NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
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Ken Kjar	Cass County Electric Co-op	Kindred, ND
Wally Lang	Minnkota Power Co-op	Grand Forks, ND
Chris Melhorn	EPRI PEAC Corporation	Knoxville, TN
David Mueller	Electrotek Concepts, Inc.	Knoxville, TN
Jim Newberg	Missoula Electric Co-op	Missoula, MT
John Pavek	RUS	Washington, DC
Chris Perry	Nolin RECC	Elizabethtown, KY
Jeff Pogue	Wabash Valley Power Assoc	Indianapolis, IN
Lewis Shaw	Brunswick EMC	Shallotte, NC
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Charles Lukkarila	Great River Energy	Elk River, MN
Charles (Bubba) McCall	Georgia Transmission Corp.	Tucker, GA
Bob Oldham	Southern Maryland EC	Hughesville, MD
Art Smith	Patterson & Dewar Engr.	Decatur, GA
David Turner	Lower Colorado River Auth.	Austin, TX
John Twitty	Alabama EC	Andalusia, AL

APPENDIX B

NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
Underground Distribution Subcommittee		
Vince Heuser, Chair	Nolin RECC	Elizabethtown, KY
Keith Bartels	Martin & Associates, Inc.	Mitchell, SD
Russ Dantzler	Mid-Carolina EC	Lexington, SC
Berl Davis	Palmetto EC	Hilton Head, SC
Trung Hiu	RUS	Washington, DC
Tim Mobley	Berkeley EC	Moncks Corner, SC
Ace Necaise	Singing River EPA	Lucedale, MS
John Rodgers	Nodak EC, Inc.	Grand Forks, ND
Blaine Strampe	Federated REA	Jackson, MN
Ed Thomas	Utility Elec. Consultants	Raleigh, NC
Keith Thomason	Middle Tennessee EMC	Murfreesboro, TN