POWER ENGINEERS

PROJECT NO: 128002-01
COPY NO: 2
ISSUED TO: AEA

ALASKA ENERGY AUTHORITY

P.O. BOX 190869
701 TUDOR ROAD
ANCHORAGE, ALASKA 99519-0869

SPECIFICATIONS & DRAWINGS

FOR

PROJECT ERECTION & MATERIALS

SHUNGNAK-KOBUK TIE LINE PROJECT

DESIGNED BY POWER ENGINEERS, INC.

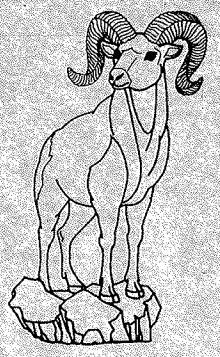
JULY, 1992

RECORD
JUL 3 1 1992
DRAWING

FOR INFORMATION REGARDING THIS DOCUMENT CONTACT:

- ROGER LOGAN
- MATT MJELDE

3940 GLENBROOK DRIVE
P.O. BOX 1066
HAILEY, IDAHO 83333
(208) 788-3456



PROJECT NO: 128002-01
COPY NO: 2
ISSUED TO: AEA

ALASKA ENERGY AUTHORITY

P.O. BOX 190869
701 TUDOR ROAD
ANCHORAGE, ALASKA 99519-0869

SPECIFICATIONS & DRAWINGS
FOR
PROJECT ERECTION & MATERIALS

SHUNGNAK-KOBUK
TIE LINE PROJECT

DESIGNED BY POWER ENGINEERS, INC.

JULY, 1992

FOR INFORMATION REGARDING
THIS DOCUMENT CONTACT:
- ROGER LOGAN
- MATT MJELDE

TABLE OF CONTENTS

PART I

SPECIFICATION FOR LINE ERECTION AND MATERIALS

1.1 Project Description

1.1.1 The Shungnak - Kobuk Tie Line replaces the old single-phase 7200 volt power line to the community of Kobuk from the generation facility at Shungnak. The 10.5 miles of 7200/12,470 volt three-phase four-wire power line utilizes #2 ACSR conductor supported by 35 foot class 5 wood poles that are secured to W8X48 H-pile foundations. The W8X48 H-pile is also used for anchoring the angle and deadend structures.

The Shungnak-Kobuk Tie Line operates at 12,470 volts phase-to-phase. Air-break group-operated switches are located at Kobuk and Shungnak to provide line isolation. Over-current protection devices are located at the Shungnak generation facility in the form of line fuses at the transformer bank and fuse-switch at the generator controls. Surge arresters are installed on the line at Shungnak and Kobuk.

The Communities of Kobuk and Shungnak are located on the Kobuk River approximately 160 miles east of Kotzebue in northwestern Alaska. The area is characterized by floodplain and lowland terrace at elevations of 200 to 300 feet above sea level. Vegetation is predominantly tundra with boreal forest. The majority of the line route traverses areas of permafrost. The temperature ranges from -60°F to 90°F.

1.2 Definitions

1.2.1 The term "Owner" shall mean Alaska Energy Authority and it's duly authorized representatives.

1.2.2 The term "Contractor" shall mean the selected construction contractor for the Project.

1.2.3 The term "Engineer" shall mean the engineer employed by the Owner to provide engineering services for the project, and said Engineer's duly authorized assistants and representatives.

1.2.4 The term "Engineer" when used in the context of receiving notice or requiring other action from the contractor shall mean Engineer/Owner and all such information shall be simultaneously submitted or noticed to the owner.

1.3 Scope of Work

1.3.1 These Specifications establish the requirements for material and construction of approximately 10.5 miles of a existing single phase distribution line and construction of 10.5 miles of a new three (3) phase 7.24/12.47kV distribution line located mostly along the existing tie line route. The work is more fully described in the following Specifications, Construction Drawings (referred to as the Drawings) and Staking Sheets.

1.3.2 The work includes furnishing of all materials and equipment not furnished by the Owner, machinery, tools, labor, transportation, and other means required to construct the Project in strict accordance with the Specifications and Drawings.

1.3.3 Contractor shall perform complete work regardless of possible omissions in the Drawings, Staking Sheets, construction units, vendor drawings, Owner-furnished material lists, and these Specifications. Miscellaneous material items that are missing shall be furnished by the Contractor, at no additional cost to the Owner, to produce a complete working system in conformity with the intent of the work. The Engineer shall have final authority in determining the Contractor's responsibility to complete all work in conformance with the Drawings and Specifications. Do not use photo reduced drawings in the specifications for construction. They do not reflect any revisions made from the bidding issue to present. The Engineer shall have the final authority to direct the Contractor to correct any and all work that has been improperly performed, at no additional cost to the Owner.

1.4 Drawing and Staking Sheets

1.4.1 Drawings and Installation Data Furnished by the Owner

1.4.1.1 Drawings of major Owner-furnished equipment items shall be provided to the Contractor. The Engineer shall determine the type of drawings, instruction books, and wiring diagrams that are necessary for the Contractor's use during construction. Two (2) sets of Drawings and Specifications approved for construction shall be furnished to the Contractor.

1.4.1.2 Neither Contractor nor any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with Owner shall have or acquire any title to or ownership rights in any of the drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer; and they shall not reuse any of them on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

1.4.2 Drawings and Installation Data Furnished by the Contractor

1.4.2.1 Drawings of all equipment, structures, and materials supplied by the Contractor shall be furnished to the Engineer. The drawings shall be submitted as follows:

1. Submit four (4) prints to the Engineer for checking and approval. After checking, one (1) print will be returned marked "No Exception Taken", "Furnish as Corrected", "Revise and Resubmit", or "Rejected".

2. After final approval submit four (4) copies and a mylar reproducible to the Engineer.

1.4.2.2 The drawings to be furnished shall include but not be limited to the following:

1. Outline drawings showing location of connections and all required clearances

2. Spare parts data

3. Complete bill of materials

4. Instruction books for installation, maintenance, and operation of equipment.

1.4.2.3 The final drawings shall be issued by the Engineer to the Contractor marked "Approved for Construction", with revisions and corrections reflecting any changes or addenda.

1.4.2.4 Contractor shall submit four (4) copies of the bill of materials, spare parts data, and instruction books to the Engineer.

1.4.2.5 Four (4) copies of any special instructions regarding unloading or storage of the equipment shall be issued and distributed as follows:

- Two (2) copies to Engineer (office)
- One (1) copy to Engineer (field)
- One (1) copy to be included with the material or equipment when shipped

1.5 Interpretation of Documents After Contract Award

1.5.1 Report any errors or ambiguities in the Specifications and/or Drawings simultaneously to the Owner and the Engineer as soon as detected. The Engineer shall interpret the intended meaning of the Specifications and his interpretation shall be final.

1.5.2 If any construction problem arises that is not covered by these Specifications, the Owner and the Engineer shall simultaneously be consulted immediately and shall render a decision regarding the problem. Failure to notify

the Owner/Engineer may preclude any consideration of change to the Contract Time or Price, however, such notice does not insure that any specific change will be granted.

1.6 Abbreviations and References

1.6.1 The Contract Documents contain references to various standard specifications, codes, practices, and requirements for materials, workmanship, installation, inspections, and tests; which standards are published and issued by the involved organizations, societies, and associations by abbreviation and name.

1.6.2 Whenever the abbreviation is specified, it shall be understood to mean the full name of the respective organization as listed below.

AA	The Aluminum Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
API	American Petroleum Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWPB	American Wood Preservers Board
AWPI	American Wood Preservers Institute
AWS	American Welding Society
BLM	Bureau of Land Management
CRSI	Concrete Reinforcing Steel Institute
EEI-AEIC	Edison Electric Institute Publications
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FS	Federal Specification
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
MSHA	Mine Safety and Health Administration
NBS	National Bureau of Standards
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NETA	National Electrical Testing Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
REA	Rural Electrification Administration (U.S.D.A.)
SAE	Society of Automotive Engineers
UBC	Uniform Building Code
UL	Underwriter's Laboratories, Inc.
USFS	U.S. Forest Service
WCRSI	Western Concrete Reinforcing Steel Institute

1.7 Codes and Standards

1.7.1 Any material, method, or procedure specified by reference to a specific standard or specification, such as a commercial standard, American National Standard, federal or state specification, industry or government code, trade association code or standard, or other similar standard, shall comply with the requirements of the latest

revision thereof and any amendments or supplements thereto in effect on the date of these Contract Documents.

1.7.2 The code, specification, or standard referred to, except as modified in these Specifications, shall have full force and effect as though printed in these Specifications. Such specifications and standards are not furnished to bidders since manufacturers and trades involved are assumed to be familiar with their requirements. The Engineer shall furnish, upon request, information as to how copies of the specifications and standards referred to may be obtained.

1.8 Manufacturer's Specifications and Instructions

1.8.1 All manufactured materials, products, processes, equipment, or the like shall be installed or applied in accordance with the manufacturer's instructions, directions, or specifications. Said installation or application shall be in accordance with printed instructions furnished by the manufacturer of the material or equipment concerned for use under conditions similar to those at the jobsite. Installation instructions shall be furnished to the Engineer and his acceptance thereof obtained before work is begun.

1.8.2 Any deviation from the manufacturer's printed recommendations shall be explained and acknowledged in writing by the manufacturer involved as correct for the circumstances. The Contractor shall be held responsible for all installations contrary to the manufacturer's recommendations. If any item of material or equipment is found to be installed out of accordance with the manufacturer's recommendations, the Contractor shall make all changes necessary to achieve such compliance.

1.8.3 Manufacturer's Field Supervision

1.8.3.1 Contractor shall be responsible for the scheduling of any manufacturer's service engineers. If a service engineer arrives at the jobsite and the equipment is not ready for adjustment and testing, a second trip by the service engineer will be scheduled at the Contractor's expense. The services of a service engineer shall normally include the following:

- Instruct the personnel installing the equipment in the proper assembly and installation, if requested by the Engineer.
- Inspect, supervise adjustment, and test the equipment after installation for proper electrical and mechanical operation.
- Represent the manufacturer and assist in placing equipment into initial service.
- Instruct the Owner's personnel in the proper operation and maintenance of the equipment furnished.

1.9 Work Quality

1.9.1 Work shall be performed by construction workers skilled and experienced in the work involved. All work on this Project shall be performed in accordance with the best practices of the various trades involved and in accordance with the Drawings and these Specifications.

1.9.2 All work shall be erected and installed plumb, level, square, and true, or true to the indicated angle, unless otherwise specified. All finished work shall be free from defects and damage. Quality workmanship is of primary importance on this Project.

1.9.3 Engineer reserves the right to reject any materials and work quality that are not considered to be up to the highest standards of the various trades involved. Such inferior material or work quality shall be repaired or replaced as directed, at no additional cost to the Owner.

1.10 Material

1.10.1 Owner-Furnished Material

1.10.1.1 Material furnished by the Owner shall be transferred to the Contractor at delivery points specified in the Contract Documents.

1.10.1.2 Contractor shall (1) accept the materials at the delivery points specified; (2) check all materials to satisfy himself that the materials delivered are in good condition and the quantities are correct; and (3) execute a receipt for all materials accepted from the Owner. Delinquency in signing material receipts may result in delayed progress payments.

1.10.1.3 All material furnished by the Owner shall meet minimum industry specifications. All materials which do not meet specifications or are broken or damaged shall be culled by the Contractor and a report made to the Owner and Engineer as to the number culled and reason for culling.

1.10.1.4 After the materials are accepted as specified above, the Contractor shall become solely responsible for their care, storage, and protection. In the event materials are damaged, lost, stolen, or destroyed by any cause whatsoever after the Contractor has signed a receipt for them, their repair or replacement shall be entirely at the Contractor's expense.

1.10.1.5 Contractor shall load, unload, haul, distribute, and store all materials furnished by the Owner. Contractor shall be responsible for any demurrage.

1.10.1.6 Owner agrees only to provide the correct quantities of the materials set forth in the "List of Owner's Materials on Hand" and the "List of Materials Ordered by Owner But Not Delivered". It is not represented that these materials are adequate to complete the Project. Any and all additional materials which are necessary for completion of the Project in accordance with the Drawings and Specifications shall be furnished by the Contractor without additional cost to the Owner.

1.10.1.7 If the Owner fails to deliver the materials set forth in the "List of Materials Ordered by Owner But Not Delivered" on the date specified on the "List", the Contractor's sole remedy and compensation shall be an extension of time not greater than the delay. Any such time extension must be requested in writing by the Contractor.

1.10.1.8 All materials (including reels) furnished by the Owner in excess of those actually used in the construction of the line shall be returned to the Owner's designated location along with a complete list of all materials returned, unless otherwise specified by the Engineer. The return of excess materials to the Owner shall be at the Contractor's expense.

1.10.2 Contractor-Furnished Material

1.10.2.1 All material and equipment (as specified on the attached Drawings) furnished by the Contractor shall be included in the current "List of Materials Acceptable for Use on Systems of REA Electrification Borrowers" (including revisions) unless otherwise specified.

1.10.2.2 Contractor shall purchase all materials and equipment (other than Owner-furnished materials) outright and not subject to any conditional sales agreement, bailment, lease, or other agreement reserving unto the seller any right, title, or interest therein. All such materials and equipment shall become the property of the Owner when erected in place.

1.10.2.3 The identification, purchasing, and delivery of all materials (except Owner-furnished materials) is the responsibility of the Contractor. Contract extension days will not be considered for Project delays caused by late delivery of Contractor-furnished materials.

1.10.3 Material Storage

1.10.3.1 All construction material and equipment shall be stored so as to be protected from detrimental effects of the elements. If outdoor storage cannot be avoided, the material and equipment shall be stacked on supports well above the ground line and protected from the elements as appropriate, with due regard to public safety.

1.10.3.2 All arrangements for material storage area(s) shall be the Contractor's responsibility. Any costs related to the storage area(s) shall be paid by the Contractor.

1.11 Substitutions

1.11.1 Contractor shall submit to the Engineer a complete list of all proposed materials and equipment which differ in any respect from materials and equipment specified in these Specifications or on the Drawings. Included with this list shall be all nonconforming materials proposed by subcontractors and also materials which are not specifically mentioned in the Specifications.

1.11.2 If the Contractor desires to use any other brand or manufacture of equal quality, appearance, and utility to the product specified, he shall request substitution as provided herein. The Engineer shall accept as satisfactory or reject the request for substitution, and his decision shall be final. The Engineer shall review the proposed substitution within fourteen (14) days of receipt.

1.11.3 Requests for substitutions will be considered only when offered by the Contractor as follows:

1.11.3.1 Submit complete technical data, including drawings and complete performance specifications.

1.11.3.2 Requests for substitutions shall contain not less than the following information in the heading or subject of the transmittal letter:

- Project title and number
- Subject (unit or division of work)
- Drawing and Specification references: Drawing no. and detail; Specification section, article, paragraph, subparagraph
- Catalog cuts of both the original item and the proposed substitution

1.11.4 Engineer may require the Contractor to furnish a written warranty, with adequate safeguards to the Owner, assuring satisfactory performance of a proposed substitute item or system for the applicable warranty period.

1.11.5 Contractor shall be responsible for the execution of any changes in other parts of its own work or the work of subcontractors or other contractors caused by substitution, at no additional cost to the Owner.

1.11.6 Contractor shall not proceed with any substitution until the Engineer has accepted the substitution, in writing, as satisfactory. Such acceptance shall not relieve the Contractor from complying with the requirements of the Drawings and Specifications.

1.12 Testing

1.12.1 Testing of equipment shall be provided as indicated under the description of the various construction units, the equipment supplier's instruction manual, and as further outlined in these Specifications. If the equipment is damaged, either in shipment or during installation, additional tests shall be made as recommended by the manufacturer and as specified by the Engineer. All equipment shall be given complete mechanical operation tests to ensure proper operation. Schedules for equipment tests shall be submitted to the Engineer for approval. All tests shall be witnessed by the Engineer.

1.13 Surveys and Layout of Work

1.13.1 General

1.13.1.1 The survey provided by the Owner shall be limited to the reference points indicated on the Drawings and in the Specifications. All other reference points shall be established by the Contractor.

1.13.1.2 Survey stakes established by the Owner shall be preserved by the Contractor unless the Engineer authorizes their removal. Any stakes destroyed or removed by the Contractor's agents, employees, or subcontractors without approval of the Engineer shall be replaced by the Owner at the Contractor's expense. Cost to the Contractor for replacing stakes destroyed or removed as aforementioned shall include actual labor costs incurred plus a reasonable charge for use of supplies and equipment, and shall be deducted from payments due the Contractor. Survey stakes destroyed or removed through no fault of the Contractor shall be replaced by the Owner at the Owner's expense. The Owner shall correct any errors or replace missing stakes as soon as possible after being notified by the Contractor. The Contractor shall receive no additional compensation for delays incurred by stakes marked in error, errors in the Staking Sheets, or stakes removed or missing.

1.13.2 Overhead Transmission and Distribution Lines

1.13.2.1 Owner shall set centerline stakes and/or pole stakes at structure locations. The pole stakes shall be clearly marked with the structure number. Staking Sheets shall be furnished detailing structure data. Included shall be the structure type, pole heights, guying, grounding arrangements, etc. Structures, anchors, etc., shall be placed in locations determined and staked by the Engineer or as shown on the Drawings. Structures, guys, etc., shall not be erected in any other location without prior approval of the Engineer.

1.13.2.2 Elevations shall be furnished by the Owner only in the form of Staking Sheets.

1.13.2.3 If a discrepancy exists between the markings on the stakes and the Drawings or the Staking Sheets, or if it appears to the Contractor that any structure as staked is in error, he shall notify the Engineer immediately and no further work shall be performed on the structure or structures in question until such discrepancy or error is resolved. If the Contractor proceeds without the Engineer's direction, all such work shall be at the Contractor's own risk.

1.14 Coordination, Construction Schedule, and Reports

1.14.1 Coordination

1.14.1.1 Contractor shall be responsible for all coordination with local, state, and federal authorities, or with any other groups who have rights to intervene in the Project. He shall also coordinate the activities of all subcontractors, suppliers, and other involved entities, with the Engineer's consent.

1.14.1.2 Contractor shall be responsible for contacting all involved utility companies and Owner's Representative prior to starting any underground work to determine the location of any

underground facilities. The Contractor shall repair any damaged underground equipment without additional cost to the Owner.

1.14.1.3 Engineer and the Contractor shall jointly prepare an outage plan for all scheduled interruptions of electrical power that affect third parties. This plan shall be signed by the Contractor, Engineer, Owner, and the affected utilities at least two (2) weeks prior to the outage. Prior to requesting signatures, all materials required for the scheduled outage shall be at the site. The outage plan shall include specific procedures for coordinating with commercial activities such as automated data processing centers (computers), hospitals, 24-hour-per-day manufacturing and processing plants, etc.

1.14.1.4 Contractor shall be required to attend a preconstruction conference with the Owner, Engineer, and any other party involved with the Project. The Contractor's superintendent (field man-in-charge) shall also attend the conference. If the Contractor's superintendent is not present, the conference shall be rescheduled at the Contractor's expense. At the conference the Contractor shall present a construction plan including but not limited to the following:

1. Construction sequence, methods, and equipment to be used in all phases.

2. Tentative access and Right-of-Way roads.

3. Location(s) of staging area(s).

4. Construction schedule showing all activities for the entire Project. The activities shall correspond to the construction units in the Bid Schedule. (A sample form is included on page I-13.)

1.14.1.5 Contractor's superintendent shall attend all meetings necessary to ensure timely completion of the Project.

1.14.1.6 If requested, the Contractor shall provide, without charge, two-way radios (maximum of three (3) per project) for the Engineer's vehicles.

1.14.1.7 Contractor shall provide a field office for his personnel. Phone service shall be provided to the field office. Contractor shall pay for all utility costs related to their field office.

1.14.1.8 Contractor shall furnish jobsite office space for use by the Engineer. Prior to any jobsite work, the Contractor shall furnish 100 square feet (minimum) of office space adjacent to the location of his own field office for the use of the Engineer. If the Contractor utilizes a mobile office and changes locations during the term of the contract, the office space provided for the Engineer shall also be mobile and the Contractor shall move the mobile unit simultaneously with transportation of his own unit. The Contractor shall make all arrangements and pay all costs for providing lighting, heating, and cooling. The office shall have a heating and cooling unit sized to provide adequate heating and cooling in temperatures ranging from -30°F to 100°F. Adequate lighting and 110-volt electrical outlets shall be provided. Engineer shall arrange and pay for their telephone services.

1.14.1.9 Contractor shall provide, without additional charge, the same non-automotive transportation (helicopter, boat, snowcat, etc.) for the Engineer as utilized by the Contractor's personnel. Under normal circumstances the Engineer shall travel at the same times as the Contractor's personnel.

1.14.10 Contractor shall maintain in a safe place at the site one (1) record copy of all Drawings, Specifications, Addenda, Change Orders, Field Orders, and written interpretations and clarifications in good order and annotated to show all changes made during construction.

1.14.2 Construction Schedule

1.14.2.1 The Construction Schedule shall be continuously updated and, if necessary, redrawn on the first working day of each month or upon issuance of any Change Order which substantially affects the scheduling. Schedule slippage shall be accompanied by a recovery plan, subject to the Engineer's acceptance, showing how the Project will be brought back on schedule. Schedule recovery, including overtime, shall be at no additional cost to the Owner. Failure to promptly provide revised schedules may result in delayed progress payments. A sample form is shown at the end of this chapter.

1.14.2.2 Time is of the essence in the completion of this Contract. The Contractor shall utilize the resources necessary to keep construction on schedule.

1.14.3 Reports

1.14.3.1 Daily and weekly progress reports shall be prepared by the Contractor. These reports shall be signed by the Contractor and forwarded to the Engineer. Delinquency in signing daily and weekly reports may result in delayed progress payments. The Engineer will develop an independent progress report every 15 days after on-site inspection is complete. (Sample forms are included at the end of this Chapter) If disagreements occur, the Contractor's representative shall circle, note, initial, and date those items in dispute.

1.14.3.2 The daily, weekly and bi-monthly reports will form a permanent part of the construction record. Once the reports are signed by the Contractor, their accuracy shall not be further contested. The reports are available to the Contractor at any time for his review.

1.15 Environmental Protection

1.15.1 Contractor shall exercise care to preserve the natural landscape in the construction area, as well as areas outside the Right-of-Way. Construction operations shall be conducted to prevent any unnecessary scarring or defacing of the natural vegetation and surroundings in the vicinity of the work. All land-disturbing activities shall be planned and designed to be compatible with the natural land forms and not detract from them. Construction methods shall be designed to limit, so far as reasonable, erosion or subsidence. The Contractor shall take such soil and resource conservation and protection measures that the Engineer determines necessary.

1.15.2 Contractor shall conduct all construction activities in a manner that will avoid or minimize degradation of air, land, and water quality. Toxic material shall not be released into any lake or water drainage. All construction work and subsequent use of the jobsite must be consistent with applicable federal, state, and local standards relating to safety, environmental quality, and public health. Mobile ground equipment shall be kept out of the waters of lakes, streams, and rivers.

1.15.3 Contractor shall obtain permits and comply with the requirements of state and local air-pollution control and fire authorities. If permitted, open burning shall only be allowed in approved locations and during appropriate weather conditions. If weather conditions rapidly change (such as wind direction or velocity), the Contractor's burning operation may be temporarily halted by the Engineer. Burn piles shall be kept as clean and dry as possible and burned in such a manner as to reduce smoke.

1.15.4 Construction activities shall be conducted to minimize the creation of dust. This may require the limitation of types of equipment, vehicle speeds, and routes utilized. Water, straw, wood chips, dust oil, dust reducer, gravel, combinations of these, or similar control measures may be required by the Engineer.

1.15.5 Crankcase oil or other petroleum products shall be containerized. No drainage onto the ground or into streams shall be allowed. A totally enclosed cage or other containment shall be provided for all trash. All

garbage, debris, and foreign matter shall be removed to an established sanitary landfill or other recognized disposal facility.

1.15.6 In all its operations under this Contract, the Contractor shall comply with all applicable federal, state, and local laws and regulations concerning the use of poisonous substances. These substances include but are not limited to insecticides, herbicides, fungicides, and rodenticides.

1.15.7 Contractor shall take such measures as are necessary to ensure unrestricted passage and movement of fish and wildlife. No artificial structure or stream channel change that causes a permanent blockage to movement of fish shall be constructed.

1.15.8 Contractor shall do everything reasonably within its power, both independently and on request of any duly-authorized representative of the United States, to prevent and suppress fires on or near the jobsite, including making available such construction personnel and equipment as may be reasonably obtainable for the suppression of such fires.

1.16 Hygiene, First Aid, and Safety

1.16.1 Contractor agrees to comply with all safety provisions for the Project, including all requirements and regulations of OSHA, MSHA and state requirements for health and safety on construction projects.

1.16.2 In the event of the occurrence of a situation wherein life and/or valuable property is in apparent imminent danger, the Contractor is hereby authorized without further special instructions from the Owner to act at its own discretion to prevent injury to persons or damage to property.

1.16.3 Contractor shall provide all required toilet facilities for its employees.

1.16.4 Contractor shall furnish to the Owner detailed written reports of all injuries occurring on the job.

1.16.5 Contractor bears sole responsibility under the law for the safety of its own personnel and for persons entering the worksite as agents or visitors of the Contractor.

1.17 Cleanup

1.17.1 Cleanup During Construction

1.17.1.1 The right-of-way and staging area(s) shall be kept in a neat and orderly condition, as stipulated below. The Engineer or Owner may at any time during construction order a general cleanup of the site as a part of the work under this section. Such cleanup shall not result in any additional cost to the Owner.

1. At the time they become scrap, all wire clippings, bundle ties, nails, breakaway bolt heads and nuts, and other metallic scrap are to be picked up and properly disposed of by the Contractor in a manner required by applicable laws and acceptable to the Engineer.

2. All garbage, lunch wraps, equipment parts, oil filters, petroleum products, and light packaging material such as plastic, paper, and cardboard are to be removed on a daily basis.

3. At the completion of each type of work all assembly, erection, and stringing remnants and debris are to be removed from each worksite.

4. After completion of construction, all survey debris - stakes, lath, flagging, etc. - shall be removed by the Contractor.

1.17.1.2 The Contractor shall dispose of waste, trash, and debris in a manner acceptable to the Engineer.

1.17.2 Final Cleanup of Facilities

1.17.2.1 Prior to final inspection by the Engineer and after all construction work is essentially complete, the Contractor shall thoroughly clean up all facilities.

1.17.2.2 Items to be cleaned up include but are not limited to all work staging areas, material storage areas, structures and facilities, access areas, and all other sites and facilities within or incidental to the construction.

1.18 Final Inspection

1.18.1 Requirements Preparatory to Final Inspection

1.18.1.1 Contractor shall notify the Engineer to perform a preliminary final inspection for the purpose of determining the state of completion of the Project. Contractor shall notify the Engineer at least seven (7) days in advance of the time this inspection is to be performed. From the information gathered from this inspection the Engineer shall prepare a punch list of work to be performed, corrected, or completed before the Project will be accepted. All work on the punch list shall be completed by the Contractor prior to final inspection.

1.18.1.2 All temporary facilities shall be removed from the jobsite, except those required for the performance of work expected to appear on the punch list.

1.18.1.3 The jobsite, including all storage areas, shall be cleaned up.

1.18.1.4 All operating instructions for equipment shall be properly mounted and posted as specified or required.

1.18.1.5 All guarantees and warranties, along with required maintenance instructions and manuals, shall be submitted to the Engineer.

1.18.2 Final Inspection

1.18.2.1 After all requirements preparatory to the final inspection have been completed as specified above, the Contractor shall notify the Engineer to perform the final inspection. Notice shall be given at least seven (7) days in advance of the time the final inspection is to be performed.

1.18.2.2 Contractor shall accompany the Engineer and Owner on the final inspection tour, along with any principal subcontractors the Engineer or Owner may request to be present.

1.18.2.3 If the work has been completed in accordance with the Contract Documents and no further corrective measures are required, the Engineer shall issue a Certificate of Completion and the Owner shall accept the Project.

1.18.2.4 If the work has been substantially completed in accordance with the Contract Documents and only minor corrective measures are required, the Engineer may conditionally accept the Project and may issue a Certificate of Completion based upon the Contractor's assurance that the corrective measures will be completed within the shortest practical time period. A Certificate of Completion will not be issued if an electrical shutdown is required to complete the Project.

1.18.2.5 If the work has not been substantially completed in accordance with the Contract Documents and numerous or substantial corrective measures are still required, the Engineer will not issue a

Certificate of Completion. Instead, a new punch list will be prepared based on the information gathered from the final inspection, and the Contractor shall be required to complete this work and then call for another final inspection following the procedure outlined above.

1.18.2.6 Upon acceptance of the Project by the Owner, the Contractor shall submit his request for the final payment.

1.19 Record Drawings

1.19.1 Upon completion of the work the Contractor shall provide the Engineer with a marked up copy of the construction drawings and the Staking Sheets. All changes made during construction shall be shown.

1.19.2 Contractor's progress payment retention will not be released until the Engineer receives the marked up construction drawings.

END OF GENERAL REQUIREMENTS

SCHEDULE OF CONSTRUCTION

ISSUED ___/___/___, REV. __, PAGE __ OF __

128002-01: SHUNGNAK - KOBUK TIE LINE

CONSTRUCTION UNITS	UNIT TOTALS	MONTH																										
		DAY																										
		WEEK	-4	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										
		SCH.																										
		ACT.																										

REVIEWED FOR: Alaska Energy Authority BY: ______ TITLE: ______ DATE: __/__/__

APPROVED FOR: (CONTRACTOR) BY: ______ TITLE: ______ DATE: __/__/__

DAILY FIELD REPORT Issued / / , Rev. __, Page __ of __

128002-01: SHUNGNAK - KOBUK TIE LINE

DATE: / / DAY: S M T W T F S Project: Week # Day #

START TIME: : (AM) (PM) STOP TIME: : (AM) (PM) Total Hrs.

VEHICLE NO. MILEAGE: Out In Total

MANPOWER: Superintendent, Foremen, Workmen, Crews.

GROUND CONDITIONS: Dry Wet Snow Ice Mud

WEATHER CONDITIONS: Clear Cloudy Rain Snow Wind

TEMPERATURE RANGE: From °F to °F Average = F°

EQUIPMENT PROBLEMS:

MATERIAL SHORTAGES:

MATERIAL ORDERED:

Copy Attached

MATERIAL RECEIVED:

Copy Attached

ACCIDENTS/PROP. DAMAGE:

Copy Attached

LOSS OF PRODUCTION DUE TO: Weather Material Equipment Other

FIELD CHANGES:

Copy Attached

CORRESPONDENCE WITH: Contractor Agency Rep. Engineer Other

Copy Attached

REMARKS:

APPROVED FOR: Alaska Energy Authority BY: DATE: / /

APPROVED FOR: (CONTRACTOR) BY: DATE: / /

WEEKLY CONSTRUCTION REPORT Issued __/__/__, Rev. __, Page __of__

128002-01: SHUNGNAK - KOBUK TIE LINE

WEEK ENDING: __/__/__ SCHEDULE WEEK # _____

Construction Units	Unit Totals	To Date		Diff.	Construction Units	Unit Totals	To Date		Diff.
		Sch.	Act.				Sch.	Act.	

AVERAGE GROUND CONDITION:
___ DRY ___ WET ___ SNOW ___ ICE ___ MUD

REMARKS:

AVERAGE WEATHER CONDITION:
___ CLOUDY ___ CLEAR ___ RAIN ___ SNOW ___ WIND

AVERAGE TEMPERATURE RANGE:
F° to °F °F Hi °F Lo

MANPOWER ON SITE: ___ Superintendent,,
____ Foremen, ____ Workmen, ____ Crews.

LOSS OF PRODUCTION DUE TO:
____ Weather ____ Material ____ Equipment ___ Other

APPROVED FOR: Alaska Energy Authority BY: _____ DATE: __/__/__

APPROVED FOR: (CONTRACTOR) BY: _____ DATE: __/__/__

2.1 General N/A

2.2 Seed Mix N/A

2.3 Seed Application N/A

2,4 Inspection and Evaluation N/A

END OF REVEGETATION

3.1 General

3.1.1 Contractor, at its expense, shall furnish and install all guard structures required for crossings over roads and other obstructions - or for protection of the conductor. As soon as the guard structure has served its purpose, it shall be removed in its entirety and all holes shall be properly backfilled.

3.2 Road Crossings

3.2.1 Such guard structures or other protective devices as may be required by local or state authorities, property owners, or the Owner for the purpose of maintaining traffic during stringing operations shall be installed. The expense of required flagmen, guard structures, and other protective devices shall be borne by the Contractor.

3.3 Notice of Crossing

3.3.1 Contractor shall notify the Owner and the Engineer of any road it intends to cross at least ten (10) calendar days in advance of the time it intends to make the crossing.

3.3.2 Contractor shall also notify the Engineer, in writing, of its intention to effect any crossing at least seventy-two (72) hours in advance of the scheduled crossing. Written notice to the Engineer shall state the location of the crossing to be made, the date and hour of the clearance, the length of time that will be required to effect the crossing, and the duration of the clearance requested.

3.3.3 Engineer, at his discretion, may inspect the Contractor's preparations to determine that they are adequate to permit the making of the crossing without undue interruption of service or delay to the public. This inspection shall in no way relieve the Contractor of any of its responsibility.

3.4 Guard Structures

3.4.1 A guard structure shall consist of a pole with stringing sheaves attached, a pole with timbers attached, two or more poles connected with a fiber rope, or two or more poles joined by timbers, with guys or braces when required. Guard structures using stringing sheaves shall contain a provision for supporting the conductor in the case of failure of the sheave and attachment assembly. In all cases there shall be provisions for avoiding damage to the conductor by the guard structure.

3.4.2 All guard structures shall be of adequate strength to withstand the stresses to which they may be subjected. Poles shall be set to a sufficient depth, all parts shall be of sufficient strength, and necessary guying or bracing shall be installed to ensure adequate strength of the structure.

END OF OVERHEAD CROSSINGS

4.1 General

4.1.1 The construction and erection of the structures shall be in accordance with the Drawings and Staking Sheets.

4.1.2 All work shall be done in a neat and workmanlike manner. Special care shall be taken to ensure that all crossarms, braces, fittings, hardware, and other fixed metalwork are installed in their correct positions. Structures shall be placed accurately and in a correct position of alignment and grade.

4.1.3 The Engineer shall inspect each structure and complete the form at the end of this Chapter. All deficiencies noted on these forms shall be corrected by the Contractor prior to acceptance of the line by the Owner.

4.2 Poles

4.2.1 All poles shall be handled with care. Particular care shall be exercised in the use of pole tongs, peavies, or cant hooks so that the poles are not damaged. Handling tools shall not be applied between the butt and one (1) foot above the ground line. Poles shall not be dropped while being unloaded from the truck,car or airplane. If the poles are snaked, suitable skids shall be used to keep the poles off the ground. Poles shall not be allowed to lie in contact with the ground for any period of time exceeding twenty (20) days. Poles that will not be set within twenty (20) days of delivery time to the site shall be piled on skids of such size that no part of the pole is in contact with the ground. Any pole broken or damaged by the Contractor shall be replaced at his expense.

4.2.2 Poles shall be matched as to size so that poles in the same structure will have approximately the same top dimension. Poles having larger top diameters than average shall be selected for use for angle and deadend structures and points of extra strain, as specified in the Staking Sheets.

4.2.3 Poles shall not be gained. Pole gains shall be used, as shown on the drawings, for the attachment of crossarms.

4.2.4 Holes shall be located at right angles to the crossarm and through the center of the pole. The Contractor shall bore all required holes in the locations shown on the Drawings. The tolerance for pole bolt-hole locations shall be plus or minus one (1) inch. All holes shall be one-sixteenth (1/16) inch larger in diameter than the bolts to be used in the holes. All holes in full-length treated poles shall be treated with preservative compound. If the holes in the pole and crossarm do not match, the bolts shall not be forced by bending or driving. The Engineer at any time may require that new holes be bored. All unused holes in the poles shall be plugged with tight-fitting, treated wood plugs. Wood plugs shall be treated by dipping in preservative compound.

4.2.5 Pilot holes shall be bored in poles where lag screws larger than one-half (1/2) inch in diameter are to be used. The pilot holes shall be three-sixteenths (3/16) inch smaller in diameter than the lag screw.

4.2.6 The roof of all cut poles shall be treated with Pole-Nu (manufactured by Chapman Chemicals) or a product judged to be equal by the Engineer. All gains, plugs, and bolt holes made by the Contractor shall be brush treated with two applications of the same type of preservative - coal tar, creosote, or pentachlorophenol - that was originally used to treat the poles. Pentachlorophenol preservative, if used, shall include a coloring agent.

4.3 Depth of Pole Set

4.3.1 Depth of the set shall be measured on the downhill side of the hole. All poles shall be set as follows:

4.3.1.1 Firm Soil -- Depth is equal to ten percent (10%) of the pole length plus three and one-half (3 1/2) feet, with a minimum depth of six (7) feet.

4.3.1.2 Solid Rock -- Depth is equal to ten percent (10%) of the pole length plus two (2) foot, with a minimum depth of six (6) feet.

4.3.1.3 The minimum setting depths for poles shall be as follows:

Pole Length (feet)	Setting Depth-Firm Soil (feet)	Setting Depth-Rock (feet)
35	7.0	6.0
40	8.0	6.0
45	8.5	6.5
50	7.0	6.0
55	7.5	6.5
60	8.0	7.0
65	8.5	7.5
70	9.0	8.0
75	9.5	8.5
80	10.0	9.0
85	10.5	9.5
90	11.0	10.0
95	11.0	10.0
100	11.0	10.0

4.3.1.4 The tolerance for pole setting depth shall be plus or minus six (6) inches.

4.3.2 Where loose rock or other unusual soil conditions are encountered, the Engineer may require poles to be set to depths greater than those for firm soil.

4.3.3 Two or three-pole structures located on sloping ground shall have the pole setting depth increased as required to level the crossarm. Pole tops may be cut only with the prior approval of the Engineer.

4.3.4 When the required depth of set is greater than the height of the treated area on the pole, the Contractor shall apply two (2) applications of the original preservative used on the pole from the treated area to a height of one (1) foot above the ground line.

4.4 Pole Holes

4.4.1 Unless otherwise provided in the Construction Units, all excavation is considered unclassified regardless of the nature of the material. No measurement of and no payment for excavation shall be made.

4.4.2 Contractor shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Facilities, for coordination of the Work with the owners of such Underground Facilities during construction, for the safety and protection thereof and repairing any damage thereto, the cost of all of which will be considered as having been included in the Contract Price.

4.4.3 Pole holes shall be excavated with straight sides eight (8) to ten (10) inches larger in diameter than the butt of the pole to allow the use of tamping bars all around the pole to the full depth of the hole.

4.4.4 If available in the immediate vicinity, granular backfill shall be used in backfilling the bottom eighteen (18) inches of the hole and the twenty-four (24) inches immediately below the original ground level. Sufficient soil shall be mixed with the rocks to eliminate voids and permit the mixture to be solidly tamped and compacted. Tamping of the backfill may be done in layers of six (6) inches or less, or may proceed continuously, provided each layer or shovelful is firmly tamped before the addition of fresh material. Backfilling shall be done in such a manner that all material in the hole will be thoroughly tamped to the compactness equal to a dry density not less than the natural dry density of the undisturbed earth surrounding the hole. The Engineer, at his sole discretion, may specify the procedure for backfilling. Hand tamping will not be allowed without the permission of the Engineer. Pole holes shall be backfilled completely in one operation. The backfill shall be evenly banked and firmly tamped around the poles to a height of about twelve (12) inches above the original ground level.

Excess excavated earth shall be neatly leveled in the vicinity of the pole or disposed of as directed by the Engineer.

4.4.5 Frozen earth, wood, leaves, decaying matter, or any material subject to decay shall not be used in backfilling. If any water is present in the hole, the water shall be removed from the hole by the Contractor before the backfill is added.

4.4.6 When the condition or type of soil is unsatisfactory for backfill, the Contractor shall, at his expense, furnish and place gravel for pole backfill in the quantities and locations specified in the Staking Sheets or by the Engineer. Sufficient soil from the excavation shall be mixed with the gravel to eliminate voids and to permit the mixture to be solidly tamped and compacted. Tamping and compacting shall comply with the procedures outlined above. Gravel shall not be placed above the ground line. Soil shall be placed and tamped to a height of twelve (12) inches above the ground line. Any excess soil from the excavation shall be disposed of in accordance with the procedures outlined above. Fill gravel shall be pit-run grade or better and shall consist of hard, durable gravel or fragments of stone free from vegetable matter and lumps of clay. The size of the material shall be three (3) inches minus. Suitability of all gravel shall be approved by the Engineer.

4.4.7 Rock and other excess excavated material remaining from pole holes located on cultivated land and other unsuitable places shall be removed and disposed of by the Contractor.

4.5 Setting of Poles and Structures

4.5.1 All structures shall be constructed in a workmanlike manner and in accordance with the details on the Drawings. Some of the Drawings may be typical only, and the Contractor shall not be entitled to any additional allowance by reason of any modification of a minor character which may be required. Not more than one class of pole may be used for any structure, nor may a combination of butt-treated poles and full-length treated poles be used for any structure without permission of the Engineer. Poles shall not be left unset in holes for more than thirty (30) days.

4.5.2 Pole tops in a complete multiple-pole structure shall be leveled to within the tolerance of one (1) inch per ten (10) feet of total pole length. If the poles are not level within this tolerance, the Engineer shall be notified, and if he so directs, the top of the high poles shall be cut off to the elevation of the lowest pole. This shall not affect the minimum dimensions shown on the Drawings and is not applicable to slope structures. The tops of poles shall not be cut except under very exceptional conditions and upon approval of the Engineer. If cutting is deemed necessary, the pole top shall be treated with Pole-Nu manufactured by Chapman Chemicals or a product judged equal by the Engineer. Under no circumstances shall the butt of any pole be cut.

4.5.3 Where raking is not required or directed, poles shall be aligned as follows: The center of the pole top shall be in vertical alignment with the center of the pole at the ground line when viewed from any direction. Vertical misalignment shall be held within a tolerance of four (4) inches provided that no pole is misaligned in a direction opposing that of another pole in the same structure. However, in any series of structures repetitive misalignment of poles shall be considered poor workmanship and shall be corrected.

4.5.4 Angle structure poles shall be raked against the conductor strain not more than one (1) inch for each ten (10) feet of pole length above ground after conductors are installed at the required tension.

4.5.5 All poles (except angle structures) shall be set in alignment with one another and plumbed. These poles shall remain plumb after the conductors are strung. At angle structures where suspension insulators are used, the poles shall be offset on the bisector of the angle so that conductors shall hang directly over the point of intersection of the tangent structures in both directions.

4.5.6 Poles shall be set within the following tolerances:

4.5.6.1 Single-pole structures -- Plus or minus four ($\pm$4) inches parallel to and perpendicular to the conductors.

4.5.6.2 Multi-pole structures -- Plus or minus four (±4) inches parallel to the conductor. Perpendicular to the conductors the poles shall be set plus two (+2) inches and minus one (-1) inch between adjacent poles.

4.5.6.3 Exceptions -- With the permission of the Engineer the above tolerances may be increased for structures set entirely by hand methods.

4.5.7 Structures shall be faced according to the following guidelines:

4.5.7.1 Pole facing -- Pole facing shall be determined by the pole brand.

4.5.7.2 Tangent structures -- Structures shall be alternately faced ahead and back on line.

4.5.7.3 Angle structures and double-deadend angles -- One (1) structure on each side of the angle shall face the angle structure. The angle structure shall face the bisector guy on the outside of the angle.

4.5.7.4 Double-deadend structures -- Two (2) structures on each side of the deadend shall face into the deadend; the deadend shall face away from the greatest span.

4.5.7.5 Terminal structures -- Two (2) structures adjacent to the terminal structure and the terminal structure shall be faced into the station.

4.5.7.6 Long spans -- The structure on each side of the long span shall be faced away from the long span.

4.5.8 At each structure one (1) survey stake showing the structure number shall be securely attached to the north side of the pole approximately five (5) feet above the ground.

4.6 H-pile Pole Foundations

4.6.1 H-pile pole foundations shall consist of a minimum of sixteen (16) foot W8X48 steel. H-pile shall be driven to a ten (10) foot depth below ground line allowing six (6) feet of exposed pile for pole attachment.

4.6.2 H-pile shall be installed with the flange (X-X axis) oriented in-line with powerline centerline. H-pile foundations shall be plumb prior to pole attachment.

4.6.3 Poles are to be secured to the H-pile foundation using three (3) 3/4" machine bolts with hardware.

4.6.4 Disturbed ground line material around H-pile foundation shall be compacted after installation is complete.

4.6.5 In areas where additional H-pile foundation lengths are required for foundation stability, diamond shaped plates welded to the W8X48 steel shall be used for splicing. Diamond shaped plates shall be welded to three faces of the H-pile.

END OF STRUCTURES

STRUCTURE INSPECTION REPORT				128002-01: SHUNGNAK - KOBUK TIE LINE			
STR. NO.	PTA'S.			POLE (HT & CL):			
GUY ASSY'S:		ANCHOR ASSY'S:					
MISC. ASSY'S:							
FOUNDATION TYPE:		H-PILE DEPTH:			EXT:		

SPEC. REF.	DESCRIPTION	AERIAL	GRND.	YES	NO	N/A	INSP
	FRAMING INSPECTION						
	Pole Ground Correctly Installed						
	Roofs, Gains, & Holes Treated						
	Arm(s) & Brace(s) Correctly Located and Installed						
	Nuts, Eyenuts, Locknuts Installed & Tight						
	Bolts Correct Length (1/2" - 2")						
	SETTING INSPECTION						
	Structure Plumb (4", Top to Bottom)						
	Angle Structure Raked (0-1"/10')						
	Crossarm(s) or Davit Arm(s) Level (1"/10')						
	Hardware in Vert. & Horiz. Alignment						
	Foundation Set to Correct Depth						
	H-Pile Extension Weld Complete and Correct						
	H-Pile Mounting Bolt Hardware Tightened and Complete						
	Structure Correctly Faced (AH or BK)						
	FINAL INSPECTION						
	Structure Backfilled (12", No Settlement) (Buried)						
	Structure Plumb (4", Top to Bottom)						
	Angle Structure Raked (0-1"/10')						
	Insulators Clean, Complete, & Aligned						
	Conductors Undamaged (Ahead Span)						
	Conductors Properly Sagged (Ahead Span)						
	Wraplock Ties Correctly Installed						
	Splices and/or Deadends Correctly Installed						
	Jumpers Correctly Installed						
	Guy Assy(s) Complete and Correct						
	Anchor Assy(s) Complete and Correct						
	Structure Area Neat and Clean						

INSPECTED :	Alaska Energy Authority	BY:	DATE ___/___/___
INSPECTED :	POWER Engineer's Inc.	BY:	DATE ___/___/___
INSPECTED :	Copper Valley Construction	BY:	DATE ___/___/___

5.1 General

5.1.1 Crossarms, braces, and all hardware shall be installed in accordance with the Drawings and Staking Sheets. Mounting holes in poles shall be located within plus or minus one (±1) inch from the specified dimension. Any holes incorrectly drilled by the pole supplier shall be redrilled by the Contractor without additional cost to the Owner.

5.2 Crossarms

5.2.1 Crossarms shall be handled with the same care as poles. Damage to the wood and preservative treatment shall be avoided. Wood arms that will not be used within twenty-four (24) hours after delivery to the site shall be placed on skids of sufficient size and design to prevent warping or bending, and which prevent any part of the crossarm from coming into contact with the ground. Crossarms shall not be used as skids.

5.2.2 Holes in crossarms shall be located within plus or minus one-half (±1/2) inch of the specified dimension. If holes in wood crossarms must be rebored, the old holes shall first be plugged with tight-fitting, treated-wood plugs. The new holes shall receive at least two applications of preservative. If crossarms must be cut, the bared surfaces shall receive at least two applications of preservative. The wood plugs, all new bolt holes, and all newly-bored surfaces shall be treated with the same type of preservative that was originally used to treat the crossarms.

5.2.3 The crossarms on the complete structures shall be level to within a tolerance of one (1) inch per ten (10) feet. If the arm is not level within this tolerance, the Engineer shall be notified, and if he so directs, the high end of the arm shall be lowered until it is level. Unused holes in the pole shall be tightly plugged with treated wood plugs.

5.3 Crossarm Fixtures

5.3.1 The permanent attachment of crossarms and fixtures to the poles may be done before the poles are erected or after the poles have been permanently set. In either case the method used shall be subject to the approval of the Engineer.

5.3.2 Where pole top pins are used, they shall be on the opposite side of the pole from the gain, with the flat side against the pole.

5.4 Braces

5.4.1 The number and location of braces shall be as shown on the Drawings and Staking Sheets, or as determined by the Engineer. Braces shall be handled with the same care as poles and crossarms. Braces that will not be used within twenty-four (24) hours after delivery to the site shall be placed on skids so that no part of the brace is in contact with the ground. Braces shall not be used as skids.

5.5 Fasteners and Hardware

5.5.1 Lag screws shall be tightened with a wrench after driving.

5.5.2 Bolts must be of proper length. Bolts shall extend at least one-half (1/2) inch and not more than two (2) inches beyond the nuts. Bolts shall not be cut unless approved by the Engineer.

5.5.3 A locknut and spring washer shall be installed with each nut, eyenut, or other fastener on all bolts or threaded hardware specified on the Drawings. All spring washers shall be installed horizontally. The round end of the spring washer shall face to the left. Any spring washers with hammer marks on the round end shall be replaced.

5.5.4 Only wrenches approved by the Engineer shall be used on nuts, bolts, and lag screws. Wrenches that will not deform the nuts, bolts, and lag screws or cut or flake the galvanizing shall be used.

5.5.5 All nuts and lock nuts shall be tightened adequately but not excessively. Lock nuts shall be applied after the first nuts have been tightened. In the case that a random check reveals laxity in firmly tightening nuts and lag screws, the Contractor may be required to retighten all nuts and lag screws on all completed structures at no extra cost to the Owner.

END OF CROSSARMS, BRACES, AND HARDWARE

6.1 General

6.1.1 Insulators and related hardware shall be carefully handled while being transported, assembled, and placed. All insulators shall be thoroughly cleaned of all foreign materials immediately before being installed on the structures. Overall dimensions shown on the Drawings for insulator and hardware assemblies are approximate only, due to differences in manufacture. Assemblies shall be measured for accurate determination of jumper lengths and conductor cut-offs when installing deadend accessories.

6.2 Suspension Insulators

6.2.1 Cotter keys shall be fully inserted into the insulator caps. Insulator assemblies shall be lifted to the crossarm from near one end of the assembly only. Bending of insulator strings to the point of bending ball pins, deforming cotter keys, or damaging hardware is prohibited. If erection is by crane, insulators may be attached to the crossarm after it has been raised sufficiently to allow half or more of the insulator string to hang vertically and precautions have been taken to prevent the insulators from striking the ground.

6.2.2 Insulator strings may be snubbed to the crossarm only with the specific approval of the Engineer. When a sheave is to be attached to the insulator string on an installed crossarm, the insulator string shall be pulled out of the vertical position only by pulling near the bottom of the string. The string shall be eased, not dropped, back to the vertical position. Under no circumstances shall suspension insulators be left unrestrained in a vertical position without conductor for more than thirty (30) calendar days.

6.3 Pin and Post-Type Insulators

6.3.1 With tie-top pin and post-type insulators the conductors shall be tied in the top groove of the insulator on tangent poles and on the side of the insulator away from the strain at angles. Pin-type insulators shall be tight on the pins. On tangent structures the top groove must be in line with the conductor after tying in.

END OF INSULATORS

7.1 General

7.1.1 Installation of guys and anchors shall consist of excavation, handling and hauling hardware, installing anchors and anchor rods in position, backfilling and compacting the backfill, and assembling and attaching the guys in accordance with the Drawings and Staking Sheets.

7.2 Guys

7.2.1 Guy types and locations shall be as staked by the Engineer and as shown on the Drawings and the Staking Sheets, except where field conditions require detailed instructions by the Engineer. Should it appear that the specified or staked location of guys or anchors is undesirable due to conflict with roads, streams, conductors, or other improvements - or due to creating a hazard to property or persons - the installation shall be deferred until specific instructions have been received from the Engineer. If the Contractor fails to get such instructions, the relocation of the guys and anchors shall be at the Contractor's expense.

7.2.2 Points of attachment to poles shall be as shown on the Drawings or on the Staking Sheets. Guys shall be installed before conductors or cable wires are strung. Prior to stringing, all guys shall be tightened sufficiently to take out the slack in the guy strand. All nuts on pole bands, clamps, and other fittings shall be tightened adequately but not excessively. Where two or more guy strands terminate at one anchor, the tension on all guy strands shall be equalized.

7.2.3 Guy marker shall all be galvanized metal and not plastic or anyother such synthetic product.

7.3 Guy Strain Insulators

7.3.1 Fiberglass guy strain insulators shall be installed on all guys attached above the distribution conductors. The insulators shall have a minimum breaking strength equal to or greater than the ultimate strength of the guy wires to which they are attached. The length of the insulator(s) shall be great enough to provide wet flashover voltage equal to or greater than the required BIL of the highest voltage on the structure.

7.3.2 Installation of the guy strain insulators shall be accomplished in a manner to meet the insulator positioning requirements given in the order of importance listed below:

Priority 1 -- Insulators shall be so located that the bottom of the insulator will not be less than eight (8) feet above the ground at any point along an arc described by it when its guy sags or is broken.

Priority 2 -- The top of the insulator shall be below the lowest line conductor when the guy strand is in a vertical position, except when the first requirement prevents such positioning.

Priority 3 -- All insulators under tension should not be less than six (6) feet from the pole, if possible, after the above conditions have been met.

7.4 Anchors and Anchor Rods

7.4.1 The length of anchor rods and the location of the plate or rock anchors to be installed shall be as shown on the Drawings, Staking Sheets, and/or as staked in the field. Certain field conditions, such as steep slopes, may require detailed instructions by the Engineer. The anchor rod shall be set in line with the guy strand and to such a depth that the eye of the rod protrudes from the ground a maximum distance of eight (8) inches after strain is applied, or to depths as specified by the Engineer. Under no circumstances shall the eye of the rod be covered.

7.4.2 The setting of each anchor in regard to depth and position shall be inspected by the Engineer and his approval given before the anchor hole is backfilled. Anchors of any type that indicate creep or withdrawal for any reason when placed under strain shall be reset by the Contractor at no extra cost to the Owner.

7.4.3 Anchor holes in earth shall be vertical and dug as near to the size of the anchor as working conditions will permit. The trench for the anchor rod shall be dug so that the anchor will pull against undisturbed earth in a straight line from the anchor to the anchor eye.

7.4.4 Wherever possible, the first two (2) feet of the backfill for anchors shall be broken rock not to exceed six (6) inches in diameter. The backfill and compacting of the backfill shall be in accordance with the applicable procedures set forth in the section on pole holes. The use of a bulldozer or power shovel to backfill anchor holes must be authorized by the Engineer.

7.5 Grouted Rock Anchors

7.5.1 The location and use of rock anchors shall be as shown on the Staking Sheets and Drawings, or as determined by the Engineer. Grouting material to be used shall be furnished by the Contractor. The diameter and depth of the drilled hole shall be as shown on the Drawings. A temporary plug shall be used to keep the hole from becoming fouled. Before the rod is placed, the hole shall be cleaned of all chips and dust and then thoroughly moistened. All excess water shall be removed.

7.5.2 Grout shall be a free-flowing, non-shrinking mixture of one of the following types, or of an equal type approved by the Engineer:

- "Custom-Plug" -- manufactured by
  Custom Building Products
  6505 Salt Lake Avenue
  Bell, CA 90201

- "Rockite" -- manufactured by
  Hart Line Products Co., Inc.
  2186 Noble Road
  Cleveland, OH 44112

7.5.3 Three (3) inches of grout shall be placed in the hole before the rod is inserted. Set rod to the full depth of the hole. Grout shall be poured to completely fill the hole. Voids shall be eliminated by tapping and agitating. The grout shall be allowed to set for not less than seven (7) calendar days before placing tension on the rod.

7.6 Swamp or Screw Anchors

7.6.1 The location and need for swamp or screw anchors shall be determined by the Engineer at the time of excavation. The substitution of a swamp or screw anchor for a plate anchor shall not result in any additional cost to the Owner.

7.6.2 Screw anchors shall be installed at an angle of approximately forty five (45) degrees to the ground.

7.7 H-pile Anchors

7.7.1 W8X48 steel H-pile anchors shall be installed at an angle approximately ten (10) degrees to the ground.

7.7.2 Disturbed ground line material around the H-pile anchor shall be compacted after installation is complete.

7.7.3 W8X48 steel H-pile anchors shall be driven a minimum of fourteen (14) feet below ground line.

7.7.4 The H-pile anchor shall be installed with the flange (X-X) axis in-line with the guy strand.

7.7.5 Guy strand is attached to the H-pile anchor using a thimble eye nut and 3/4" machine bolt hardware.

7.7.6 In areas where additional H-pile foundation lengths are required for foundation stability, diamond shaped plates welded to the W8X48 steel shall be used for splicing. Diamond shaped plates shall be welded to three faces of the H-pile.

END OF GUYS, ANCHORS, AND ANCHOR RODS

8.1 General

8.1.1 Handling, stringing, sagging, and clipping-in of the conductor shall be by methods which will prevent damage to the conductor and line structures in any way. The Contractor shall provide a separate radio communication channel at all times during the stringing and sagging of the conductors and wires. This equipment shall be located at and provide communication between the following: (1) all crossings (i.e., highway, railroad, power and communication lines, etc.); (2) all payout and takeup installations of the conductor, whether stationary or mobile; (3) all locations where the sag is being determined; and (4) any other locations specified by the Engineer. Installation of conductors and accessories shall be done in strict accordance with the manufacturer's recommendations and/or IEEE-Standard 524.

8.1.2 Contractor shall furnish the Engineer, at least fifteen (15) days prior to intended use, the information detailed below. Failure to provide this information and receive approval from the Engineer shall be cause for the suspension of stringing operations.

- A list showing the type, size, brand name, and catalog number of all grips (including stocking type and come-along) and/or other tools and equipment used for attachment to the conductor, shield wire, and guys for the purpose of (1) pulling and sagging conductors and ground wires, and (2) installing of guys.
- Complete manufacturer's data, including model number, capacity, horsepower, etc., for all pulling equipment, tensioners, wire stands, and travelers.
- A list of the brand and catalog numbers of all sleeving presses and dies.

8.1.3 Under certain conditions temporary guys may be required to hold structures during stringing and sagging operations. The locations of these guys and anchors shall be determined by the Engineer after the structures have been erected and the stringing sequences defined by the Contractor. These guys and anchors shall be provided without additional cost to the Owner and shall be removed when clipping-in is completed.

8.1.4 Engineer shall suspend stringing and sagging operations when high wind velocities prevent satisfactory completion of these operations.

8.1.5 Contractor shall provide grounding for the protection of personnel.

8.1.6 Contractor shall rewind scrap conductor from metal reels onto wood reels supplied by the Owner.

8.2 Handling

8.2.1 Care shall be exercised to avoid kinking, twisting, or abrading the conductor in any manner. Conductors shall not be trampled on, run over by vehicles, or dragged over sharp rocks. The wire on each reel shall be inspected for cuts, kinks, or other injuries. Injured portions (or crooked or imperfect splices) in either the conductor or overhead ground wire shall be cut out and the wire respliced. Bends of less than the minimum bending radius shall not be permitted. To avoid damage to the conductor, the Contractor may be required by the Engineer to reinforce the reels or rewind the conductor on new reels. Re-reeling of conductor because of reels damaged by the Contractor shall be at the expense of the Contractor. No payment shall be made for any reinforcing of reels.

8.2.2 Reels of conductor shall be picked up with a spreader bar to prevent crushing of the conductor and/or reel.

8.2.3 Braking of the reels shall be positively controlled by means of a mechanically adjustable device and shall be applied in a manner which will avoid damage to the conductor, reel and line structures.

8.3 Stringing

8.3.1 Conductors shall be pulled over suitable rollers or stringing sheaves properly mounted on the pole or crossarm to prevent binding while stringing., Stringing sheaves may be hung on insulator strings or traveler slings (chokers) of equal length or attached to the structure arms with suitable hooks or clamps placed so as to properly distribute the load on the arm. The stringing sheave shall support the conductor within twelve (12) inches of its permanent elevation when clipped in.

8.3.2 Any part of the structure subject to abrasion by the pulling line or conductor shall be protected against damage by suitable lagging. The pulling (sock) line shall be connected to the conductor with a swivel connection and a stocking-type grip. The open end of the stocking-type grip shall be bonded with equipment approved by the Engineer. Tail wires of the grip shall be taped down so that the grip will run freely in the sheaves and will not damage them. Sheaves damaged by pulling lines shall not be used on the conductor.

8.3.3 The conductor shall not be permitted to contact any object which may damage it. When tension is used to clear obstructions, the tension shall not be permitted to exceed the sagging tension prescribed for the portion of the line involved. Adequate guards shall be provided where there may be danger of the conductor being run over by vehicles or damaged by other equipment and/or objects. The conductor shall not be left in contact with the ground, vegetable matter, or any conducting or semi-conducting material longer than five (5) days.

8.3.4 Unless otherwise approved by the Engineer or specified in the Contract, conductors shall be strung by the controlled-tension stringing method.

8.3.4.1 Neoprene-lined (or approved equal), double-bullwheel type tension stringing equipment shall be used to string conductors by the controlled tension method. The equipment shall have a bullwheel diameter and groove sizes that will in no way damage the conductor. It shall be of a type capable of maintaining preset tensions and pulling speeds. Sufficient continuous tension shall be maintained to keep the conductor clear of the ground or obstructions that could damage it or that could be damaged by it. Sheaves shall be designed and used so that the pulling line does not damage them or deposit foreign matter in the liners that may damage the conductor or be deposited on the conductor.

8.3.4.2 The maximum pulling tensions shall not exceed 110% of final sag tension. The cable pullers, tensioners, and pulling machines shall be located as near midspan as possible, but in no case shall the slope of the conductor between the pulling machine and stringing block at the first structure be steeper than four (4) horizontal to one (1) vertical. The length of conductor pulled in one operation shall be limited to that length which can be sagged satisfactorily, as approved by the Engineer.

8.3.5 During stringing operations and before sagging, if it becomes necessary to leave the conductor in the stringing blocks for longer than eight (8) hours, the conductor shall be left at reduced tension. The percent of sag, the spans involved, and the time interval shall be noted and this information forwarded to the Engineer.

8.4 Sagging

8.4.1 Prior to sagging, all guys shall be pulled, all angle structures raked, and all double-deadend structures shall be plumb.

8.4.2 Conductors shall be sagged by the Contractor in accordance with the Stringing Sag Tables furnished. Each conductor shall be sagged individually for the temperature at the time of sagging. All conductors in a sag section shall be treated uniformly with respect to tension and time intervals during stringing, and sagging. Sagging operations shall not be carried on when, in the opinion of the Engineer, wind or other physical conditions prevent satisfactory sagging.

8.4.3 Contractor shall be responsible for contacting the conductor manufacturer to determine the need for offset clipping. Engineer shall receive a copy of the manufacturer's recommendation concerning offset clipping prior to the start of stringing operations.

8.4.4 The length of conductor sagged in one operation shall be limited to that length which will permit attainment of the correct sag. Anchor snubs shall not be located so close to the structures that the crossarms will be overloaded. Temporary anchoring of the conductor shall not be permitted to any structures except deadend structures at the normal point of attachment. Conductors shall not be left attached to temporary anchors for more than ten (10) days, unless otherwise approved by the Engineer.

8.4.5 Spans used for determining the correct sag shall be, where possible, the longer level spans in the section of line being sagged. The sag shall be determined on both sides of angles of more than ten degrees (10°). When sagging a conductor section of more than four (4) spans the sag shall be determined at or near each end, but not less frequently than at one (1) mile intervals. In unusual situations additional determinations may be required. After the conductors in spans used for the determination of the correct sag have been pulled to the correct tension, as many successive spans as can be observed from the instrument positions shall be examined for uniformity of sag. Determination of the sag shall be by means of a transit or theodolite and targets furnished by the Contractor. Targets shall be positioned after stringing of the conductor. A sag watch can be used for sagging operations upon approval of the Engineer.

8.4.6 The conductors shall be sagged within a tolerance of 0.01 times sag-in-feet increase, but not exceeding one-half (1/2) foot increase, provided all the conductors in the sagging span assume the same relative position to true sag and the required clearances are obtained. Under no circumstances shall a decrease in the specified sag be allowed.

8.4.7 The air temperature at the time and place of sagging shall be determined by a certified thermometer placed inside a piece of conductor of the type and size being strung. This assembly shall be suspended a minimum of five (5) feet above the ground in an exposed, sunlit area. The temperature at which the conductor is sagged and the spans in which sags are measured shall be recorded and signed by the Contractor, and this information shall be given to the Engineer. A sample form is shown at the end of this chapter.

8.4.8 Any foreign matter (such as pitch, paint, grease, etc.) on the conductor and fittings shall be removed by non-injurious methods before the conductor is final sagged.

8.4.9 Prior to sagging a new section of conductor the insulator strings on at least three (3) suspension structures adjacent to the new section shall be clipped in. These insulator strings shall be in a plumb position, plus or minus one ($\pm$1) inch, upon completion of the sagging of the new section and during plumb marking.

8.4.10 All conductors in a sag section shall be sagged, plumb marked (if required), and clipped in during one continuous three (3) day period.

8.4.11 The sag of all conductors after stringing shall be in accordance with the conductor manufacturer's recommendations.

8.5 Clipping-In

8.5.1 Suspension clamps shall be installed so that the insulator string will hang in a vertical plane through the point of the insulator string attachment to the structure with the structure properly aligned. Torque wrenches shall be used to tighten the suspension clamps to the torques recommended by the manufacturer or the Engineer.

8.5.2 All conductors in a sag section shall be clipped in as follows:

8.5.2.1 In flat terrain, upon completion of sagging clipping-in shall begin at the second structure from the forward end of the pull and progress back on line, structure by structure, until all structures are clipped in.

8.5.2.2 In hilly or mountainous terrain, upon completion of sagging all conductors shall be plumb marked at each structure for the complete section sagged before clipping-in or deadending of the conductor is begun. The conductor shall be marked with paint, crayon, or wax pencil - not with metal objects. Plumb marking shall be done unless otherwise specified by the Engineer. Clipping-in shall begin at the second structure from the forward end of the pull and progress back on line, structure by structure, until all structures are clipped in.

8.6 Splices and Deadends

8.6.1 All splicing shall be done in the presence of the Engineer. Splices shall not be made within fifteen (15) feet of a structure, nor shall there be more than one (1) splice per conductor in any span. Splices shall not be installed in crossings over railroads, roads, highways, transmission lines, or rivers. Splice sleeves shall not be installed within one hundred (100) feet of a deadend. Whenever splices are made under tension, come-alongs shall not be placed nearer than twenty-five (25) feet to the point of the splice or deadend.

8.6.2 The conductor shall be laid out straight for a distance of fifty (50) feet and straightened before preparation of the ends for splicing or deadending. The portion of the conductor damaged by the grips shall be cut off before the conductor is spliced. The aluminum strands shall be cut back a distance that will leave not more than one-eighth (1/8) inch between the ends of the conductor strands and the compressed steel sleeve. The ends of the conductors and the bores of the compression sleeves shall be thoroughly cleaned immediately prior to compressing. The lay of strands shall be tightened before the first compression is made. The compression shall be carefully made so that the completed splice is as straight as possible. If, in the opinion of the Engineer, the completed splice requires straightening, it shall be straightened on a wood block by the use of a sledge and shaper, wood maul, or hydraulic press. However, if the steel sleeve of a two-piece sleeve is bent too much to slip inside the aluminum sleeve, it shall be straightened by constantly applied hydraulic pressure or replaced. The steel sleeve shall not be straightened by pounding it with any type of hammer or maul.

8.6.3 After compression has been completed, all corners, sharp projections, and indentations resulting from compression shall be carefully rounded. All other edges and corners of the fittings that have been damaged shall be carefully rounded to their original radiuses. Nicked or abraded surfaces shall be carefully smoothed. Tape, tape residue, and excess filler paste shall be removed from the fittings and conductor.

8.6.4 All splices shall be installed in accordance with the procedures recommended by the manufacturer. All splicing tools and equipment required for the splicing of overhead conductors and wires shall be furnished by the Contractor.

8.7 Repairs

8.7.1 Damage to the conductor caused by the Contractor shall be repaired in a manner determined by the Engineer at the expense of the Contractor. Damage is defined as any deformity on the surface of the conductor which can be detected by eye or by feel. Damage includes but is not limited to nicks, scratches, abrasions, kinks, basketing, popped-out strands, and broken strands.

8.7.2 Depending upon the severity of the damage and the length of the damaged section, repair shall be made by carefully smoothing the conductor with fine sandpaper, covering it with preformed repair rods, or by cutting and splicing.

8.7.3 Kinked, basketed, or severely damaged sections of conductor shall be cut out. When there is repeated damage in the same span or in consecutive spans, all conductor in these spans shall be replaced.

8.7.4 When one (1) aluminum strand is broken or nicked deeper than one-third (1/3) its diameter, or when a number of strands are reduced in area not exceeding the area of one (1) strand, a preformed repair rod shall be installed. When more than one strand is broken or the conductor is reduced in area by more than one strand, the damaged section shall be cut out.

8.7.5 Not more than two (2) splice sleeves for repairing damage shall be applied in any two hundred (200) feet of conductor, except at the direction of the Engineer. Compression repair splice sleeves shall not be installed within fifteen (15) feet of a suspension structure. A minimum of twenty (20) feet of conductor (or ground wire) shall be cut off on each side of the damaged section.

8.8 Jumpers

8.8.1 Jumpers shall be so proportioned and hung that under normal conditions they will meet the clearance requirements of the National Electrical Safety Code (NESC).

8.8.2 Installation of compression connectors shall conform to the specifications for conductors. Jumpers shall be formed to provide the maximum amount of clearance and in accordance with the Drawings. Where unusual conditions cause impaired clearance, the Engineer shall issue specific instructions.

8.8.3 Oxide-inhibitor compound shall be used on all jumper connections.

8.9 Clamps and Joints

8.9.1 All contact areas shall be thoroughly cleaned before installing parallel groove clamps and copper to aluminum joints, whether bolted or compressed. The contact areas and bolt holes shall be coated with oxide-inhibitor compound. The contact areas shall be wire-brushed through the coating to remove any oxide film. The fittings shall be installed without removing the compound. After the installation of the parallel groove clamps the grooves at the sides and ends of the clamp shall be filled with compound. The compound to be used shall be Burndy "Penatrox A" or its equivalent, as approved by the Engineer. Bolts shall be brought down hard, but the threads must not be overstressed.

8.10 Grounding

8.10.1 In addition to the grounding provisions of applicable national, state, and local safety codes, the following requirements shall apply: (1) The Contractor shall place electrical grounds at both ends of the line or section of line being worked on under the Contract and also at such intervals along the line as the Engineer may direct, using ground sets to be furnished by the Contractor. (2) Grounding sets installed at both ends of the line or a section of line shall remain in place until completion of the work by the Contractor. These provisions shall not prevent the Contractor from furnishing and installing as many additional grounds as it deems necessary for the protection of its own workmen against static electricity and accidental contacts with foreign circuits.

8.10.2 Grounds shall be firmly installed to avoid loose or intermittent connections. All grounds furnished and placed by the Contractor for protection against static electricity shall be of adequate size and clearly visible for inspection. They shall be flagged by the use of a red cloth placed in a conspicuous place on the conductor at the point of grounding. The location of all grounds shall be reported in writing to the Engineer. All grounds and red flags that the Contractor has elected to install shall be removed as soon as they are no longer needed for protection. The grounds shall remain the property of the Contractor.

END OF CONDUCTOR

CONDUCTOR INSPECTION REPORT

Issued: / / Revision: Page __ of __

128002-01: Shungnak - Kobuk Tie Line Project

CONDUCTOR:

TRANSIT STR.	TARGET STR.	LENGTH SPAN	TEMP °F	SAG		APPROVED			REMARKS
				FT.	IN.	CONTR.	ENGR.	DATE	

REEL NUMBER	DATE	TIME START	TIME FINISH	SPLICE @ STR.

9.1 Taps and Jumpers

9.1.1 Jumpers and other leads connected to line conductors shall have sufficient slack to allow free movement of the conductors. Where slack is not shown on the construction drawings, it will be provided by at least two (2) bends in a vertical plane, or one (1) in a horizontal plane, or the equivalent. In areas where aeolian vibration occurs, special measures to minimize the effects of jumper breaks shall be used as specified.

9.1.2 All leads on equipment such as transformers, switches, etc., shall be a minimum of #2/0 copper conductivity. Where aluminum jumpers are used, a connection to an unplated bronze terminal shall be made by splicing a short stub of copper to the aluminum jumper using a compression connector suitable for the bimetallic connection.

9.2 Hot-Line Clamps and Connectors

9.2.1 Connectors and hot-line clamps suitable for the purpose shall be installed as shown on the guide drawings. On all hot-line clamp installations, the clamp and jumper shall be installed so that they are permanently bonded to the load side of the line, allowing the jumper to be de-energized when the clamp is disconnected.

9.3 Surge Arrester Gap Settings

9.3.1 The external gap electrodes of surge arresters, combination arrester cutout units, and transformer mounted arresters shall be adjusted to the manufacturer's recommended spacing. Care shall be taken that the adjusted gap is not disturbed when the equipment is installed.

9.4 Conductor Ties

9.4.1 Hand-formed ties shall be in accordance with construction drawings. Factory-formed ties shall be installed in accordance with the manufacturer's recommendations.

9.5 Secondaries and Service Drops

9.5.1 Secondary conductors shall be multi-conductor service cable. The conductors shall be sagged in accordance with the manufacturer's recommendations.

9.5.2 Service drops shall be covered wire or service cable.

9.5.3 Secondaries and service drops shall be so installed as not to obstruct climbing space. There shall not be more than one splice per conductor in any span, and splices shall be located at least 10 feet from the conductor support. Where the same covered conductors or service cables are to be used for the secondary and service drop, they may be installed in one continuous run.

9.5.4 The Contractor shall be responsible for all service connections required during construction.

9.6 Grounds

9.6.1 Ground rods shall be driven full length in undisturbed earth in accordance with the construction drawings. The top shall be at least 12 inches below the surface of the earth. The ground wire shall be attached to the rod with a clamp and shall be secured to the pole with staples. The staples on the ground wire shall be spaced 2 feet apart, except for a distance of eight (8) feet above the ground and eight (8) feet from the top of the pole where they shall be 6 inches apart.

9.6.2 All equipment shall have at least two (2) connections from the frame, case or tank to the multi-grounded neutral conductor.

9.6.3 The equipment ground, neutral wires, and surge-protection equipment shall be interconnected and attached to a common ground wire.

9.7 Distribution Transformers

9.7.1 General

9.7.1.1 New distribution transformers shall be installed in locations specified on the Staking Sheets or as directed by the Owner's representative. The re-use of old units shall be only with the Owner's Representative's approval.

9.7.2 Tap Settings

9.7.2.1 The Contractor shall be responsible for making the proper tap settings and checking the Service voltage for each transformer installed.

9.7.2.2 Tap setting shall be selected to yield secondary voltages on an unloaded transformer as follows:

Nominal Voltage	Voltage Range
120	120-123
208	208-213
240	240-246
480	480-492

9.7.2.3 For all two or three transformers banks, all transformers in the bank shall be set on the same tap.

9.7.3 Conductor Sizing

9.7.3.1 Transformer leads shall be sized according to the following Conductor Sizing Chart.

CONDUCTOR SIZING
Single-Phase Transformers, 120/240 volt, 3-bushing

	Transformer Leads	
	Phases	Neutral
75 KVA	1 -4/0 AWG CU	1 -4/0 AWG CU
50 KVA	1 -4/0 AWG CU	1 -4/0 AWG CU
25 KVA	1 - #2 AWG CU	1 - #2 AWG CU
15 KVA	1 - #2 AWG CU	1 - #2 AWG CU
10 KVA	1 - #2 AWG CU	1 - #2 AWG CU

1. Aluminum secondary and service conductors should be spliced to these leads using appropriate compression connectors. Only copper conductor may be connected to transformer lugs.

2. Aluminum to copper connections. Conductors shall be arranged such that the copper is on the bottom and the aluminum is on the top. Alternatively, the connection must be made water tight by sealing with Aqua Seal (or equivalent) and electrical tap (3M Type 88 or equivalent).

3. All connections shall be insulated with electrical tap (3M Type 88 or equivalent), or with insulating boots designed for the purpose.

9.7.4 14.4/24.9kV Transformer Fusing Scheduling

Transformer KVA	Fuse Size*
500	50
100	8
75	6
50	6
25	3*
15	3*
10	3*

*Hi Surge Links

Fuse each transformer according to its size. In case of open delta with one lead common to two transformers, fuse that lead according to rating of larger transformer.

9.7.5 Load Balance

9.7.5.1 Transformers shall be connected to the three phases so as to balance the loading on the three phases to the extent practical.

END OF OVERHEAD EQUIPMENT

10.1 General

10.1.1 The location, need, size, length, and number of ground rods and coupled-length sections as shown on the Drawings shall be as determined by the Engineer.

10.2 Ground Rods

10.2.1 Ground rods shall be driven vertically until the rod and leads to the pole are twelve (12) inches below ground, except in cultivated areas, where the minimum depth shall be twenty-four (24) inches. Leads from the ground rod to the pole shall be buried a minimum of twelve (12) inches, except in cultivated areas, where they shall be buried twenty-four (24) inches. Ground rods shall be installed in undisturbed earth unless specified by the Engineer. The location of the ground rods shall be in accordance with the Drawings. Leads from the ground rods to the pole ground wire shall be attached to the ground rods with standard ground-rod clamps. Connections of the leads to the ground wire shall be made with compression splices above ground line at the pole, unless otherwise specified.

10.3 H-pile Foundations

10.3.1 Leads from the pole ground wire shall be attached to the H-pile foundation with a ground wire bonding clip and machine bolt hardware. Machine bolt attachment to the H-pile shall be clean, electrically continuous and of low resistance. Groundwire lead between the pole and the H-pile shall have adequate length to accommodate differential movement of the pole and/or H-pile foundation.

END OF GROUNDS

PART II

STAKING SHEETS

STAKING SHEET – SINGLE POLE
128002; SHUNGNAK – KOBUK TIE LINE PROJECT

ISSUED: 7/27/92
REVISION: RECORD

STR. NO.	STATION	AHEAD SPAN	CL. ELEV.	STR. HT-CL	FOUND. TYPE	DIST. PTAS	GUYING ASSY.	ANCHOR ASSY.	MISC. ASSY.	REMARKS
--	------	----	----	----	----	----			1/K10C 1/M8-6	Existing generator building. Attach meter and overhead service condutors to Southwest corner of building. Span triplex conductor over existing shed to structure 1A
1A	-42.0	42.0	198	35-4	H-PILE	C7-1			1/G312-75 1/M2-11 1/K14C	Transformer structure. Begin Shungnak-Kobuk Tie line. Slack span no. 2 ACSR conductors to structure 1. Cut 45' pole to 35' pole.
1	0.0	208.9	195.5	35-5	H-PILE	C8-3	2/E1-3 2/E3-10	1/F1-4P	1/M2-11H	PI-1,0-0-0. Double deadend tangent structure. Back in-line guys. Begin 325' ruling span. Pipe line crossings.
2	208.9	227.9	190.6	35-5	H-PILE	M3-15			1/M2-15A	Double deadend switch structure. Trail crossing.
3	436.9	276.5	191.5	35-5	H-PILE	C7-1 C7-1	6/E1-3 6/E3-10	4/H-PILE	1/M2-11H	PI-2, 83-51-22R. Double deadend angle structure. Locate lower C7-1 x-arm 4'-0" below upper C7-1 x-arm. Locate upper neutral deadend assembly 4'-0" below lower C7-1 x-arm. Use 6" spacing between neutral assemblies. Attach conductors from structure 4 to upper C7-1 x-arm. Ahead and back in-line guys. 30' and 35' guy leads.
4	713.4	344.6	183.8	35-5	H-PILE	C1A				
5	1058.0	332.1	179.3	35-5	H-PILE	C1A				
6	1390.1	343.6	177.1	35-5	H-PILE	C1A			1/M2-11H	Trail crossing.
7	1733.7	329.6	177.0	35-5	H-PILE	C1A				
8	2063.3	322.7	174.7	35-5	H-PILE	C1A				
9	2386.0	349.2	168.4	35-5	H-PILE	C1A			1/M2-11H	
10	2735.2	327.0	170.0	35-5	H-PILE	C1A				
11	3062.3	268.4	170.4	35-5	H-PILE	C1A				
12	3330.6	346.8	171.6	35-5	H-PILE	C2	1/E1-3 1/E3-10		1/M2-11H	PI-3, 00-01-38R. Angle structure. Bisector guy. Use existing anchor 40' lead.
13	3677.4	302.6	171.6	35-5	H-PILE	C1A				
14	3980.0	340.6	169.2	35-5	H-PILE	C1A				
15	4320.6	202.9	166.1	35-5	H-PILE	C1A				
16	4523.5	346.3	161.0	35-5	H-PILE	C1-1A			1/M2-11H	
17	4869.8	326.7	161.1	35-5	H-PILE	C1A				
18	5196.6	346.3	166.8	35-5	H-PILE	C1A				

STAKING SHEET – SINGLE POLE
128002; SHUNGNAK – KOBUK TIE LINE PROJECT

ISSUED: 7/27/92
REVISION: RECORD

STR. NO.	STATION	AHEAD SPAN	CL. ELEV.	STR. HT-CL	FOUND. TYPE	DIST. PTAS	GUYING ASSY.	ANCHOR ASSY.	MISC. ASSY.	REMARKS
19	5542.9	329.1	170.4	35–5	H–PILE	C1A				
20	5872.0	339.9	172.4	35–5	H–PILE	C1A			1/M2–11H	
21	6211.9	338.1	175.7	35–5	H–PILE	C1A				
22	6550.0	335.0	178.9	35–5	H–PILE	C1A				
23	6885.1	342.9	179.7	35–5	H–PILE	C1A				
24	7228.0	335.7	181.4	35–5	H–PILE	C1A			1/M2–11H	
25	7563.7	335.3	188.3	35–5	H–PILE	C1A				
26	7899.0	329.1	194.8	35–5	H–PILE	C1A				
27	8228.1	348.7	198.7	35–5	H–PILE	C1A				
28	8576.8	326.7	199.9	35–5	H–PILE	C1A			1/M2–11H	
29	8903.6	330.9	203.5	35–5	H–PILE	C1A				
30	9234.5	288.9	202.4	35–5	H–PILE	C1A				
31	9523.3	210.3	207.8	35–5	H–PILE	C1A				
32	9733.6	207.7	215.3	35–5	H–PILE	C1A			1/M2–11H	
33	9941.3	273.1	223.4	35–5	H–PILE	C1–1A				
34	10214.4	350.4	225.0	35–5	H–PILE	C1–1A				
35	10564.8	329.6	218.1	35–5	H–PILE	C1A				
36	10894.4	344.8	213.5	35–5	H–PILE	C1A				
37	11239.2	311.9	210.3	35–5	H–PILE	C7–1 C7–1	6/E1–3 6/E3–10	4/H–PILE	1/M2–11H 1/M5–5	PI–4, 68–49–38R. Double deadend angle structure. Locate lower C7–1 x–arm 4'–0" below upper C7–1 x–arm. Locate upper neutral deadend assembly 4'–0" below lower C7–1 x–arm. Use 6" spacing between neutral assemblies. Attach conductors from structure 38 to upper C7–1 x–arm. Ahead and back in–line guys. 30' and 35' guy leads. Lower crossarm was lowered 30" for guy wire clearance.
38	11551.0	324.6	209.9	35–5	H–PILE	C1A				
39	11875.6	287.6	199.6	40–4	H–PILE	C1A				
40	12163.3	344.5	192.6	35–5	H–PILE	C8–2			1/M2–11H	Double deadend tangent structure.
41	12507.7	328.1	188.9	35–5	H–PILE	C1A				
42	12835.8	345.9	184.9	35–5	H–PILE	C1A				
43	13181.8	333.3	178.7	35–5	H–PILE	C1A			1/M2–11H	
44	13515.1	254.3	172.1	35–5	H–PILE	C1A				
45	13769.4	309.5	165.2	40–4	H–PILE	C1A			1/M2–11H	Creek crossing.
46	14078.9	206.0	173.1	35–5	H–PILE	C1A				

STAKING SHEET – SINGLE POLE
128002; SHUNGNAK – KOBUK TIE LINE PROJECT

ISSUED: 7/27/92
REVISION: RECORD

STR. NO.	STATION	AHEAD SPAN	CL. ELEV.	STR. HT-CL	FOUND. TYPE	DIST. PTAS	GUYING ASSY.	ANCHOR ASSY.	MISC. ASSY.	REMARKS
47	14284.9	346.8	176.0	35–5	H–PILE	C8–2	1/E1–3 1/E3–10	1/H–PILE	1/M2–11H 4/M5–21 2/M5–5 1/J–10	PI–5, 32–07–57L. Double deadend angle structure. Bisector guy. Use M5–21 units on x–arm deadend insulators for extension links. Use M5–5, pin insulators, for jumpering x–arm conductor on guy attachment side. Install M5–5 units 6″ from insulator deadend bolt. Substitute neutral attachment with J–10 assembly. 35' guy lead.
48	14631.7	326.4	175.8	35–5	H–PILE	C1A				
49	14958.0	291.0	182.3	35–5	H–PILE	C1A				
50	15249.0	254.6	186.6	35–5	H–PILE	C1A			1/M2–11H	
51	15503.5	255.9	188.7	35–5	H–PILE	C1A				
52	15759.5	251.8	189.5	35–5	H–PILE	C1A				
53	16011.3	346.2	188.4	35–5	H–PILE	C2	1/E1–3 1/E3–10	1/H–PILE	1/M2–11H	PI–6, 14–40–40R. Angle structure. Bisector guy. 35' guy lead.
54	16357.4	332.2	185.5	35–5	H–PILE	C1A				
55	16689.7	308.2	183.2	35–5	H–PILE	C1–1A				
56	16997.9	302.3	175.2	35–5	H–PILE	C1A			1/M2–11H	
57	17300.2	349.8	172.8	35–5	H–PILE	C1A				
58	17649.9	323.1	174.3	35–5	H–PILE	C1A				
59	17973.1	347.2	174.1	35–5	H–PILE	C1A				
60	18320.3	218.0	171.7	35–5	H–PILE	C1A			1/M2–11H	
61	18538.2	342.8	165.2	35–5	H–PILE	C1A				Wesley creek crossing.
62	18881.0	349.0	157.0	40–4	H–PILE	C1A				Wesley creek crossing.
63	19230.0	253.9	158.6	35–5	H–PILE	C1A				
64	19483.9	330.1	158.6	35–5	H–PILE	C8–2	1/E1–3 1/E3–10	1/H–PILE	1/M2–11H 4/M5–21 2/M5–5 1/J–10	PI–7,18–01–53R. Double deadend angle structure. Bisector guy. Use M5–21 units on x–arm deadend insulators for extension links. Use M5–5, pin insulators, for jumpering x–arm conductor on guy attachment side. Install M5–5 units 6″ from insulator deadend bolt. Substitute neutral attachment with J–10 assembly. 35' guy lead.
65	19814.0	293.9	165.2	35–5	H–PILE	C1–1A				
66	20107.9	352.8	165.9	35–5	H–PILE	C8–2			1/M2–11H	Double deadend tangent structure

STAKING SHEET – SINGLE POLE
128002; SHUNGNAK – KOBUK TIE LINE PROJECT

ISSUED: 7/27/92
REVISION: RECORD

STR. NO.	STATION	AHEAD SPAN	CL. ELEV.	STR. HT–CL	FOUND. TYPE	DIST. PTAS	GUYING ASSY.	ANCHOR ASSY.	MISC. ASSY.	REMARKS
67	20460.7	204.3	171.7	40–4	H–PILE	C1A				
68	20665.0	370.1	180.2	40–4	H–PILE	C1A				
69	21035.1	248.6	192.5	35–5	H–PILE	C1A				
70	21283.8	321.2	203.0	35–5	H–PILE	C7–1 C7–1	3/E2–3 3/E1–3 3/E3–10	2/H–PILE	1/M2–11H 1/M5–5	PI–8, 44–50–43L. Double deadend angle structure. Locate lower C7–1 x–arm 4'–0" below the upper C7–1 x–arm. Locate the upper neutral deadend assembly 4'–0" below lower C7–1 x–arm. Use 6" spacing between neutral assemblies. Attach conductors from structure 69 to upper C7–1 x–arm. Ahead and back in–line guys. Span guys to structure 70A. 30' and 35' guy leads.
70A	------	----	----	35–5	H–PILE	----	3/E1–3 3/E3–10	2/H–PILE		Guy stub pole. Span guys to structure 70 upper C7–1 assembly. 25' and 30' guy leads.
71	21605.0	325.0	203.9	35–5	H–PILE	C1A				
72	21930.0	324.9	207.5	35–5	H–PILE	C1A				
73	22254.9	257.5	210.6	35–5	H–PILE	C1A				
74	22512.4	346.4	214.1	35–5	H–PILE	C8–2	1/E1–3 1/E3–10	1/H–PILE	1/M2–11H 4/M5–21 2/M5–5 1/J–10	PI–9, 26–46–38R. Double deadend angle structure. Bisector guy. Use M5–21 units on x–arm deadend insulators for extension links. Use M5–5, pin insulators, for jumpering x–arm conductor on guy attachment side. Install M5–5 units 6" from insulator deadend bolt. Substitute neutral attachment with J–10 assembly. 35' guy lead.
75	22858.8	330.9	218.1	35–5	H–PILE	C1A				
76	23189.7	340.8	221.5	35–5	H–PILE	C1A				
77	23530.4	332.7	226.7	35–5	H–PILE	C1A				
78	23863.1	337.6	229.4	35–5	H–PILE	C1A			1/M2–11H	
79	24200.7	336.1	234.3	35–5	H–PILE	C1A				
80	24536.7	339.3	237.9	35–5	H–PILE	C1A				
81	24876.0	340.1	244.1	35–5	H–PILE	C1A				
82	25216.1	313.2	249.2	35–5	H–PILE	C1–1A			1/M2–11H	
83	25529.3	348.9	249.0	35–5	H–PILE	C1A				
84	25878.3	321.6	247.8	35–5	H–PILE	C1A				

STAKING SHEET – SINGLE POLE
128002; SHUNGNAK – KOBUK TIE LINE PROJECT

ISSUED: 7/27/92
REVISION: RECORD

STR. NO.	STATION	AHEAD SPAN	CL. ELEV.	STR. HT–CL	FOUND. TYPE	DIST. PTAS	GUYING ASSY.	ANCHOR ASSY.	MISC. ASSY.	REMARKS
85	26199.9	344.4	247.4	35–5	H–PILE	C1A				
86	26544.3	328.9	245.2	35–5	H–PILE	C1A			1/M2–11H	
87	26873.2	344.4	240.1	35–5	H–PILE	C1A				
88	27217.7	266.2	234.8	35–5	H–PILE	C1A				
89	27483.9	342.5	229.7	35–5	H–PILE	C8–2			1/M2–11H	Double deadend tangent structure.
90	27826.4	314.6	231.8	35–5	H–PILE	C1A				
91	28141.0	309.6	231.3	35–5	H–PILE	C1–1A				
92	28450.6	206.8	224.4	35–5	H–PILE	C1A				
93	28657.4	347.3	215.9	35–5	H–PILE	C8–2	2/E1–3 2/E3–10	2/H–PILE	1/M2–11H	Double deadend tangent structure. Ahead and back in–line guys. Use 6″ spacing for E1–3 assemblies on pole. Anchors not staked. 35' guy leads. Creek crossing.
94	29004.7	245.4	232.5	35–5	H–PILE	C1A				
95	29250.1	343.1	242.6	35–5	H–PILE	C1–1A				
96	29593.3	308.3	248.7	35–5	H–PILE	C1–1A				
97	29901.6	345.0	246.9	35–5	H–PILE	C1A			1/M2–11H	
98	30246.5	330.6	242.3	35–5	H–PILE	C1A				
99	30577.2	349.5	244.1	35–5	H–PILE	C1A				
100	30926.6	321.4	250.6	35–5	H–PILE	C1A			1/M2–11H	
101	31248.0	296.1	255.2	40–4	H–PILE	C1A				
102	31544.1	341.7	263.9	35–5	H–PILE	C1A				
103	31885.8	338.2	263.2	35–5	H–PILE	C1A			1/M2–11H	
104	32224.0	331.1	262.3	35–5	H–PILE	C1A				
105	32555.2	207.8	263.4	35–5	H–PILE	C1–1A				
106	32763.0	340.3	259.2	35–5	H–PILE	C8–2			1/M2–11H	Double deadend tangent structure.
107	33103.3	288.2	259.8	35–5	H–PILE	C1A				
108	33391.5	345.4	260.1	35–5	H–PILE	C8–2	1/E1–3 1/E3–10	1/H–PILE	1/M2–11H 4/M5–21 2/M5–5 1/J–10	PI–10,24–59–12R. Double deadend angle structure. Bisector guy. Use M5–21 units on x–arm deadend insulators for extension links. Use M5–5, pin insulators, for jumpering x–arm conductor on guy attachment side. Install M5–5 units 6″ from insulator deadend bolt. Substitute neutral attachment with J–10 assembly. 35' guy lead.

STAKING SHEET – SINGLE POLE
128002; SHUNGNAK – KOBUK TIE LINE PROJECT

ISSUED: 7/27/92
REVISION: RECORD

STR. NO.	STATION	AHEAD SPAN	CL. ELEV.	STR. HT-CL	FOUND. TYPE	DIST. PTAS	GUYING ASSY.	ANCHOR ASSY.	MISC. ASSY.	REMARKS
109	33736.9	333.5	257.9	35–5	H–PILE	C1A				
110	34070.4	340.7	254.3	35–5	H–PILE	C1A				
111	34411.1	331.8	249.1	35–5	H–PILE	C1A				
112	34742.9	324.7	243.8	35–5	H–PILE	C1A			1/M2–11H	
113	35067.6	348.5	233.8	35–5	H–PILE	C1A				
114	35416.1	308.7	229.6	35–5	H–PILE	C1A				
115	35724.8	295.0	222.1	35–5	H–PILE	C1A			1/M2–11H	
116	36019.8	306.3	213.6	35–5	H–PILE	C1A				
117	36326.2	285.5	212.0	35–5	H–PILE	C1–1A				
118	36611.6	321.4	198.2	40–4	H–PILE	C8–2			1/M2–11H	Double deadend tangent structure.
119	36933.0	292.1	201.9	35–5	H–PILE	C8–2	2/E1–3 2/E3–10	2/H–PILE	1/M2–11H	Double deadend tangent structure. Ahead and back in–line guys. Use 6″ spacing for E1–3 assemblies on pole. Anchors not staked. 35' guy leads.
120	37225.1	348.4	209.2	35–5	H–PILE	C8–2			1/M2–11H	Double deadend tangent structure.
121	37573.5	224.6	228.3	35–5	H–PILE	C1–1A				
122	37798.1	326.8	233.9	35–5	H–PILE	C1A				
123	38124.9	227.3	242.1	35–5	H–PILE	C1–1A				Road crossing.
124	38352.2	285.7	240.2	40–4	BURIED	C7–1 C7–1	6/E1–3 6/E3–10	4/F1–4P	1/M2–11 1/M5–5	PI–11,79–15–55R. Double deadend angle structure. Locate lower C7–1 x–arm 4'–0″ below upper C7–1 x–arm. Locate upper neutral deadend assembly 4'–0″ below lower C7–1 x–arm. Use 6″ spacing between neutral assemblies. Attach conductors from structure 123 to upper C7–1 x–arm. Ahead and back in–line guys. 30' and 38' guy leads.
125	38637.9	242.1	235.5	40–4	BURIED	C1A				
126	38880.0	333.9	228.0	40–4	BURIED	C1–1A				
127	39213.8	256.4	204.5	45–4	BURIED	C1–1A				
128	39470.3	299.4	189.1	40–4	BURIED	C8–2	2/E1–3 2/E3–10	2/F1–4P	1/M2–11	Double deadend tangent structure. Ahead and back in–line guys. Use 6″ spacing for E1–3 assemblies on pole. Anchors not staked. 35' guy leads.
129	39769.7	355.5	191.3	40–4	BURIED	C1A				

STAKING SHEET – SINGLE POLE
128002; SHUNGNAK – KOBUK TIE LINE PROJECT

ISSUED: 7/27/92
REVISION: RECORD

STR. NO.	STATION	AHEAD SPAN	CL. ELEV.	STR. HT-CL	FOUND. TYPE	DIST. PTAS	GUYING ASSY.	ANCHOR ASSY.	MISC. ASSY.	REMARKS
130	40125.2	171.6	194.6	40–4	BURIED	C1–1A				
131	40296.8	366.4	185.1	40–4	BURIED	C1–1A				
132	40663.2	248.9	150.5	35–5	H–PILE	C8–2	2/E1–3 2/E3–10	2/H–PILE	1/M2–11H	Double deadend tangent structure. Ahead and back in–line guys. Use 6″ spacing for E1–3 assemblies on pole. Anchors not staked. 35' guy leads.
133	40912.1	164.4	168.8	33–5	H–PILE	C1–1A				Cut top two (2') of pole to make 33–5 pole. Treat top of pole in accordance with the specifications.
134	41076.5	341.5	168.1	35–5	H–PILE	C1–1A				
135	41418.0	317.3	159.6	35–5	H–PILE	C1A				
136	41735.3	341.4	152.8	40–4	H–PILE	C1A			1/M2–11H	
137	42076.7	329.4	156.1	35–5	H–PILE	C1A				
138	42406.1	321.9	155.5	35–5	H–PILE	C1A				
139	42728.0	260.6	154.8	35–5	H–PILE	C7–1 C7–1	6/E1–3 6/E3–10	4/H–PILE	1/M2–11H 1/M5–5	PI–12,77–05–46L. Double deadend angle structure. Locate lower C7–1 x–arm 4'–0″ below upper C7–1 x–arm. Locate upper neutral deadend assembly 4'–0″ below lower C7–1 x–arm. Use 6″ spacing between neutral assemblies. Attach conductors from structure 140 to upper C7–1 x–arm. Ahead and back in–line guys. 30' and 35' guy leads. Lower crossarm was lowered 30″ for guy wire clearance.
140	42988.7	321.7	156.9	35–5	H–PILE	C1–1A				
141	43310.4	207.2	157.9	35–5	H–PILE	C1–1A				
142	43517.6	348.7	151.2	35–5	H–PILE	C8–2			1/M2–11H	Double deadend tangent structure. Dahl Creek crossing.
143	43866.3	331.7	148.6	35–5	H–PILE	C1A				
144	44198.0	299.2	144.9	35–5	H–PILE	C1A				
145	44497.2	297.9	146.9	35–5	H–PILE	C1A				
146	44795.1	341.7	145.0	35–5	H–PILE	C1A				
147	45136.8	337.8	146.2	35–5	H–PILE	C1A			1/M2–11H	
148	45474.6	332.3	146.6	35–5	H–PILE	C1A				

STAKING SHEET – SINGLE POLE
128002; SHUNGNAK – KOBUK TIE LINE PROJECT

ISSUED: 7/27/92
REVISION: RECORD

STR. NO.	STATION	AHEAD SPAN	CL. ELEV.	STR. HT-CL	FOUND. TYPE	DIST. PTAS	GUYING ASSY.	ANCHOR ASSY.	MISC. ASSY.	REMARKS
149	45806.8	347.5	147.9	35–5	H–PILE	C1A				
150	46154.3	315.7	146.6	35–5	H–PILE	C1A	2/E1–3 2/E3–10	2/H–PILE		Side guys. 15' guy leads.
151	46470.0	255.2	143.8	35–5	H–PILE	C1A			1/M2–11H	Lake crossing.
152	46725.2	234.5	141.5	40–4	H–PILE	C1–1A				Lake crossing structure. Confirm structure stake location prior to constructing. 39' H–pile foundation depth.
153	46959.8	327.0	145.1	35–5	H–PILE	C1A				
154	47286.8	345.5	147.8	35–5	H–PILE	C1A				
155	47632.2	328.8	148.0	35–5	H–PILE	C1A			1/M2–11H	
156	47961.1	328.8	149.2	35–5	H–PILE	C1–1A				
157	48289.9	349.1	144.7	35–5	H–PILE	C1A				
158	48639.0	329.8	144.0	35–5	H–PILE	C1A				
159	48968.8	348.0	146.0	35–5	H–PILE	C1A			1/M2–11H	
160	49316.8	328.5	148.9	35–5	H–PILE	C1A				
161	49645.3	347.1	151.0	35–5	H–PILE	C1A				
162	49992.5	301.3	151.1	35–5	H–PILE	C1A			1/M2–11H	
163	50293.8	296.4	147.7	35–5	H–PILE	C1A				
164	50590.2	259.8	147.4	35–5	H–PILE	C1A				Road crossing.
165	50850.0	253.9	147.3	35–5	H–PILE	C1–1A				
166	51104.0	317.5	146.8	35–5	H–PILE	C7–1 C7–1	3/E2–3 3/E1–3 3/E3–10	2/H–PILE	1/M2–11H 2/M5–5	PI–13, 50–13–40R. Double deadend angle structure. Locate lower C7–1 x–arm 4'–0" below upper C7–1 x–arm. Locate upper neutral deadend assembly 4'–0" below lower C7–1 x–arm. Use 6" spacing between neutral assemblies. Attach conductors from structure 167 to upper C7–1 x–arm. Ahead and back in–line guys. Span guys to structure 166A. 30' and 35' guy leads.
166A	------	----	----	35–5	H–PILE	----	3/E1–3 3/E3–10	2/H–PILE		Guy stub pole. Span guys to structure 166 upper C7–1 assembly. 25' and 30' guy leads.
167	51421.5	325.0	147.7	35–5	H–PILE	C1A				
168	51746.5	319.4	146.9	35–5	H–PILE	C1A				
169	52065.9	323.5	147.7	35–5	H–PILE	C1A			1/M2–11H	

STAKING SHEET - SINGLE POLE
128002; SHUNGNAK - KOBUK TIE LINE PROJECT

ISSUED: 7/27/92
REVISION: RECORD

STR. NO.	STATION	AHEAD SPAN	CL. ELEV.	STR. HT-CL	FOUND. TYPE	DIST. PTAS	GUYING ASSY.	ANCHOR ASSY.	MISC. ASSY.	REMARKS
170	52389.4	260.8	147.3	35-5	H-PILE	C1A				
171	52650.3	254.8	148.3	35-5	H-PILE	C1A				
172	52905.1	329.7	148.9	35-5	H-PILE	C7-1 C7-1	3/E2-3 3/E1-3 3/E3-10	2/H-PILE	1/M2-11H 2/M5-5	PI-14, 48-12-22R. Double deadend angle structure. Locate lower C7-1 x-arm 4'-0" below upper C7-1 x-arm. Locate upper neutral deadend assembly 4'-0" below lower C7-1 x-arm. Use 6" spacing between neutral assemblies. Attach conductors from structure 173 to upper C7-1 x-arm. Ahead and back in-line guys. Span guys to structure 172A. 30' and 35' guy leads.
172A	------	----	----	35-5	H-PILE	----	3/E1-3 3/E3-10	2/H-PILE		Guy stub pole. Span guys to structure 172 upper C7-1 assembly. 25' and 30' guy leads.
173	53234.8	347.5	146.6	35-5	H-PILE	C1A				
174	53582.3	330.2	147.4	35-5	H-PILE	C1A				
175	53912.6	320.3	147.9	35-5	H-PILE	C1A				
176	54232.9	243.6	147.9	35-5	H-PILE	C7-1 C7-1	5/E1-3 5/E3-10	4/H-PILE	1/M2-11H	PI-15,69-37-48R. Double deadend angle structure. Locate lower C7-1 x-arm 4'-0" below upper C7-1 x-arm. Locate upper neutral deadend assembly 4'-0" below lower C7-1 x-arm. Use 6" spacing between neutral assemblies. Attach conductors from structure 177 to upper C7-1 x-arm. Ahead and back in-line guys. 30' and 35' guy leads. Lower crossarm was lowered 30" for guy wire clearance.
177	54476.4	209.8	145.7	35-5	H-PILE	C1A				Road crossing.
178	54686.2	200.2	145.2	35-5	H-PILE	C1A				Creek crossing.
179	54886.4	265.6	145.5	35-5	H-PILE	C8-2	1/E1-3 1/E3-10	1/H-PILE	1/M2-11H 4/M5-21 2/M5-5 1/J-10	PI-16, 29-25-30R. Double deadend angle structure. Bisector guy. Use M5-21 units on x-arm deadend insulators for extension links. Use M5-5, pin insulators, for jumpering x-arm conductor on guy attachment side. Install M5-5 units 6" from insulator deadend bolt. Substitute neutral attachment with J-10 assembly. 45' guy lead.

STAKING SHEET – SINGLE POLE
128002; SHUNGNAK – KOBUK TIE LINE PROJECT

ISSUED: 7/27/92
REVISION: RECORD

STR. NO.	STATION	AHEAD SPAN	CL. ELEV.	STR. HT–CL	FOUND. TYPE	DIST. PTAS	GUYING ASSY.	ANCHOR ASSY.	MISC. ASSY.	REMARKS
180	55152.0	201.5	141.1	35–5	H–PILE	C1A				
181	55353.5	49.6	141.1	35–5	H–PILE	C8–3	3/E1–3 3/E3–10	2/F1–4P	1/M2–11H LA	Double deadend tangent structure. Ahead in–line guys. End 325' ruling span to structure 1. Slack span conductors to structure 182.
										30' and 35' guy leads.
182	55403.1	50.0	141.6	35–5	H–PILE	M3–15			1/M2–15A	Switch structure. Slack span to structure 183.
183	55453.1	0.0	------	40–4	H–PILE	C7–1			1/M2–11H	Deadend structure and tie to Kobuk distribution system. Locate C7–1 1'–0" below top of pole. locate neutral assembly 6" below neutral assembly for Kobuk system. End Shungnak – Kobuk Tie Line Project.

PART III

STRINGING SAG TABLES

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	Location (ft)	LINE ANGLE Deg Mn Se	TOWER No. Typ/Insl (N a m e)	POINT OF Height (ft)	SUPPORT Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) (feet) -40F	-30F	-20F	-10F	0F	10F	20F	30F	40F	50F
0	0.00	0-00-00	1 13 (D) (C8-3,35-5,H)	28.50	224.01	208.9	0.7	0.8	0.8 Dead-End Tower	0.9	1	1.1	1.2	1.4	1.6	1.8
6	208.93	0-00-00	2 14 (D) (M3-15,35-5,H)	30.00	220.57	227.9	0.8	0.9	0.9 Dead-End Tower	1.0	1.1	1.2	1.4	1.5	1.7	1.9
19	436.88	83-51-22R	3 8 (D) (C7-1,35-5,H)	26.00	217.54	276.5	0.9	1	1.0 Dead-End Tower	1.1	1.2	1.2	1.3	1.4	1.6	1.7
28	713.37	0-00-00	4 3 (S) (C1A,35-5,H)	29.50	213.28	344.6	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.6
39	1057.95	0-00-00	5 2 (S) (C1A,35-5,H)	29.50	208.81	332.1	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
52	1390.08	0-00-00	6 2 (S) (C1A,35-5,H)	29.50	206.60	343.6	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.6
67	1733.69	0-00-00	7 2 (S) (C1A,35-5,H)	29.50	206.45	329.6	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4
78	2063.30	0-00-00	8 3 (S) (C1A,35-5,H)	29.50	204.24	322.7	1.3	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.3
89	2386.00	0-00-00	9 2 (S) (C1A,35-5,H)	29.50	197.85	349.2	1.5	1.6	1.6	1.7	1.9	2.0	2.1	2.3	2.5	2.7
111	2735.22	0-00-00	10 2 (S) (C1A,35-5,H)	29.50	199.51	327.0	1.3	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.2	2.4
120	3062.27	0-00-00	11 3 (S) (C1A,35-5,H)	29.50	199.90	268.4	0.9	0.9	1	1.0	1.1	1.2	1.3	1.4	1.5	1.6
127	3330.64	0-01-38	12 6 (S) (C2,35-5,H)	29.50	201.10	346.8	1.5	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.5	2.7
134	3677.40	0-00-00	13 3 (S) (C1A,35-5,H)	29.50	201.11	302.6	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0
138	3980.03	0-00-00	14 3 (S) (C1A,35-5,H)	29.50	198.72	340.6	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6
145	4320.61	0-00-00	15 3 (S) (C1A,35-5,H)	29.50	195.59	202.9	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9
160	4523.51	0-00-00	16 11 (S) (C1-1A,35-5,H)	29.50	190.52	346.3	1.5	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5	2.7
171	4869.83	0-00-00	17 2 (S) (C1A,35-5,H)	29.50	190.57	326.7	1.3	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.2	2.4
183	5196.57	0-00-00	18 2 (S) (C1A,35-5,H)	29.50	196.27	346.3	1.5	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5	2.7

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	Location (ft)	LINE ANGLE Deg Mn Se	TOWER No. Typ/Insl (Name)	POINT OF Height (ft)	SUPPORT Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) (feet) -40F	-30F	-20F	-10F	0F	10F	20F	30F	40F	50F
202	5542.89	0-00-00	19 2 (S) (C1A,35-5,H)	29.50	199.90	329.1	1.3	1.4	1.5	1.5	1.6	1.8	1.9	2.0	2.2	2.4
209	5872.02	0-00-00	20 2 (S) (C1A,35-5,H)	29.50	201.91	339.9	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6
221	6211.90	0-00-00	21 2 (S) (C1A,35-5,H)	29.50	205.19	338.1	1.4	1.5	1.5	1.6	1.7	1.9	2.0	2.2	2.3	2.6
229	6550.04	0-00-00	22 2 (S) (C1A,35-5,H)	29.50	208.36	335.0	1.4	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.5
240	6885.08	0-00-00	23 2 (S) (C1A,35-5,H)	29.50	209.19	342.9	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6
246	7227.98	0-00-00	24 2 (S) (C1A,35-5,H)	29.50	210.85	335.7	1.4	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.5
259	7563.69	0-00-00	25 2 (S) (C1A,35-5,H)	29.50	217.80	335.3	1.4	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.5
269	7898.98	0-00-00	26 2 (S) (C1A,35-5,H)	29.50	224.34	329.1	1.3	1.4	1.5	1.5	1.6	1.8	1.9	2.0	2.2	2.4
278	8228.08	0-00-00	27 2 (S) (C1A,35-5,H)	29.50	228.16	348.7	1.5	1.6	1.6	1.7	1.8	2.0	2.1	2.3	2.5	2.7
290	8576.82	0-00-00	28 2 (S) (C1A,35-5,H)	29.50	229.40	326.7	1.3	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.2	2.4
297	8903.56	0-00-00	29 3 (S) (C1A,35-5,H)	29.50	233.03	330.9	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4
307	9234.47	0-00-00	30 3 (S) (C1A,35-5,H)	29.50	231.90	288.9	1.0	1.1	1.1	1.2	1.3	1.3	1.4	1.6	1.7	1.9
315	9523.34	0-00-00	31 3 (S) (C1A,35-5,H)	29.50	237.30	210.3	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1
325	9733.63	0-00-00	32 3 (S) (C1A,35-5,H)	29.50	244.78	207.7	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.9	1
332	9941.31	0-00-00	33 11 (S) (C1-1A,35-5,H)	29.50	252.88	273.1	0.9	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.5	1.6
344	10214.40	0-00-00	34 11 (S) (C1-1A,35-5,H)	29.50	254.50	350.4	1.5	1.6	1.6	1.7	1.9	2.0	2.1	2.3	2.5	2.7
357	10564.76	0-00-00	35 2 (S) (C1A,35-5,H)	29.50	247.58	329.6	1.3	1.4	1.5	1.5	1.6	1.8	1.9	2.0	2.2	2.4
371	10894.39	0-00-00	36 2 (S) (C1A,35-5,H)	29.50	242.99	344.8	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.6

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	Location (ft)	LINE ANGLE Deg Mn Se	TOWER No. Typ/Insl (Name)	POINT OF Height (ft)	SUPPORT Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) (feet) -40F	-30F	-20F	-10F	0F	10F	20F	30F	40F	50F
386	11239.17	68-49-38R	37 8 (D) (C7-1,35-5,H)	26.00	236.29	311.9	1.2	1.3	1.4	1.5	1.5	1.7	1.8	1.9	2.1	2.3
									Dead-End Tower							
394	11551.03	0-00-00	38 3 (S) (C1A,35-5,H)	29.50	239.37	324.6	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
404	11875.64	0-00-00	39 5 (S) (C1A,40-4,H)	34.50	234.07	287.6	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.7	1.8	2.0
411	12163.26	0-00-00	40 7 (D) (C8-2,35-5,H)	29.50	222.06	344.5	1.5	1.6	1.6	1.7	1.9	2.0	2.1	2.3	2.5	2.8
									Dead-End Tower							
425	12507.74	0-00-00	41 2 (S) (C1A,35-5,H)	29.50	218.43	328.1	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
437	12835.82	0-00-00	42 2 (S) (C1A,35-5,H)	29.50	214.42	345.9	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.6	2.8
444	13181.76	0-00-00	43 2 (S) (C1A,35-5,H)	29.50	208.15	333.3	1.4	1.5	1.5	1.6	1.7	1.9	2.0	2.2	2.4	2.6
459	13515.06	0-00-00	44 3 (S) (C1A,35-5,H)	29.50	201.56	254.3	0.8	0.8	0.9	1	1.0	1.1	1.2	1.3	1.4	1.5
473	13769.39	0-00-00	45 5 (S) (C1A,40-4,H)	34.50	199.68	309.5	1.2	1.3	1.3	1.4	1.5	1.6	1.7	1.9	2.1	2.2
488	14078.90	0-00-00	46 3 (S) (C1A,35-5,H)	29.50	202.61	206.0	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1
497	14284.86	32-07-57R	47 7 (D) (C8-2,35-5,H)	29.50	205.53	346.8	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6	2.8
									Dead-End Tower							
507	14631.67	0-00-00	48 2 (S) (C1A,35-5,H)	29.50	205.27	326.4	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
516	14958.02	0-00-00	49 3 (S) (C1A,35-5,H)	29.50	211.75	291.0	1.1	1.1	1.2	1.2	1.3	1.4	1.5	1.7	1.8	2.0
524	15248.98	0-00-00	50 3 (S) (C1A,35-5,H)	29.50	216.12	254.6	0.8	0.8	0.9	1	1.0	1.1	1.2	1.3	1.4	1.5
532	15503.54	0-00-00	51 3 (S) (C1A,35-5,H)	29.50	218.23	255.9	0.8	0.9	0.9	1	1.0	1.1	1.2	1.3	1.4	1.5
541	15759.48	0-00-00	52 3 (S) (C1A,35-5,H)	29.50	219.01	251.8	0.8	0.8	0.9	0.9	1	1.1	1.1	1.2	1.4	1.5
552	16011.25	14-40-40R	53 6 (S) (C2,35-5,H)	29.50	217.87	346.2	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.6	2.8
560	16357.44	0-00-00	54 2 (S) (C1A,35-5,H)	29.50	214.96	332.2	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.2	2.4	2.6

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	Location (ft)	LINE ANGLE Deg Mn Se	TOWER No. Typ/Insl (Name)	POINT OF Height (ft)	SUPPORT Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) -40F	-30F	-20F	-10F	0F (feet)	10F	20F	30F	40F	50F
573	16689.69	0-00-00	55 11 (S) (C1-1A,35-5,H)	29.50	212.72	308.2	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	2.2
585	16997.89	0-00-00	56 3 (S) (C1A,35-5,H)	29.50	204.65	302.3	1.1	1.2	1.3	1.3	1.4	1.5	1.7	1.8	2.0	2.1
595	17300.15	0-00-00	57 3 (S) (C1A,35-5,H)	29.50	202.28	349.8	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.6	2.9
607	17649.93	0-00-00	58 2 (S) (C1A,35-5,H)	29.50	203.80	323.1	1.3	1.4	1.4	1.5	1.6	1.8	1.9	2.0	2.2	2.4
621	17973.05	0-00-00	59 2 (S) (C1A,35-5,H)	29.50	203.57	347.2	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6	2.8
634	18320.27	0-00-00	60 3 (S) (C1A,35-5,H)	29.50	201.22	218.0	0.6	0.6	0.7	0.7	0.7	0.8	0.9	0.9	1.0	1.1
644	18538.23	0-00-00	61 3 (S) (C1A,35-5,H)	29.50	194.67	342.8	1.5	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.5	2.8
660	18881.03	0-00-00	62 4 (S) (C1A,40-4,H)	34.50	191.49	349.0	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.6	2.9
683	19230.04	0-00-00	63 3 (S) (C1A,35-5,H)	29.50	188.05	253.9	0.8	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.5
702	19483.92	18-01-53R	64 7 (D) (C8-2,35-5,H)	29.50	188.12	330.1	1.4	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.6
									Dead-End Tower							
715	19814.02	0-00-00	65 11 (S) (C1-1A,35-5,H)	29.50	194.68	293.9	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0
725	20107.90	0-00-00	66 9 (D) (C8-2,35-5,H)	29.50	195.40	352.8	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.6	2.9
									Dead-End Tower							
735	20460.67	0-00-00	67 5 (S) (C1A,40-4,H)	34.50	206.19	204.3	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.9	1
745	20664.98	0-00-00	68 5 (S) (C1A,40-4,H)	34.50	214.67	370.1	1.7	1.8	1.9	2.0	2.1	2.3	2.4	2.7	2.9	3.2
757	21035.13	0-00-00	69 3 (S) (C1A,35-5,H)	29.50	222.04	248.6	0.8	0.8	0.8	0.9	1	1.0	1.1	1.2	1.3	1.4
765	21283.77	44-50-43R	70 8 (D) (C7-1,35-5,H)	26.00	228.96	321.2	1.3	1.4	1.4	1.5	1.6	1.8	1.9	2.1	2.2	2.5
									Dead-End Tower							
774	21605.01	0-00-00	71 3 (S) (C1A,35-5,H)	29.50	233.41	325.0	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
787	21930.03	0-00-00	72 3 (S) (C1A,35-5,H)	29.50	236.99	324.9	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	Location (ft)	LINE ANGLE Deg Mn Se	TOWER No. Typ/Insl (N a m e)	POINT OF Height (ft)	SUPPORT Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) (feet) -40F	-30F	-20F	-10F	0F	10F	20F	30F	40F	50F
797	22254.91	0-00-00	73 3 (S) (C1A,35-5,H)	29.50	240.08	257.5	0.8	0.9	0.9	1	1.0	1.1	1.2	1.3	1.4	1.6
804	22512.37	26-46-38R	74 7 (D) (C8-2,35-5,H)	29.50	243.55	346.4	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6
									Dead-End Tower							
813	22858.80	0-00-00	75 2 (S) (C1A,35-5,H)	29.50	247.59	330.9	1.3	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.2	2.4
825	23189.65	0-00-00	76 2 (S) (C1A,35-5,H)	29.50	250.99	340.8	1.4	1.5	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.5
835	23530.40	0-00-00	77 2 (S) (C1A,35-5,H)	29.50	256.23	332.7	1.3	1.4	1.5	1.5	1.6	1.7	1.9	2.0	2.2	2.4
843	23863.08	0-00-00	78 2 (S) (C1A,35-5,H)	29.50	258.93	337.6	1.4	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4
856	24200.66	0-00-00	79 2 (S) (C1A,35-5,H)	29.50	263.83	336.1	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4
864	24536.73	0-00-00	80 2 (S) (C1A,35-5,H)	29.50	267.37	339.3	1.4	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
874	24876.00	0-00-00	81 2 (S) (C1A,35-5,H)	29.50	273.62	340.1	1.4	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.5
885	25216.10	0-00-00	82 11 (S) (C1-1A,35-5,H)	29.50	278.73	313.2	1.2	1.2	1.3	1.4	1.4	1.5	1.7	1.8	1.9	2.1
894	25529.33	0-00-00	83 2 (S) (C1A,35-5,H)	29.50	278.50	348.9	1.5	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.6
905	25878.27	0-00-00	84 2 (S) (C1A,35-5,H)	29.50	277.33	321.6	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.2
915	26199.91	0-00-00	85 2 (S) (C1A,35-5,H)	29.50	276.87	344.4	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.5
926	26544.33	0-00-00	86 2 (S) (C1A,35-5,H)	29.50	274.66	328.9	1.3	1.4	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.3
935	26873.23	0-00-00	87 2 (S) (C1A,35-5,H)	29.50	269.63	344.4	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.5
948	27217.66	0-00-00	88 3 (S) (C1A,35-5,H)	29.50	264.29	266.2	0.8	0.9	0.9	1	1.0	1.1	1.2	1.3	1.4	1.5
960	27483.87	0-00-00	89 7 (D) (C8-2,35-5,H)	29.50	259.18	342.5	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6	2.9
									Dead-End Tower							
974	27826.38	0-00-00	90 3 (S) (C1A,35-5,H)	29.50	261.31	314.6	1.3	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.2	2.4

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	Location (ft)	LINE ANGLE Deg Mn Se	TOWER No. Typ/Insl (N a m e)	POINT OF Height (ft)	SUPPORT Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) (feet) -40F	-30F	-20F	-10F	0F	10F	20F	30F	40F	50F
985	28140.98	0-00-00	91 11 (S) (C1-1A,35-5,H)	29.50	260.77	309.6	1.2	1.3	1.4	1.4	1.5	1.7	1.8	1.9	2.1	2.3
1002	28450.62	0-00-00	92 3 (S) (C1A,35-5,H)	29.50	253.85	206.8	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.9	1	1.0
1009	28657.40	0-00-00	93 7 (D) (C8-2,35-5,H)	29.50	245.42	347.3	1.5	1.6	1.6 Dead-End Tower	1.7	1.8	2.0	2.1	2.3	2.5	2.7
1029	29004.66	0-00-00	94 3 (S) (C1A,35-5,H)	29.50	262.02	245.4	0.7	0.8	0.8	0.9	0.9	1	1.1	1.1	1.2	1.4
1044	29250.11	0-00-00	95 11 (S) (C1-1A,35-5,H)	29.50	272.10	343.1	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.6
1056	29593.25	0-00-00	96 11 (S) (C1-1A,35-5,H)	29.50	278.21	308.3	1.2	1.2	1.3	1.4	1.4	1.5	1.7	1.8	2.0	2.1
1066	29901.55	0-00-00	97 3 (S) (C1A,35-5,H)	29.50	276.43	345.0	1.5	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.4	2.7
1084	30246.52	0-00-00	98 2 (S) (C1A,35-5,H)	29.50	271.77	330.6	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
1104	30577.17	0-00-00	99 2 (S) (C1A,35-5,H)	29.50	273.59	349.5	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.3	2.5	2.7
1117	30926.63	0-00-00	100 2 (S) (C1A,35-5,H)	29.50	280.14	321.4	1.3	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.3
1131	31248.02	0-00-00	101 5 (S) (C1A,40-4,H)	34.50	289.70	296.1	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.7	1.8	2.0
1147	31544.11	0-00-00	102 3 (S) (C1A,35-5,H)	29.50	293.39	341.7	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6
1160	31885.79	0-00-00	103 2 (S) (C1A,35-5,H)	29.50	292.72	338.2	1.4	1.5	1.5	1.6	1.7	1.9	2.0	2.2	2.3	2.6
1178	32224.03	0-00-00	104 2 (S) (C1A,35-5,H)	29.50	291.82	331.1	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.5
1196	32555.18	0-00-00	105 11 (S) (C1-1A,35-5,H)	29.50	292.85	207.8	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1
1203	32762.96	0-00-00	106 7 (D) (C8-2,35-5,H)	29.50	288.69	340.3	1.4	1.5	1.6	1.7	1.8 Dead-End Tower	1.9	2.1	2.2	2.4	2.7
1218	33103.28	0-00-00	107 3 (S) (C1A,35-5,H)	29.50	289.25	288.2	1.0	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.8	1.9
1231	33391.51	24-59-12R	108 7 (D) (C8-2,35-5,H)	29.50	289.61	345.4	1.5	1.5	1.6	1.7	1.8 Dead-End Tower	1.9	2.1	2.2	2.4	2.7

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	Location (ft)	LINE ANGLE Deg Mn Se	TOWER No. Typ/Insl (Name)	POINT OF Height (ft)	SUPPORT Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) -40F	-30F	-20F	-10F	0F	10F	20F	30F	40F	50F (feet)
1243	33736.94	0-00-00	109 2 (S) (C1A,35-5,H)	29.50	287.41	333.5	1.4	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
1256	34070.43	0-00-00	110 2 (S) (C1A,35-5,H)	29.50	283.77	340.7	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6
1268	34411.13	0-00-00	111 2 (S) (C1A,35-5,H)	29.50	278.63	331.8	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
1279	34742.91	0-00-00	112 3 (S) (C1A,35-5,H)	29.50	273.31	324.7	1.3	1.4	1.4	1.5	1.6	1.7	1.8	2.0	2.2	2.4
1293	35067.57	0-00-00	113 2 (S) (C1A,35-5,H)	29.50	263.28	348.5	1.5	1.6	1.6	1.7	1.8	2.0	2.1	2.3	2.5	2.7
1301	35416.06	0-00-00	114 3 (S) (C1A,35-5,H)	29.50	259.08	308.7	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1
1311	35724.77	0-00-00	115 3 (S) (C1A,35-5,H)	29.50	251.62	295.0	1.1	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.8	2.0
1319	36019.81	0-00-00	116 3 (S) (C1A,35-5,H)	29.50	243.14	306.3	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.8	1.9	2.1
1333	36326.15	0-00-00	117 11 (S) (C1-1A,35-5,H)	29.50	241.53	285.5	1	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.7	1.8
1351	36611.63	0-00-00	118 15 (D) (C8-2,40-4,H)	34.50	232.70	321.4	1.3	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.3
1376	36933.02	0-00-00	119 7 (D) (C8-2,35-5,H)	29.50	231.36	292.1	1.1	1.2	1.3	1.3	1.4	1.6	1.7	1.8	2.0	2.2
1393	37225.14	0-00-00	120 7 (D) (C8-2,35-5,H)	29.50	238.74	348.4	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.6	2.8	3.1
1412	37573.52	0-00-00	121 11 (S) (C1-1A,35-5,H)	29.50	257.78	224.6	0.7	0.7	0.7	0.8	0.8	0.9	1	1.1	1.2	1.3
1428	37798.13	0-00-00	122 3 (S) (C1A,35-5,H)	29.50	263.38	326.8	1.4	1.5	1.5	1.6	1.8	1.9	2.1	2.2	2.5	2.7
1445	38124.90	0-00-00	123 11 (S) (C1-1A,35-5,H)	29.50	271.55	227.3	0.7	0.7	0.7	0.8	0.9	0.9	1	1.1	1.2	1.3
1461	38352.16	79-15-55R	124 16 (D) (C7-1,40-4,B)	25.00	265.16	285.7	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.8	2.0	2.2
1480	38637.87	0-00-00	125 17 (S) (C1A,40-4,B)	28.50	264.02	242.1	0.8	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.6
1496	38879.95	0-00-00	126 18 (S) (C1-1A,40-4,B)	28.50	256.51	333.9	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5	2.7	3.0

Dead-End Tower
Dead-End Tower
Dead-End Tower
Dead-End Tower

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	Location (ft)	LINE ANGLE Deg Mn Se	TOWER No. Typ/Insl (Name)	POINT OF Height (ft)	SUPPORT Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) (feet) -40F	-30F	-20F	-10F	0F	10F	20F	30F	40F	50F
1517	39213.83	0-00-00	127 19 (S) (C1-1A,45-4,B)	33.00	237.51	256.5	0.9	0.9	1	1.1	1.1	1.2	1.3	1.5	1.6	1.8
1536	39470.28	0-00-00	128 20 (D) (C8-2,40-4,B)	28.50	217.56	299.4	1.1	1.1	1.2 Dead-End Tower	1.3	1.4	1.4	1.6	1.7	1.8	2.0
1548	39769.72	0-00-00	129 17 (S) (C1A,40-4,B)	28.50	219.82	355.5	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6	2.8
1569	40125.22	0-00-00	130 18 (S) (C1-1A,40-4,B)	28.50	223.08	171.6	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7
1582	40296.77	0-00-00	131 18 (S) (C1-1A,40-4,B)	28.50	213.63	366.4	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.5	2.8	3.0
1609	40663.16	0-00-00	132 7 (D) (C8-2,35-5,H)	29.50	180.03	248.9	0.8	0.8	0.9 Dead-End Tower	0.9	1	1.1	1.1	1.2	1.3	1.5
1631	40912.11	0-00-00	133 11 (S) (C1-1A,35-5,H)	27.50	196.32	164.4	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6
1639	41076.48	0-00-00	134 11 (S) (C1-1A,35-5,H)	29.50	197.57	341.5	1.5	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.5	2.8
1658	41417.99	0-00-00	135 2 (S) (C1A,35-5,H)	29.50	189.14	317.3	1.3	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.2	2.4
1679	41735.32	0-00-00	136 4 (S) (C1A,40-4,H)	34.50	187.32	341.4	1.5	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.5	2.8
1697	42076.71	0-00-00	137 2 (S) (C1A,35-5,H)	29.50	185.64	329.4	1.4	1.4	1.5	1.6	1.7	1.8	2.0	2.2	2.3	2.6
1708	42406.10	0-00-00	138 3 (S) (C1A,35-5,H)	29.50	185.03	321.9	1.3	1.4	1.4	1.5	1.6	1.8	1.9	2.1	2.2	2.5
1719	42728.04	77-05-46R	139 8 (D) (C7-1,35-5,H)	26.00	180.77	260.6	0.9	1	1.0 Dead-End Tower	1.1	1.2	1.3	1.4	1.6	1.7	1.9
1728	42988.67	0-00-00	140 11 (S) (C1-1A,35-5,H)	29.50	186.38	321.7	1.4	1.5	1.6	1.7	1.8	2.0	2.2	2.4	2.7	2.9
1741	43310.37	0-00-00	141 11 (S) (C1-1A,35-5,H)	29.50	187.37	207.2	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1	1.1	1.2
1751	43517.58	0-00-00	142 7 (D) (C8-2,35-5,H)	29.50	180.66	348.7	1.5	1.6	1.7 Dead-End Tower	1.8	1.9	2.0	2.1	2.3	2.5	2.8
1775	43866.28	0-00-00	143 2 (S) (C1A,35-5,H)	29.50	178.08	331.7	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
1793	44197.95	0-00-00	144 3 (S) (C1A,35-5,H)	29.50	174.41	299.2	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	Location (ft)	LINE ANGLE Deg Mn Se	TOWER No. Typ/Insl (Name)	POINT OF Height (ft)	SUPPORT Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) (feet) -40F	-30F	-20F	-10F	0F	10F	20F	30F	40F	50F
1815	44497.15	0-00-00	145 3 (S) (C1A,35-5,H)	29.50	176.35	297.9	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.0
1833	44795.05	0-00-00	146 3 (S) (C1A,35-5,H)	29.50	174.53	341.7	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.6
1846	45136.78	0-00-00	147 2 (S) (C1A,35-5,H)	29.50	175.68	337.8	1.4	1.5	1.6	1.6	1.8	1.9	2.0	2.2	2.4	2.6
1861	45474.58	0-00-00	148 2 (S) (C1A,35-5,H)	29.50	176.10	332.2	1.4	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
1873	45806.83	0-00-00	149 2 (S) (C1A,35-5,H)	29.50	177.42	347.5	1.5	1.6	1.6	1.7	1.9	2.0	2.1	2.3	2.5	2.7
1887	46154.33	0-00-00	150 2 (S) (C1A,35-5,H)	29.50	176.05	315.7	1.2	1.3	1.4	1.4	1.5	1.6	1.8	1.9	2.1	2.3
1901	46470.01	0-00-00	151 3 (S) (C1A,35-5,H)	29.50	173.34	255.2	0.8	0.8	0.9	0.9	1	1.1	1.1	1.2	1.4	1.5
1907	46725.24	0-00-00	152 12 (S) (C1-1A,40-4,H)	34.50	175.95	234.5	0.7	0.7	0.7	0.8	0.8	0.9	1	1.0	1.1	1.2
1916	46959.75	0-00-00	153 3 (S) (C1A,35-5,H)	29.50	174.58	327.0	1.3	1.4	1.5	1.5	1.6	1.8	1.9	2.0	2.2	2.4
1925	47286.76	0-00-00	154 2 (S) (C1A,35-5,H)	29.50	177.29	345.5	1.5	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.5	2.7
1936	47632.23	0-00-00	155 2 (S) (C1A,35-5,H)	29.50	177.54	328.8	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4
1948	47961.05	0-00-00	156 11 (S) (C1-1A,35-5,H)	29.50	178.71	328.8	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4
1963	48289.87	0-00-00	157 2 (S) (C1A,35-5,H)	29.50	174.16	349.1	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.5	2.8
1980	48638.99	0-00-00	158 2 (S) (C1A,35-5,H)	29.50	173.51	329.8	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.3	2.5
1991	48968.82	0-00-00	159 2 (S) (C1A,35-5,H)	29.50	175.53	348.0	1.5	1.6	1.6	1.7	1.9	2.0	2.1	2.3	2.5	2.7
2004	49316.82	0-00-00	160 2 (S) (C1A,35-5,H)	29.50	178.42	328.5	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4
2013	49645.34	0-00-00	161 2 (S) (C1A,35-5,H)	29.50	180.51	347.1	1.5	1.6	1.6	1.7	1.8	2.0	2.1	2.3	2.5	2.7
2030	49992.48	0-00-00	162 3 (S) (C1A,35-5,H)	29.50	180.64	301.3	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.1

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	LINE ANGLE Location (ft)	Deg Mn Se	TOWER No. Typ/Insl (Name)	POINT OF SUPPORT Height (ft)	Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) -40F	-30F	-20F	-10F	0F	10F	20F	30F	40F	50F
							(feet)									
2041	50293.75	0-00-00	163 3 (S) (C1A,35-5,H)	29.50	177.18	296.5	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.7	1.8	2.0
2063	50590.20	0-00-00	164 3 (S) (C1A,35-5,H)	29.50	176.91	259.8	0.8	0.9	0.9	1	1.0	1.1	1.2	1.3	1.4	1.5
2077	50850.04	0-00-00	165 11 (S) (C1-1A,35-5,H)	29.50	176.77	253.9	0.8	0.8	0.9	0.9	1	1.1	1.1	1.2	1.3	1.5
2087	51103.99	50-13-40R	166 8 (D) (C7-1,35-5,H)	26.00	172.79	317.5	1.3	1.4	1.4	1.5	1.6	1.8	1.9	2.1	2.3	2.5
									Dead-End Tower							
2095	51421.52	0-00-00	167 3 (S) (C1A,35-5,H)	29.50	177.18	325.0	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.2	2.4	2.6
2108	51746.53	0-00-00	168 3 (S) (C1A,35-5,H)	29.50	176.37	319.4	1.3	1.4	1.5	1.5	1.6	1.8	1.9	2.1	2.3	2.5
2122	52065.94	0-00-00	169 3 (S) (C1A,35-5,H)	29.50	177.17	323.5	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.3	2.6
2136	52389.44	0-00-00	170 3 (S) (C1A,35-5,H)	29.50	176.80	260.8	0.9	0.9	1	1.0	1.1	1.2	1.3	1.4	1.5	1.7
2149	52650.28	0-00-00	171 3 (S) (C1A,35-5,H)	29.50	177.82	254.8	0.8	0.9	0.9	1	1.0	1.1	1.2	1.3	1.5	1.6
2161	52905.10	48-12-22R	172 8 (D) (C7-1,35-5,H)	26.00	174.85	329.7	1.3	1.4	1.4	1.5	1.6	1.7	1.8	2.0	2.2	2.3
									Dead-End Tower							
2177	53234.80	0-00-00	173 2 (S) (C1A,35-5,H)	29.50	176.11	347.5	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6
2191	53582.33	0-00-00	174 2 (S) (C1A,35-5,H)	29.50	176.92	330.2	1.3	1.4	1.4	1.5	1.6	1.7	1.8	2.0	2.2	2.3
2211	53912.55	0-00-00	175 3 (S) (C1A,35-5,H)	29.50	177.43	320.3	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.2
2226	54232.86	69-37-48R	176 8 (D) (C7-1,35-5,H)	26.00	173.90	243.6	0.9	1	1.1	1.2	1.3	1.4	1.6	1.8	2.0	2.3
									Dead-End Tower							
2234	54476.43	0-00-00	177 3 (S) (C1A,35-5,H)	29.50	175.22	209.8	0.7	0.7	0.8	0.9	1	1.1	1.2	1.3	1.5	1.7
2249	54686.21	0-00-00	178 3 (S) (C1A,35-5,H)	29.50	174.69	200.2	0.6	0.7	0.7	0.8	0.9	1	1.1	1.2	1.4	1.6
2266	54886.41	29-25-30R	179 7 (D) (C8-2,35-5,H)	29.50	174.97	265.6	1.1	1.1	1.2	1.3	1.4	1.6	1.7	1.9	2.2	2.4
									Dead-End Tower							
2282	55151.99	0-00-00	180 3 (S) (C1A,35-5,H)	29.50	170.56	201.5	0.6	0.6	0.7	0.8	0.8	0.9	1	1.1	1.2	1.4

S A G R E P O R T - C O N D U C T O R I N S H E A V E S

SHUNGNAK - KOBUK TIE LINE
7.2/12.5KV DISTRIBUTION LINE

Allowable span lengths: minimum = 150.00 maximum = 375.00
Basic clearance = 20.00 Conductor shape: Parabola Conductor Number: 1
Station spacing (for interpolation) = 10.00 Station spacing (for clearance checking) = 25.00
Section Length: 55353.53 (ft) 10.48 (miles)
Filename = C:\TDES\SHUN\TLC\SHUNFNAL.TLC

STATION No.	Location (ft)	LINE ANGLE Deg Mn Se	TOWER No. Typ/Insl (Name)	POINT OF SUPPORT Height (ft)	Elev (ft)	SPAN AHEAD (ft)	Sag in Sheaves (forward span) -40F	-30F	-20F	-10F	0F	10F	20F	30F	40F	50F (feet)
2293	55353.53	0-00-00	181 13 (D) (C8-3,35-5,H)	29.50	170.61	49.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
									Dead-End Tower							

128002; SHUNGNAK – KOBUK TIE LINE PROJECT TIME SAG TABLE DATE: 12/4/91			
SAG (FEET)	SAG (INCHES)	TIME IN (SECONDS) 5th RETURN	7th RETURN
0.1	1	1.6	2.2
0.2	2	2.2	3.1
0.3	4	2.7	3.8
0.4	5	3.2	4.4
0.5	6	3.5	4.9
0.6	7	3.9	5.4
0.7	8	4.2	5.8
0.8	10	4.5	6.2
0.9	11	4.7	6.6
1.0	12	5.0	7.0
1.1	13	5.2	7.3
1.2	14	5.5	7.7
1.3	16	5.7	8.0
1.4	17	5.9	8.3
1.5	18	6.1	8.6
1.6	19	6.3	8.8
1.7	20	6.5	9.1
1.8	22	6.7	9.4
1.9	23	6.9	9.6
2.0	24	7.0	9.9
2.1	25	7.2	10.1
2.2	26	7.4	10.4
2.3	28	7.6	10.6
2.4	29	7.7	10.8
2.5	30	7.9	11.0
2.6	31	8.0	11.3
2.7	32	8.2	11.5
2.8	34	8.3	11.7
2.9	35	8.5	11.9
3.0	36	8.6	12.1
3.1	37	8.8	12.3
3.2	38	8.9	12.5
3.3	40	9.0	12.7
3.4	41	9.2	12.9
3.5	42	9.3	13.1

128002; SHUNGNAK – KOBUK TIE LINE PROJECT

TIME SAG TABLE DATE: 12/4/91

SAG (FEET)	SAG (INCHES)	TIME IN (SECONDS)	
		5th RETURN	7th RETURN
3.6	43	9.5	13.3
3.7	44	9.6	13.4
3.8	46	9.7	13.6
3.9	47	9.8	13.8
4.0	48	10.0	14.0
4.1	49	10.1	14.1
4.2	50	10.2	14.3
4.3	52	10.3	14.5
4.4	53	10.4	14.7
4.5	54	10.6	14.8
4.6	55	10.7	15.0
4.7	56	10.8	15.1
4.8	58	10.9	15.3
4.9	59	11.0	15.5
5.0	60	11.1	15.6
5.1	61	11.2	15.8
5.2	62	11.4	15.9
5.3	64	11.5	16.1
5.4	65	11.6	16.2
5.5	66	11.7	16.4
5.6	67	11.8	16.5
5.7	68	11.9	16.7
5.8	70	12.0	16.8
5.9	71	12.1	17.0
6.0	72	12.2	17.1

PART IV

PROJECT DRAWING LIST

SHUNGNAK – KOBUK TIE LINE PROJECT DRAWING LIST

CADD PLAN DRAWINGS

00	VICINITY MAP
00a	PLAN
01	PLAN
02	PLAN
03	PLAN
04	PLAN
05	PLAN

CADD PROFILE DRAWINGS

SHEET 1	PROFILE
SHEET 2	PROFILE
SHEET 3	PROFILE
SHEET 4	PROFILE
SHEET 5	PROFILE
SHEET 6	PROFILE
SHEET 7	PROFILE
SHEET 8	PROFILE
SHEET 9	PROFILE
SHEET 10	PROFILE
SHEET 11	PROFILE

REA STRUCTURE DRAWINGS

C1A	STRUCTURE C1A (TANGENT, O DEGS.)
C1-1A	STRUCTURE C1-1A (TANGENT, 0 DEGS.)
C2	STRUCTURE C2 (TANGENT & LT ANGLE, O-20 DEGS.)
C8-2	STRUCTURE C8-2 (DDE, 0-40 DEGS.)
C8-3	STRUCTURE C8-3 (DDE, 0 DEGS.)
C7-1	STRUCTURE C7-1 (SDE & DDE BUCKARM (40-90 DEGS.)
M3-15	STRUCTURE M3-1 (SECTIONALIZING AIR BREAK SWITCH)

REA ASSEMBLY DRAWINGS

G312-75	ASSEMBLY G312-75 (3-TRANSFORMER CLUSTER MOUNT ASSEMBLY)
M2-11	ASSEMBLY M2-11 (GROUND ROD ASSEMBLY)
M2-15A	ASSEMBLY M2-15A (AIR BREAK SWITCH GROUNDING ASSEMBLY)
J10	ASSEBLY J10 (NEUTRAL ANGLE ASSEMBLY)
K10C	ASSEMBLY K10C (SERVICE CABLE ATTACHMENT ASSEMBLY)
K14C	ASSEMBLY K14C (SERVICE CABLE ATTACHMENT ASSEMBLY)
M8-6	ASSEMBLY M8-6 (SECONDARY METERING GUIDE ASSEBLY)
M5-5	ASSEMBLY M5-5 (INSULATOR PIN ASSEMBLY)
M5-21	ASSEMBLY M5-21 (EYE BOLT EXTENSION LINK ASSEMBLY)

REA GUIDE DRAWINGS

M19	CROSSARM DRILLING GUIDE
M20	POLE DRILLING GUIDE
M40-10	TYING GUIDE, SINGLE INSULATOR
M40-17	TYING GUIDE, DOUBLE INSULATOR
M42-11	DEADEND ASSEMBLY GUIDE
R1	CLEARING RIGHT-OF-WAY GUIDE

CADD ASSEMBLY DRAWINGS

MS01	MISCELLANEOUS ASSEMBLIES
AD01	GUYING AND ANCHOR ASSEMBLIES
GD01	GUYING ASSEMBLIES
GA-01	GUYING ARRANGEMENTS
GA-02	GUYING ARRANGEMENTS

PART V

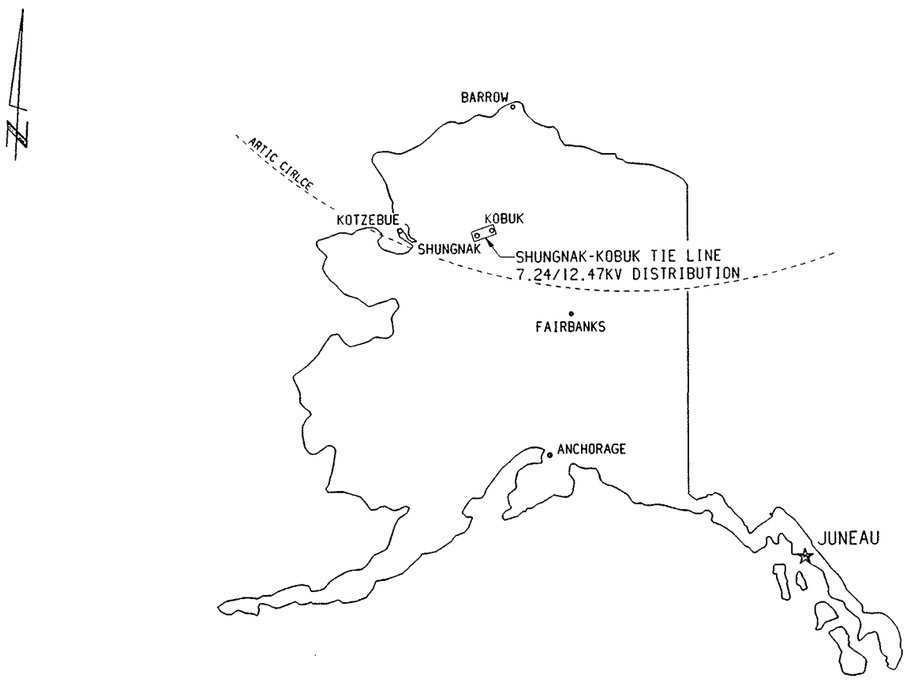
PLAN AND PROFILE DRAWINGS

SHUNGNAK - KOBUK TIE LINE

7.24/12.47KV DISTRIBUTION

FOR

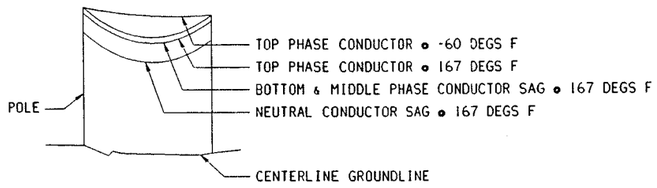
ALASKA ENERGY AUTHORITY



VICINITY MAP

PROFILE DRAWING LEGEND

5	6
0-0-0	0-0-0
C1A.35-5.H	C1A.35-5.H
29.50	29.50
179.31	177.10
1057.95	1390.08
208.81	206.60
332.13	343.61



STRUCTURE INFORMATION LEGEND

CONST. NO. - STRUCTURE NUMBER
LINE ANGLE - DEFLECTION ANGLE
TOWER NAME - POLE TOP ASSEMBLY WITH POLE HEIGHT AND CLASS
HEIGHT - DISTANCE OF LOWEST POINT OF ATTACHMENT ABOVE GROUND
CL HUB EL - CENTERLINE GROUND ELEVATION
STATION LOC - STRUCTURE STATION LOCATION
P.S. ELEV - ELEVATION OF LOWEST POINT OF ATTACHMENT
SPAN AHEAD - HORIZONTAL DISTANCE TO NEXT STRUCTURE

REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
E	REFERENCE DRAWING				
D	ISSUED FOR RECORD	6-20-92	MWM	-	-
C	ISSUED FOR CONSTRUCTION	-	-	-	-
B	ISSUED FOR BIDDING	-	-	-	-
A	ISSUED FOR APPROVAL	-	-	-	-

REFERENCE DRAWINGS	
TYP	STRUCTURE ASSY DWGS
TYP	PLAN & PROFILE
TYP	GUYING ASSEMBLIES
TYP	ANCHOR ASSEMBLIES
TYP	MISCELLANEOUS ASSYS

ALASKA ENERGY AUTHORITY

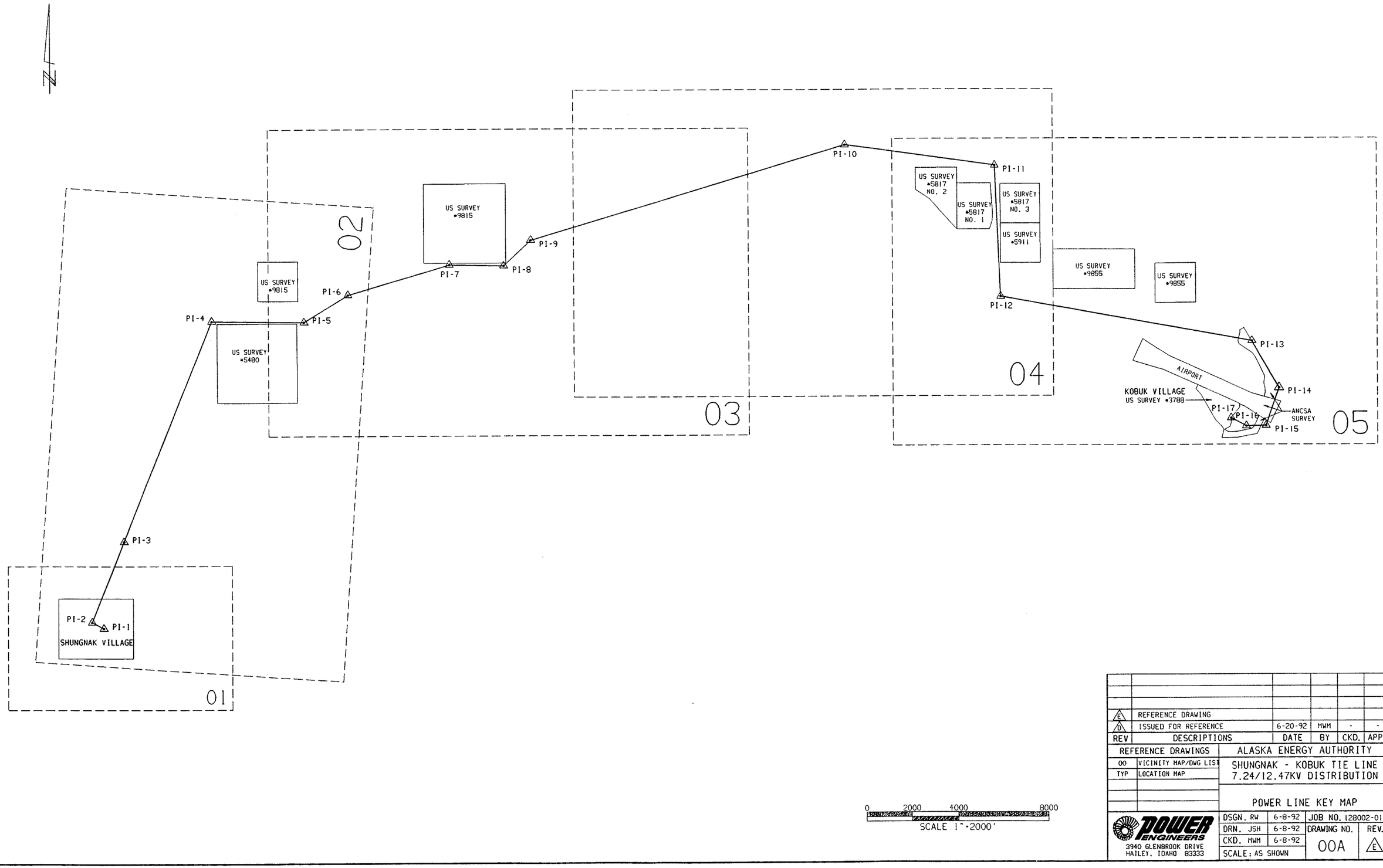
SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION

VICINITY MAP & LEGEND

POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. MWM	9-3-91	JOB NO. 126002-01	
DRN. JSH	9-3-91	DRAWING NO.	REV.
CKD. MWM	6-20-92	00	E
SCALE: NONE			

00.shn.pro



REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
E	REFERENCE DRAWING				
D	ISSUED FOR REFERENCE	6-20-92	MWM	-	-

REFERENCE DRAWINGS	
00	VICINITY MAP/DWG LIST
TYP	LOCATION MAP

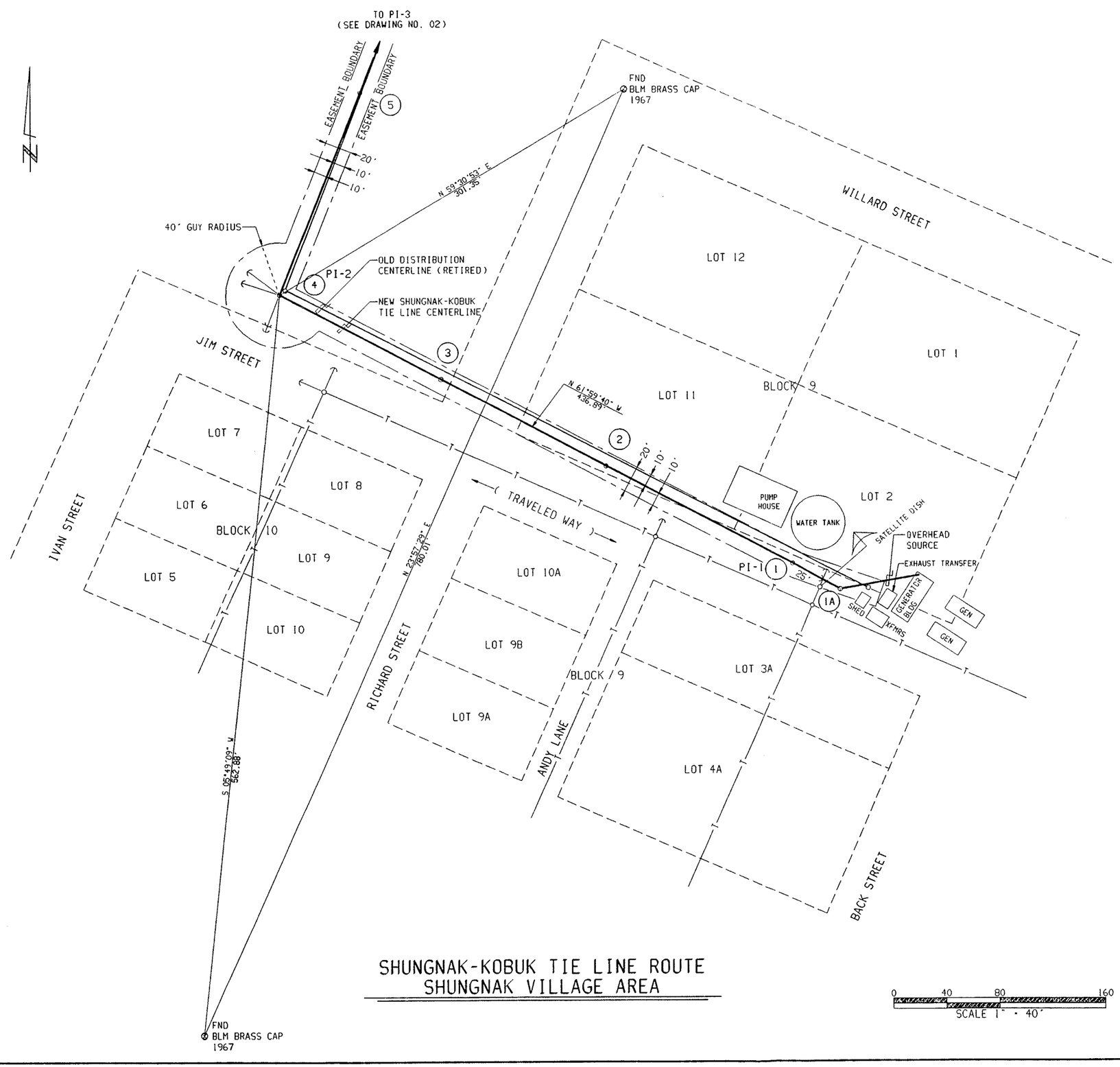
ALASKA ENERGY AUTHORITY

SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION

POWER LINE KEY MAP

POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. RW	6-8-92	JOB NO. 128002-01	
DRN. JSH	6-8-92	DRAWING NO.	REV.
CKD. MWM	6-8-92	00A	E
SCALE: AS SHOWN			



SHUNGNAK-KOBUK TIE LINE ROUTE
SHUNGNAK VILLAGE AREA

LEGEND

PLAN

- POLE LOCATION (NEW POWER LINE)
- OLD POLE LOCATION (RETIRED POWER LINE)
- EXISTING COMMUNICATION LINE
- GUY AND ANCHOR
- PROPERTY LINE
- POWERLINE EASEMENT BOUNDARY
- (1) STRUCTURE NUMBER (NEW POWER LINE)

NOTES

1. SHUNGNAK-KOBUK TIE LINE POWERLINE EASEMENT WIDTH IS TWENTY (20) FEET WITH TEN (10) FEET EITHER SIDE OF CENTERLINE. PI-2, STRUCTURE #4, HAS A GUY EASEMENT RADIUS OF FORTY (40) FEET.
2. LOCATIONS OF BUILDINGS AND COMMUNICATIONS LINES ARE APPROXIMATE.
3. PROPERTY INFORMATION SHOWN IS COMPILED FROM VILLAGE PLAT MAPS.

REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
E	REFERENCE DRAWING				
D	ISSUED FOR REFERENCE	6-20-92	MWM	-	-
A	ISSUED FOR APPROVAL	-	-	-	-

REFERENCE DRAWINGS	
00A	KEY MAP
02	LOCATION MAP

ALASKA ENERGY AUTHORITY

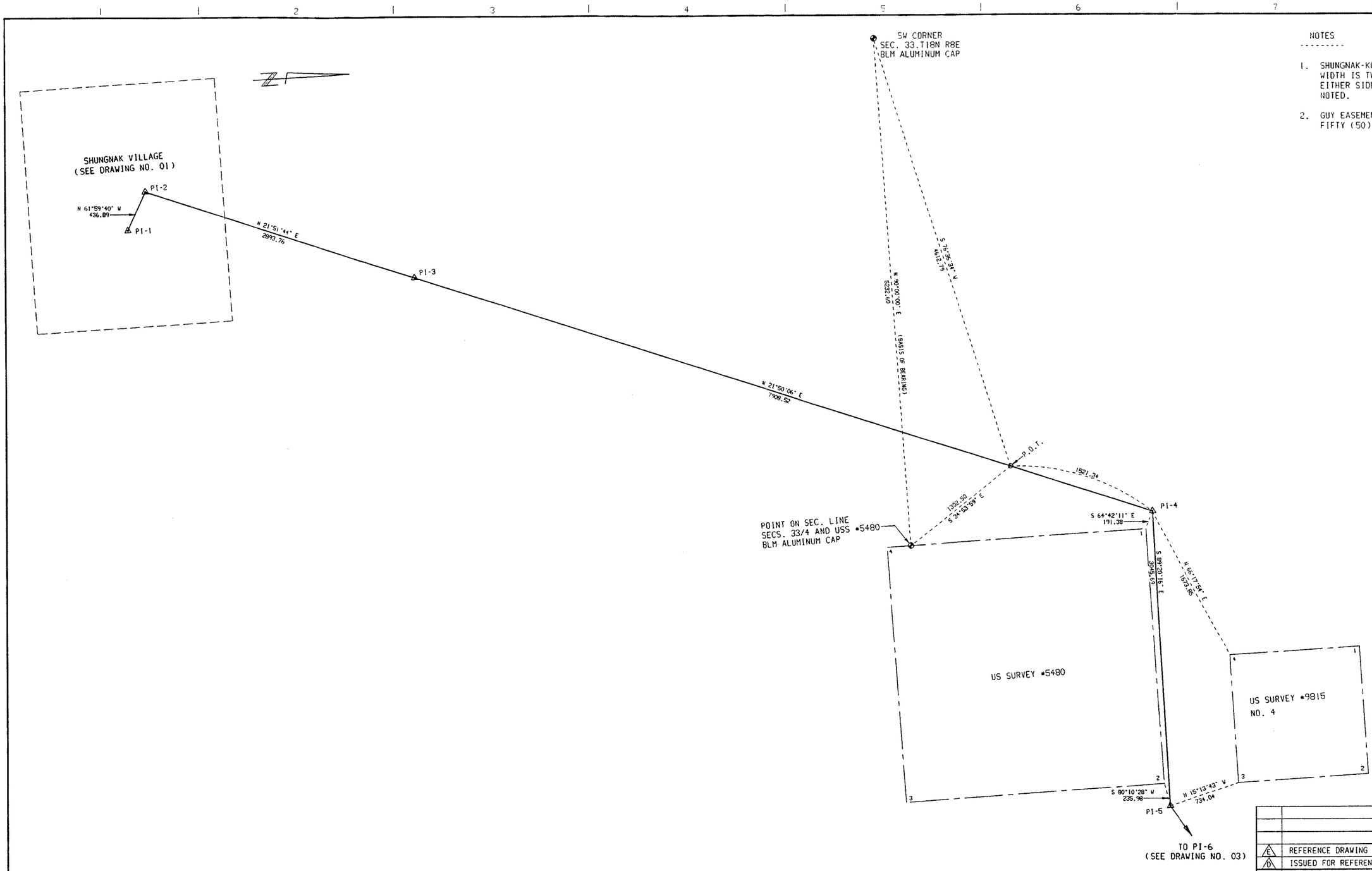
SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION

SHUNGNAK VILLAGE
POWER LINE LOCATION MAP

POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. MWM	10-3-91	JOB NO. 128002-02	
DRN. JSH	10-3-91	DRAWING NO. 01	REV. E
CKD. MWM	10-4-91		
SCALE: AS SHOWN			

01.shun



NOTES

1. SHUNGNAK-KOBUK TIE LINE POWERLINE EASEMENT WIDTH IS TWENTY (20) FEET WITH TEN (10) FEET EITHER SIDE OF CENTERLINE. UNLESS OTHERWISE NOTED.
2. GUY EASEMENT RADIUS AT PI LOCATIONS IS FIFTY (50) FEET. UNLESS OTHERWISE NOTED.

REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
E	REFERENCE DRAWING				
D	ISSUED FOR REFERENCE	6-20-92	MWM	-	-

REFERENCE DRAWINGS	
00A	KEY MAP
01	LOCATION MAP
03	LOCATION MAP

ALASKA ENERGY AUTHORITY

SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION

POWER LINE LOCATION MAP

POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. RW	6-8-92	JOB NO. 128002-02
DRN. JSH	6-8-92	DRAWING NO. 02
CKD. MWM	6-8-92	REV. E
SCALE: AS SHOWN		

02.shun

NOTES

1. SHUNGNAK-KOBUK TIE LINE POWERLINE EASEMENT WIDTH IS TWENTY (20) FEET WITH TEN (10) FEET EITHER SIDE OF CENTERLINE. UNLESS OTHERWISE NOTED.
2. GUY EASEMENT RADIUS AT PI LOCATIONS IS FIFTY (50) FEET, UNLESS OTHERWISE NOTED.

SEE DRAWING NO. 02
FOR BASIS OF BEARING

US SURVEY • 9815
NO. 2 AND 3

US SURVEY •9815
NO. 4

US SURVEY •5480

TO PI-4
(SEE DRAWING NO. 02)

PI-5

S 80°10'28" W
235.98

N 15°19'43" W
724.04

N 59°31'47" E
1725.39

PI-6

N 73°12'27" E
3972.66

PI-7

N 86°11'00" W
833.21

S 88°45'39" E
1799.86

PI-8

N 34°18'58" E
117.78

N 45°23'36" E
1268.80

PI-9

N 73°10'15" E
10879.13

TO PI-10
(SEE DRAWING NO. 04)

0 500 1000 2000
SCALE 1"=500'

REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
E	REFERENCE DRAWING				
D	ISSUED FOR REFERENCE	6-20-92	MWM	-	-

REFERENCE DRAWINGS	
00A	KEY MAP
02	LOCATION MAP
04	LOCATION MAP

ALASKA ENERGY AUTHORITY

SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION

POWER LINE LOCATION MAP

POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

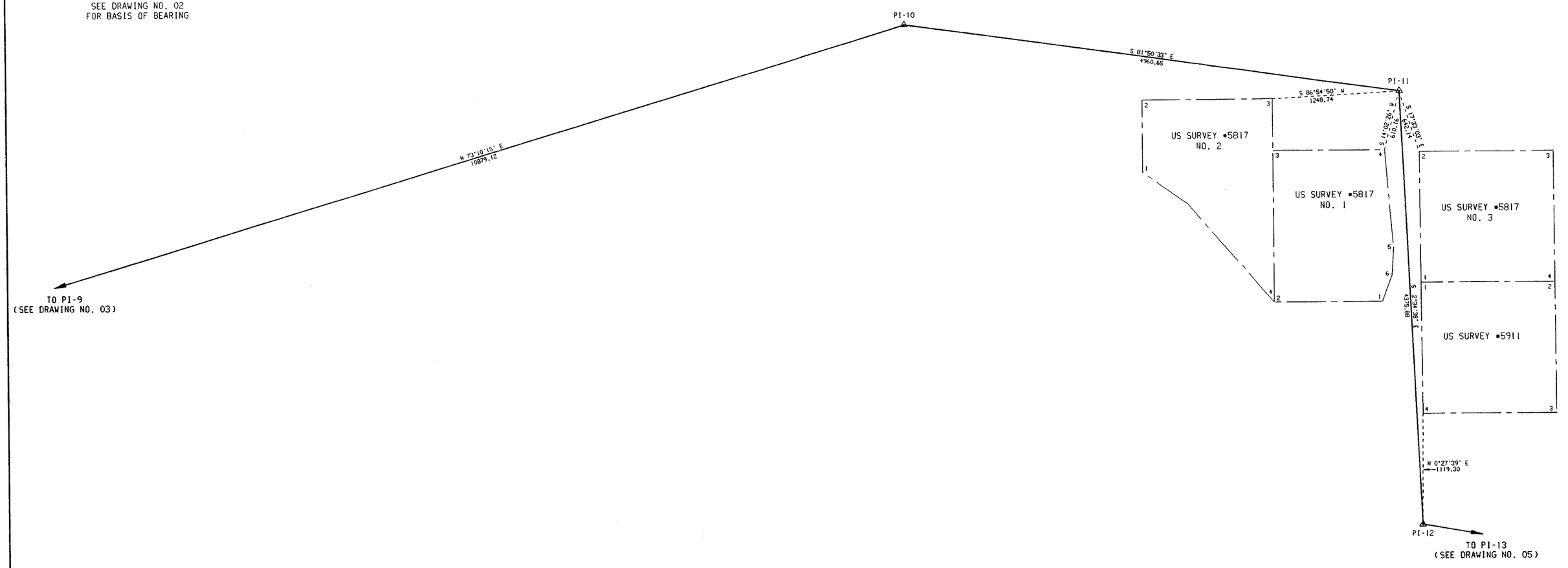
DSGN. RW	6-8-92	JOB NO. 128002-02	
DRN. JSH	6-8-92	DRAWING NO. 03	REV. E
CKD. MWM	6-8-92		
SCALE: AS SHOWN			

03.shm

NOTES

1. SHUNGNAK-KOBUK TIE LINE POWERLINE EASEMENT WIDTH IS TWENTY (20) FEET WITH TEN (10) FEET EITHER SIDE OF CENTERLINE. UNLESS OTHERWISE NOTED.
2. GUY EASEMENT RADIUS AT PI LOCATIONS IS FIFTY (50) FEET. UNLESS OTHERWISE NOTED.

SEE DRAWING NO. 02
FOR BASIS OF BEARING



0 500 1000 2000
SCALE 1"=500'

REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
E	REFERENCE DRAWING				
D	ISSUED FOR REFERENCE	6-20-92	MWM	-	-

REFERENCE DRAWINGS	
00A	KEY MAP
03	LOCATION MAP
05	LOCATION MAP

ALASKA ENERGY AUTHORITY

SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION

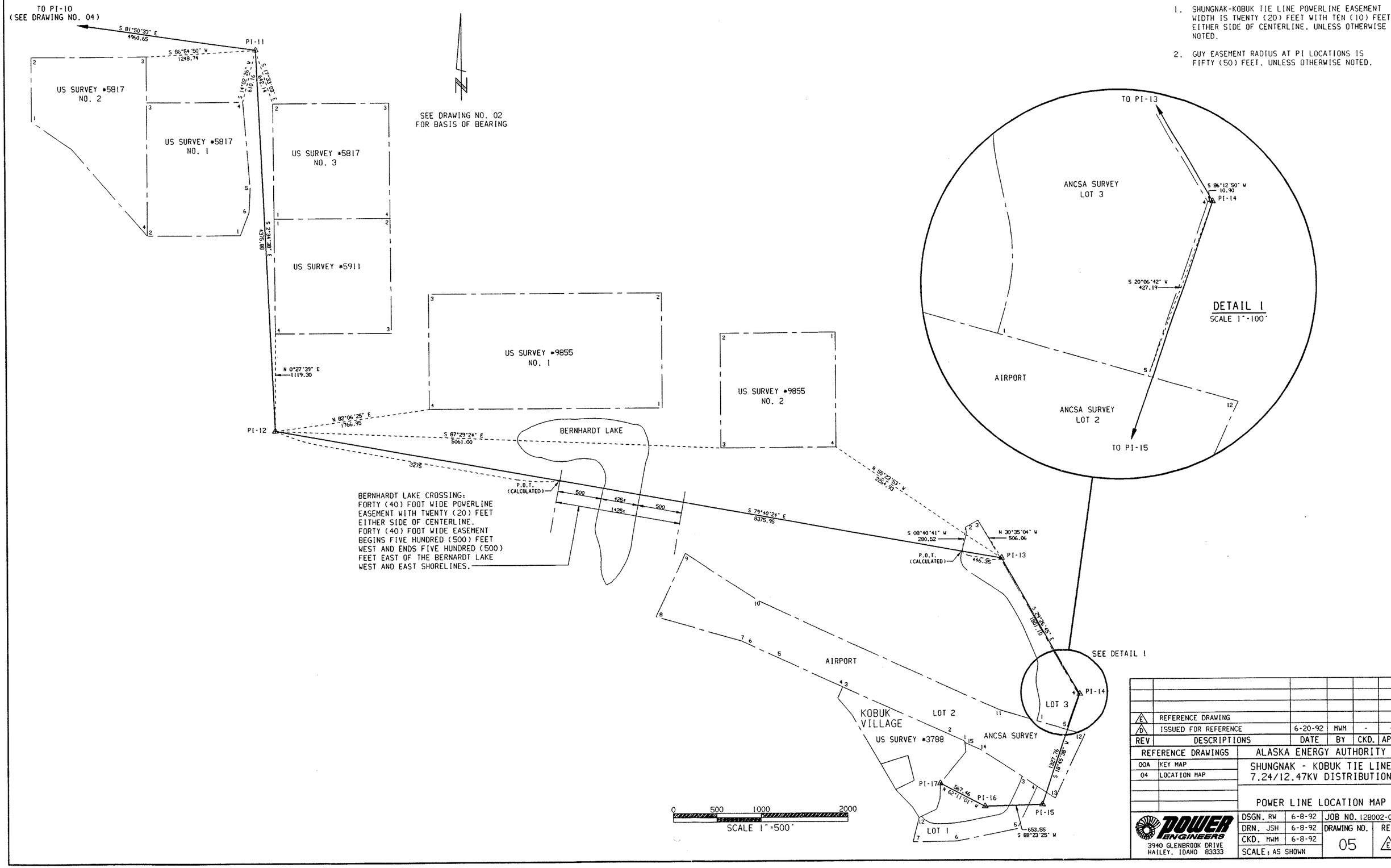
POWER LINE LOCATION MAP

POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. RW	6-8-92	JOB NO. 128002-02	
DRN. JSH	6-8-92	DRAWING NO.	REV.
CKD. MWM	6-8-92	04	E
SCALE: AS SHOWN			

NOTES

1. SHUNGNAK-KOBUK TIE LINE POWERLINE EASEMENT WIDTH IS TWENTY (20) FEET WITH TEN (10) FEET EITHER SIDE OF CENTERLINE. UNLESS OTHERWISE NOTED.
2. GUY EASEMENT RADIUS AT PI LOCATIONS IS FIFTY (50) FEET. UNLESS OTHERWISE NOTED.



REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
E	REFERENCE DRAWING				
D	ISSUED FOR REFERENCE	6-20-92	MWM	-	-

REFERENCE DRAWINGS	
00A	KEY MAP
04	LOCATION MAP

ALASKA ENERGY AUTHORITY

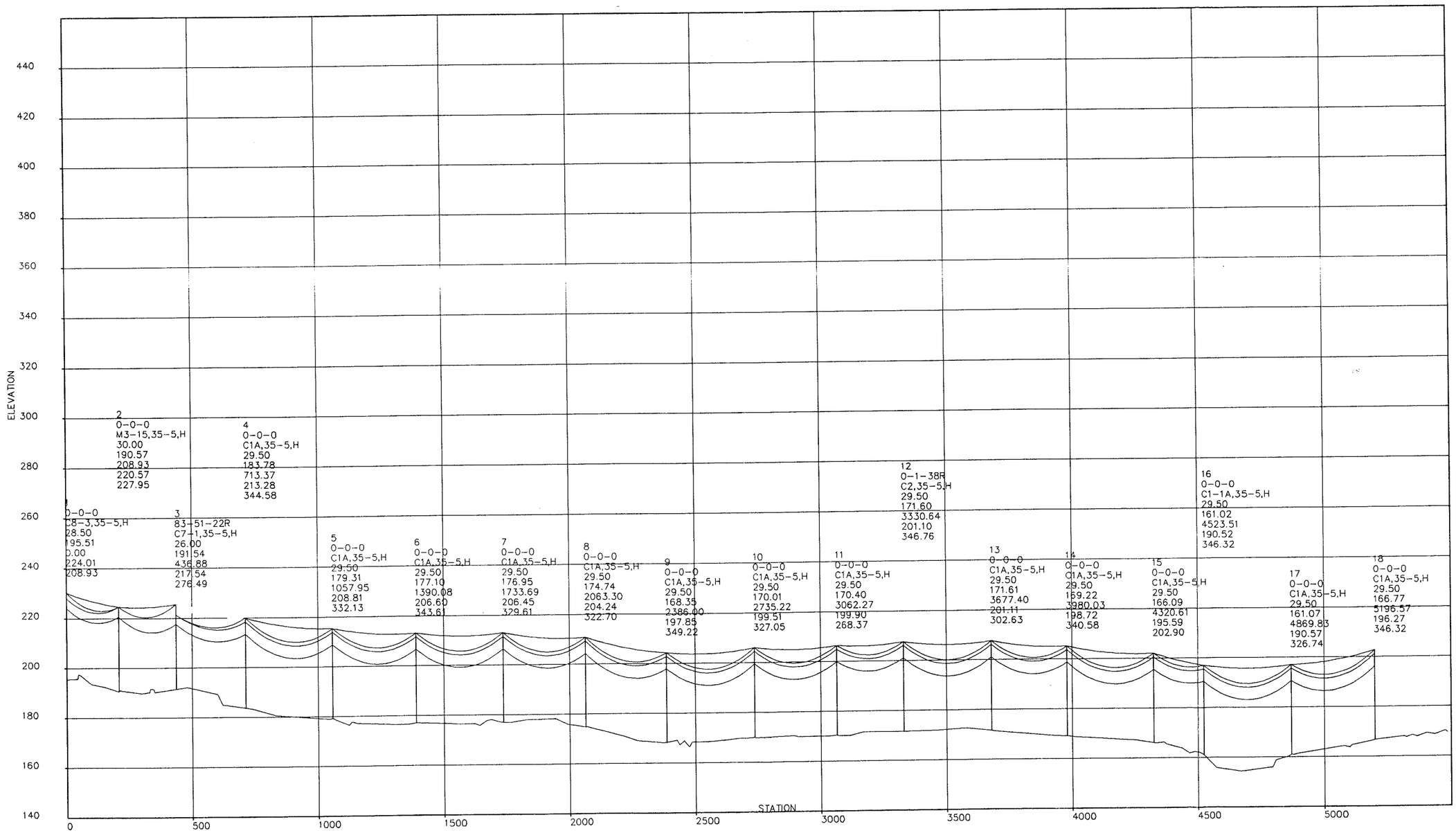
SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION

POWER LINE LOCATION MAP

POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. RW	6-8-92	JOB NO. 128002-02	
DRN. JSH	6-8-92	DRAWING NO. 05	REV. E
CKD. MWM	6-8-92		
SCALE: AS SHOWN			

05.shun



POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

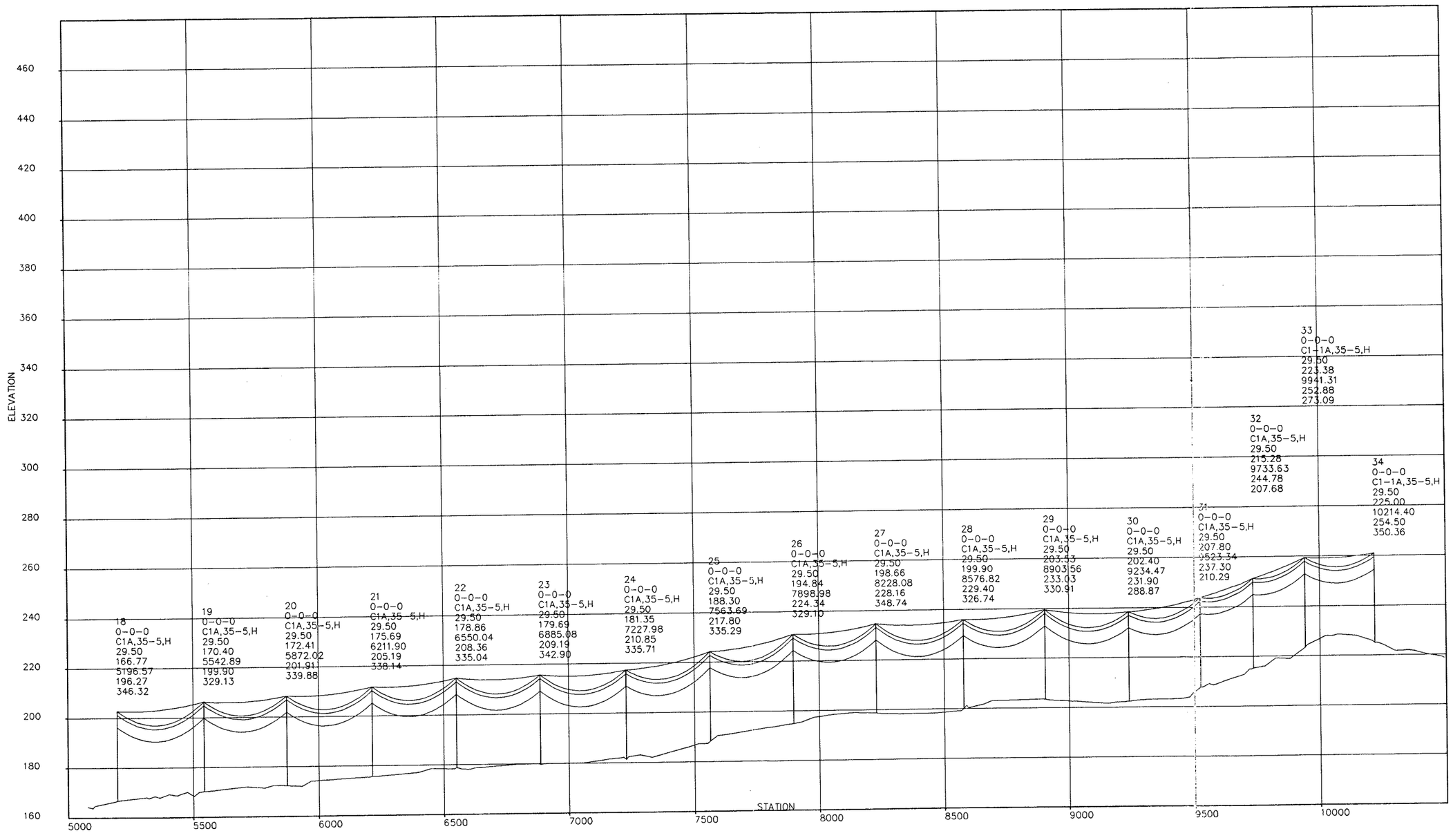
Wed Nov 20 16:31:39 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

Sheet 1 of 11

ALASKA ENERGY AUTHORTITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877



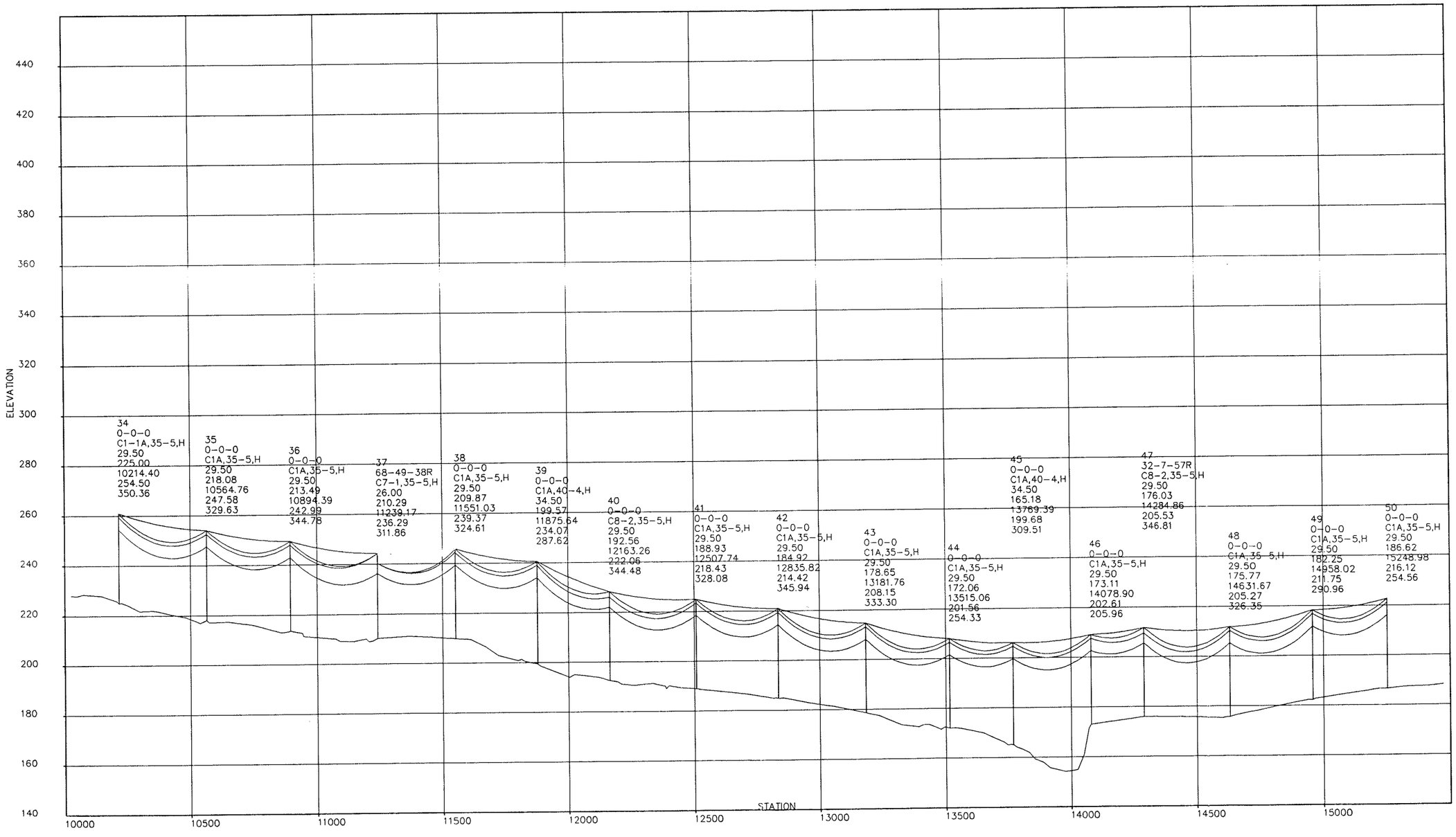
POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

Wed Nov 20 16:31:47 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

ALASKA ENERGY AUTHORITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877



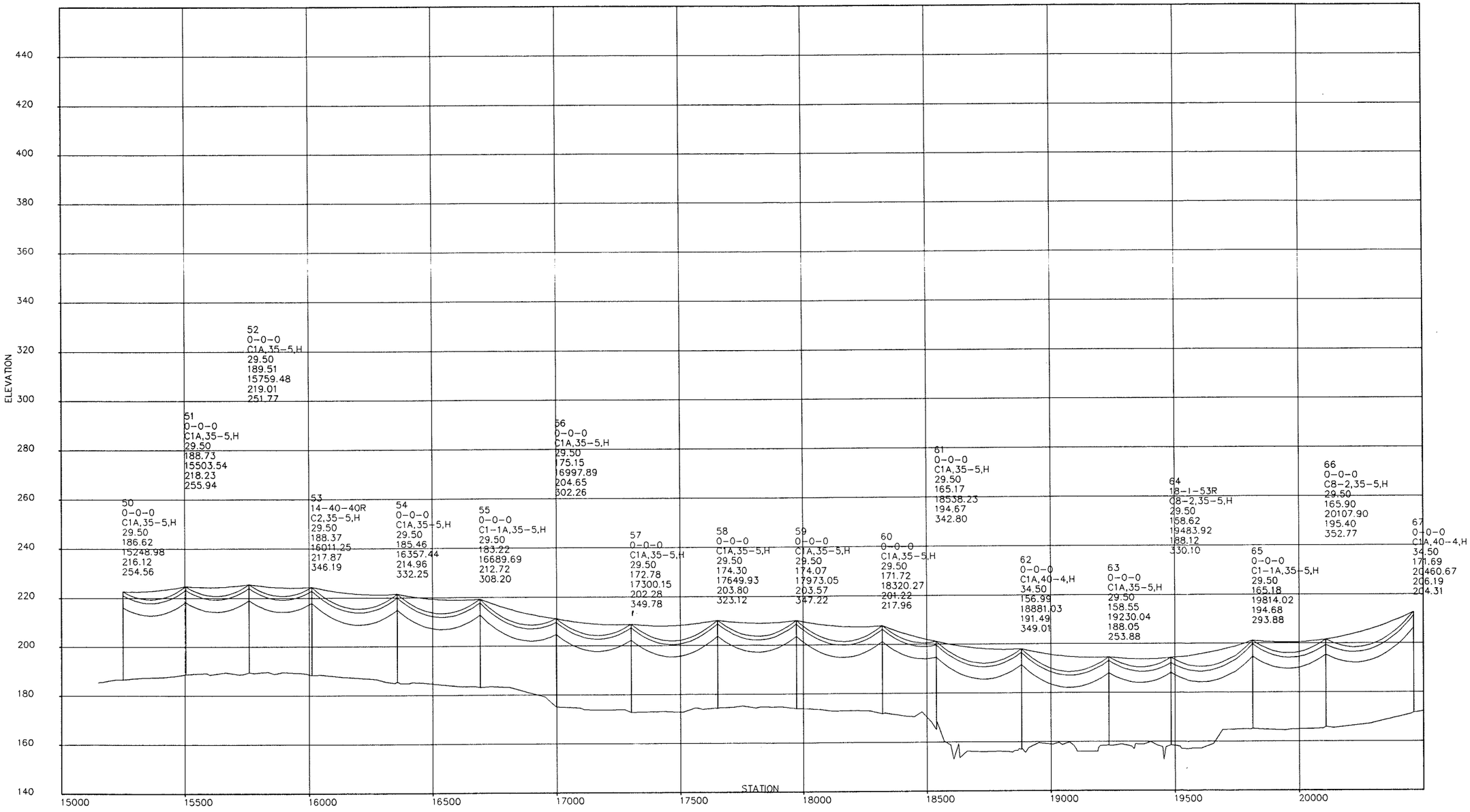
POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

Wed Nov 20 16:31:55 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

ALASKA ENERGY AUTHORTITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877



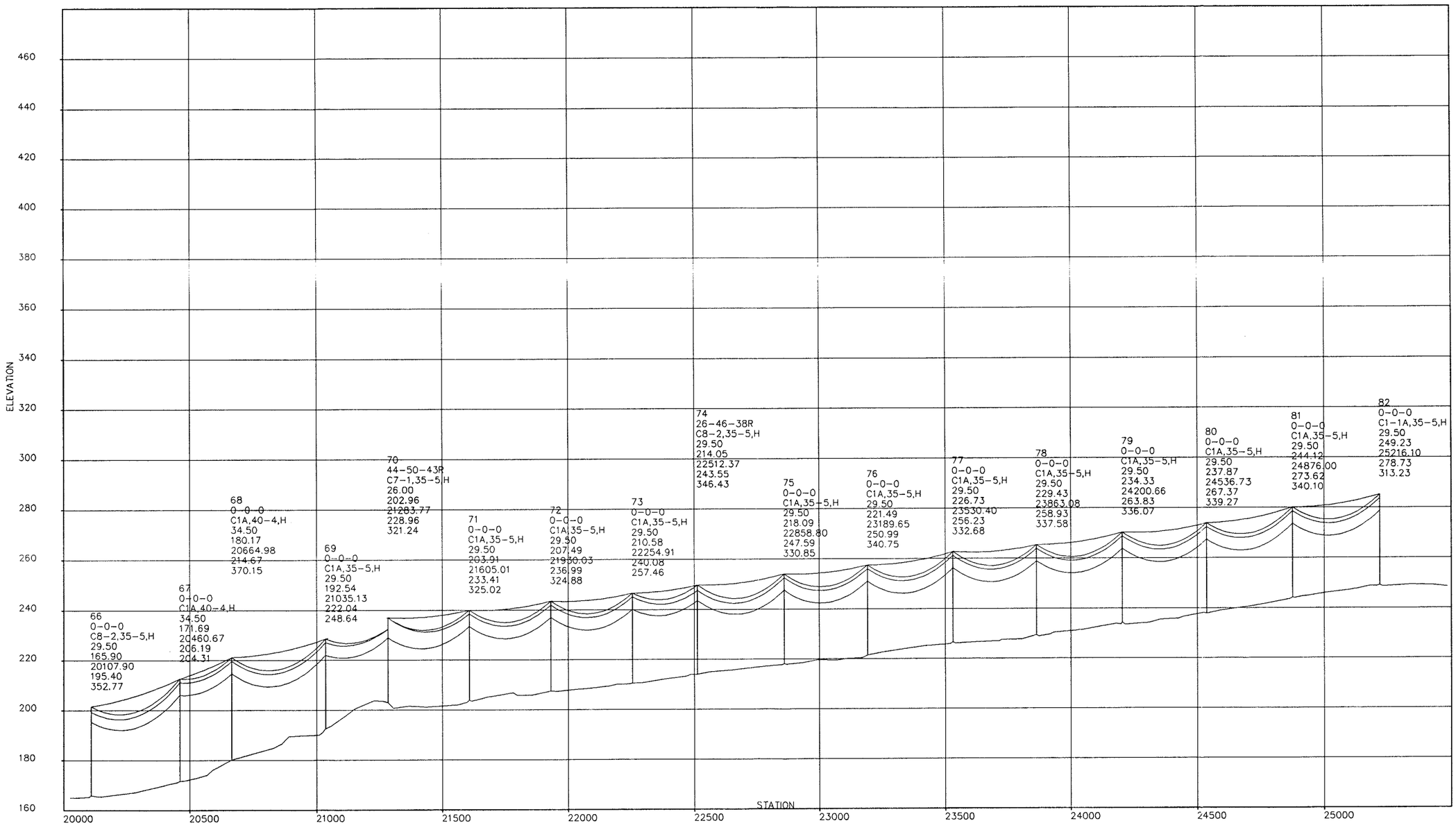
POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

Wed Nov 20 16:32:03 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

ALASKA ENERGY AUTHORITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877



POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

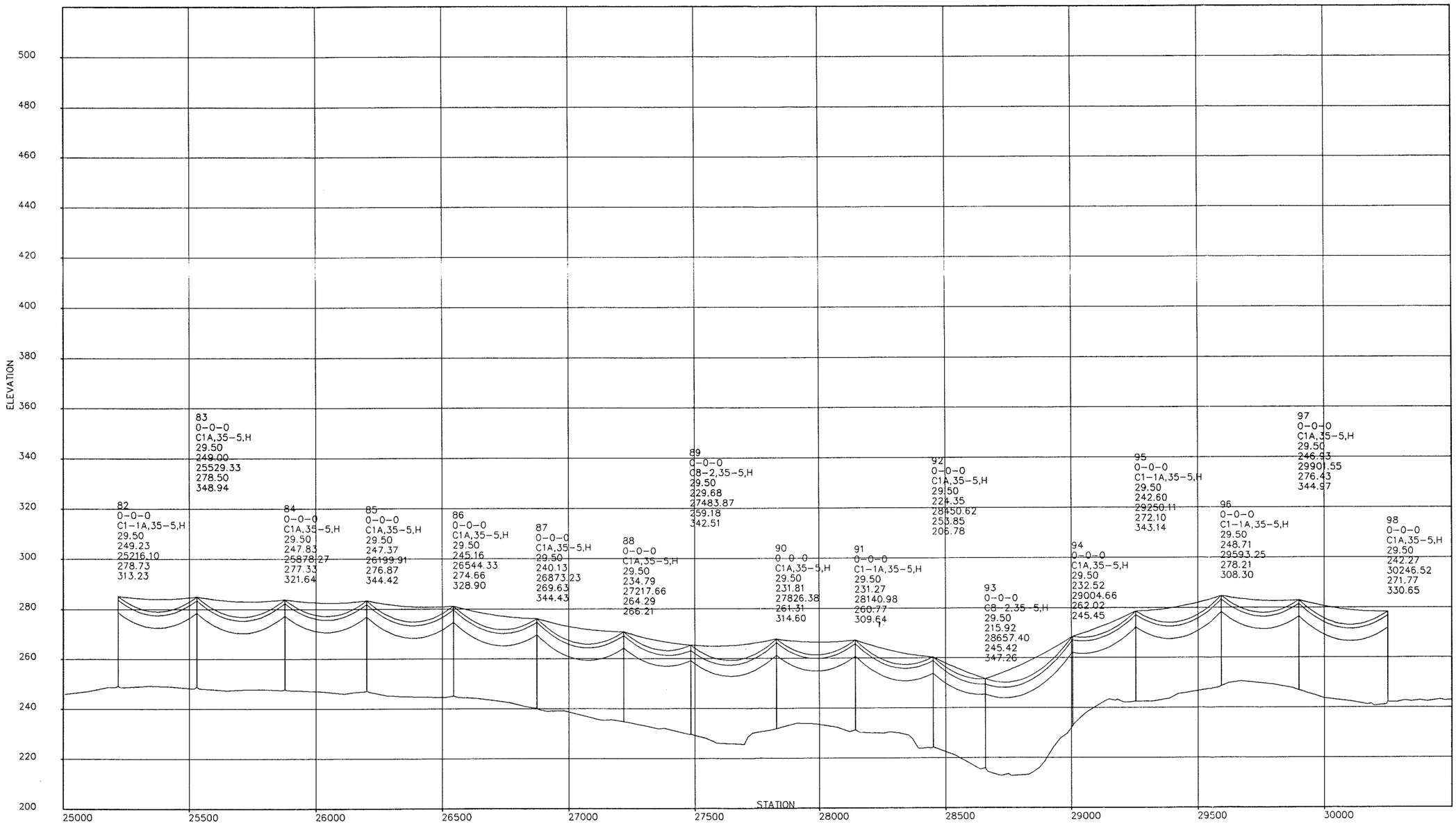
Wed Nov 20 16:32:11 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

Sheet 5 of 11

ALASKA ENERGY AUTHORITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877



POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

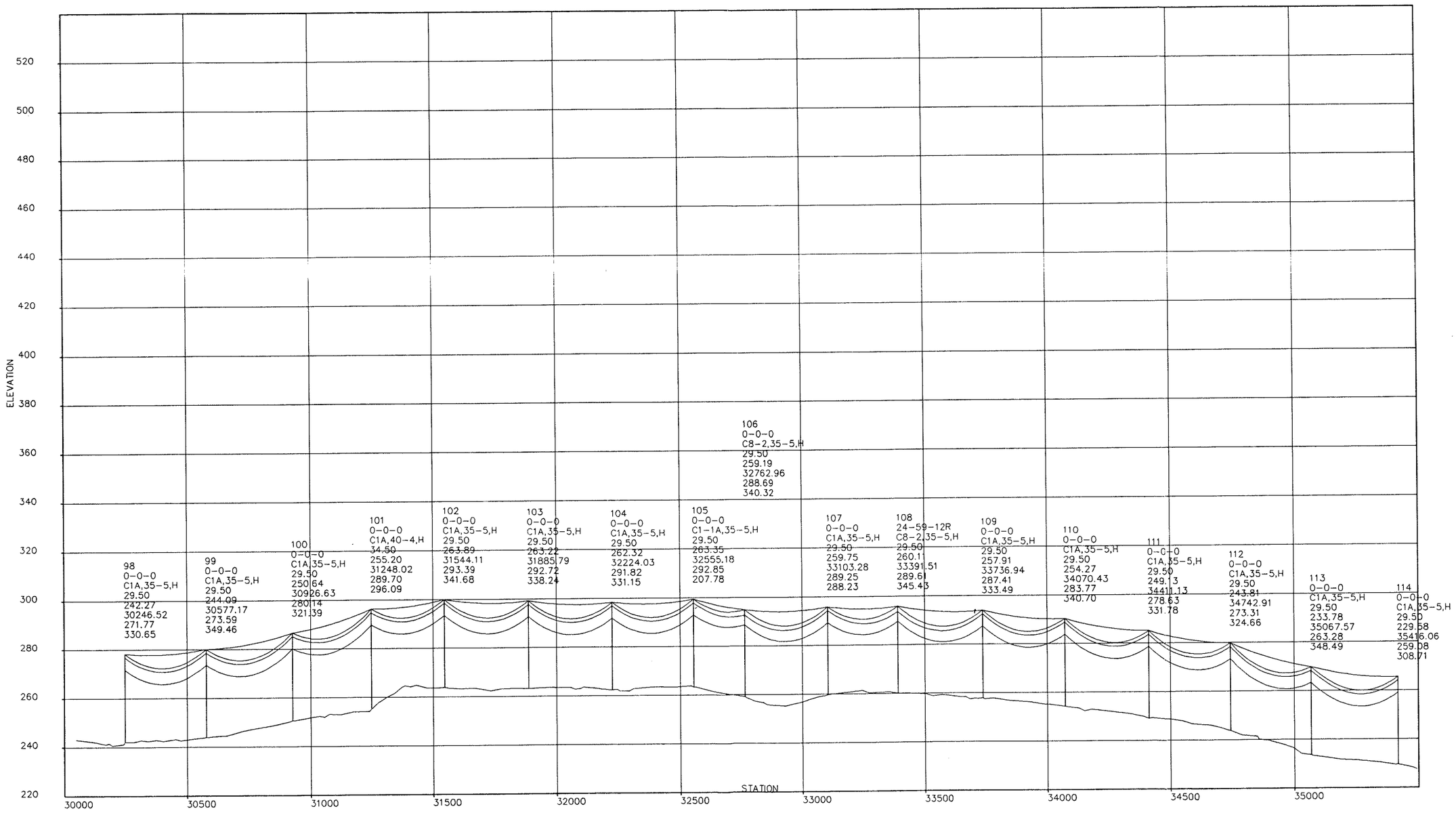
Wed Nov 20 16:32:19 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

Sheet 6 of 11

ALASKA ENERGY AUTHORTITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877



POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

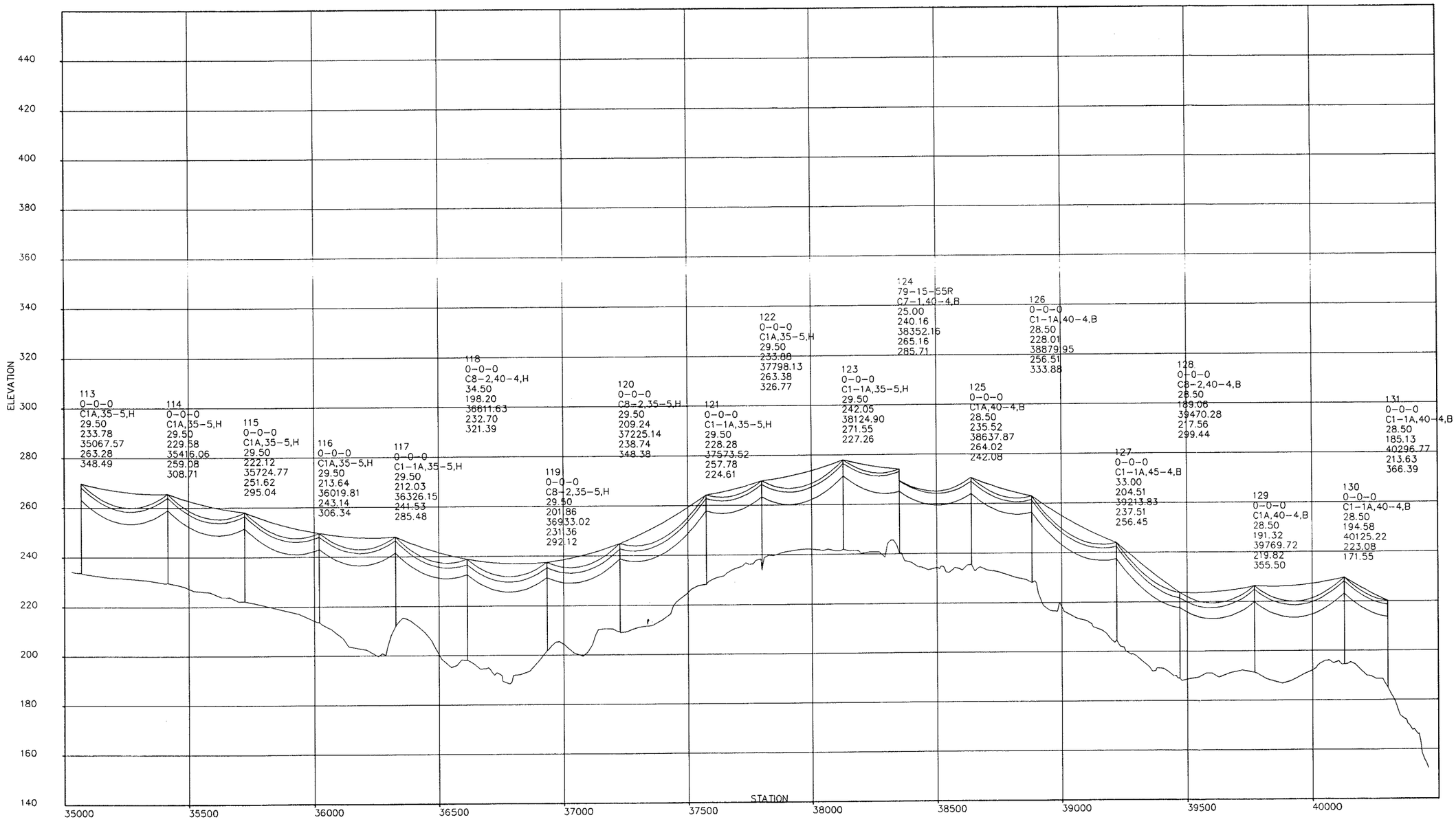
Wed Nov 20 16:32:28 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

Sheet 7 of 11

ALASKA ENERGY AUTHORTITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877



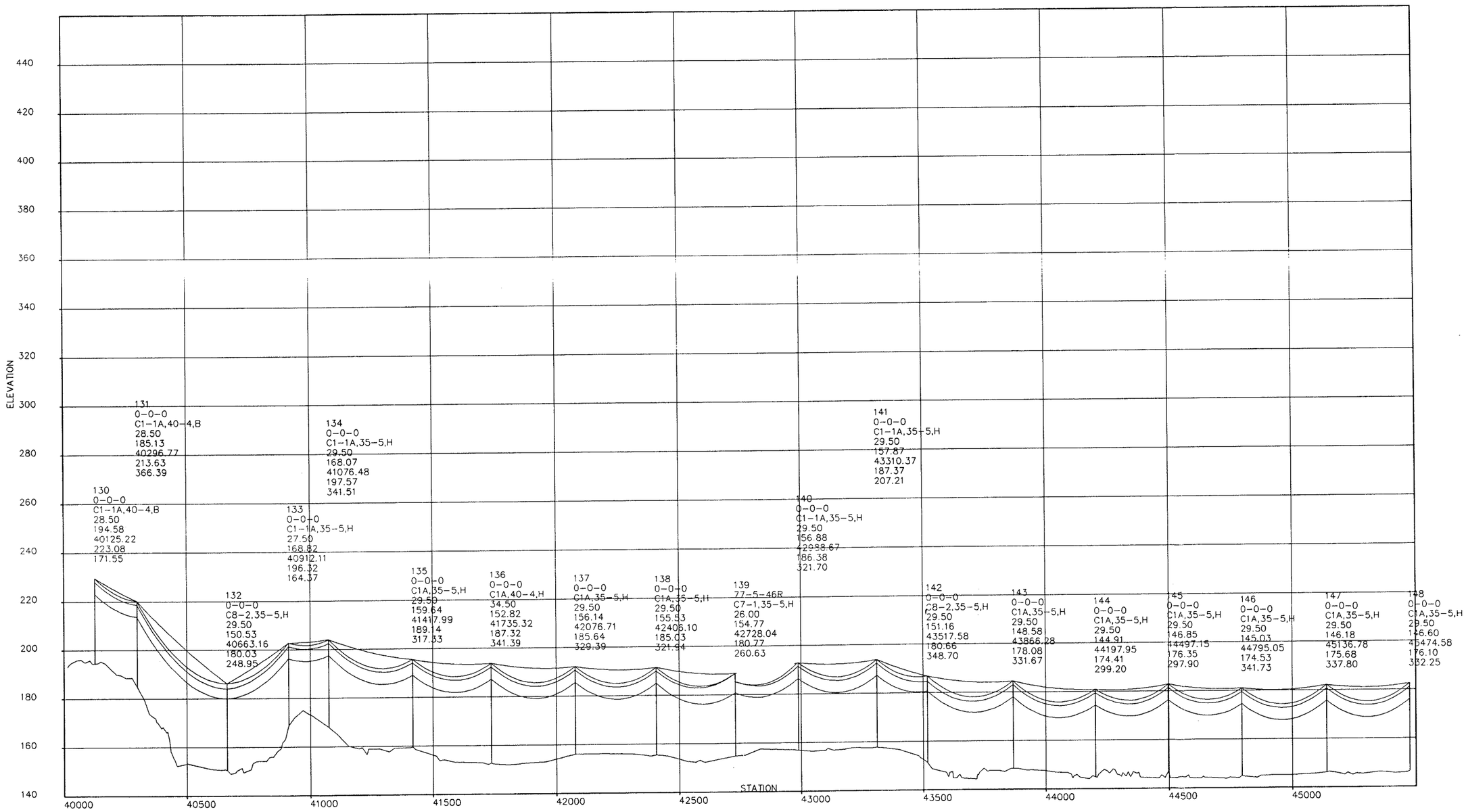
POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

Wed Nov 20 16:32:36 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

ALASKA ENERGY AUTHORTITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877



POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

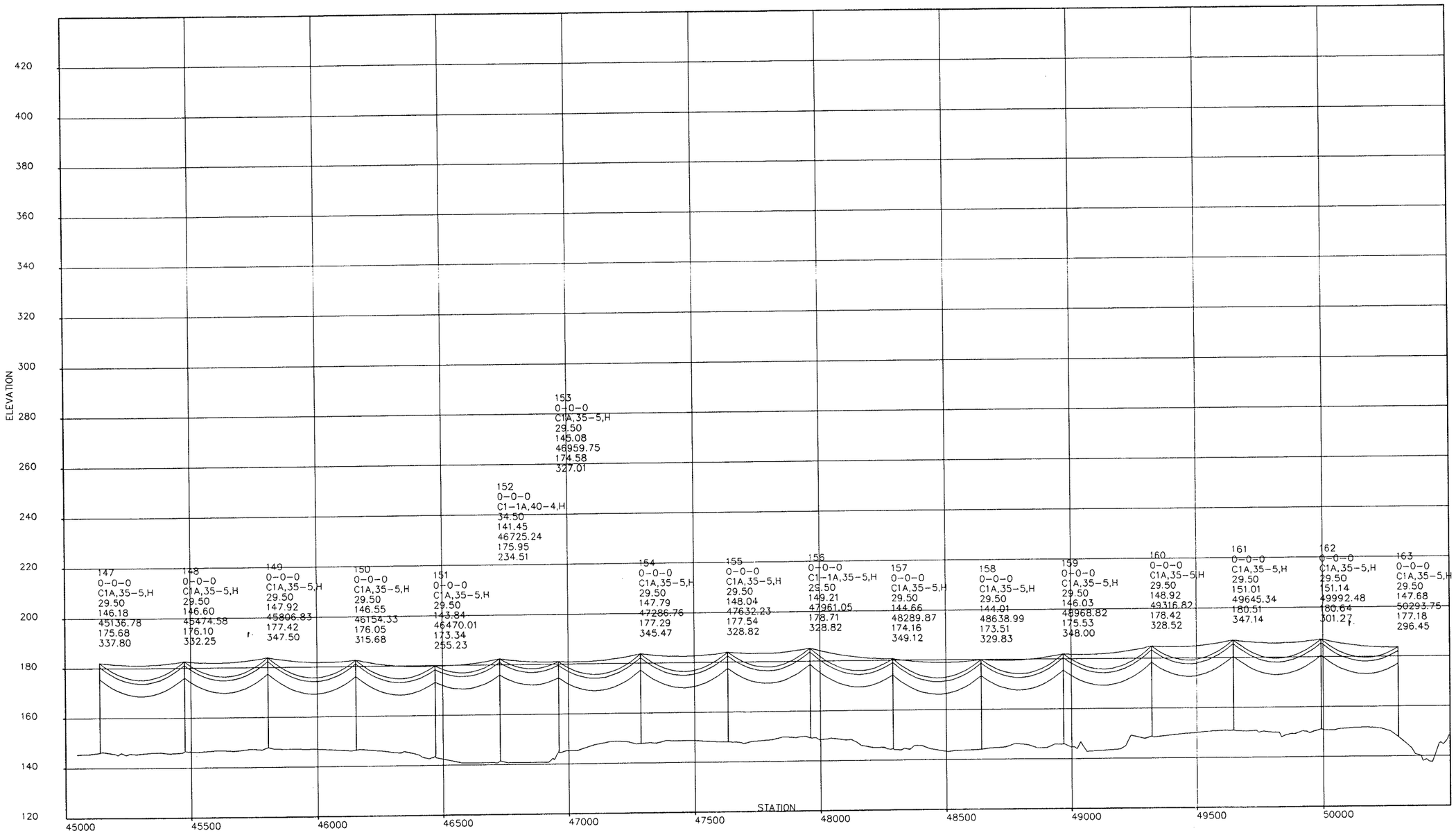
Wed Nov 20 16:32:46 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

Sheet 9 of 11

ALASKA ENERGY AUTHORITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877



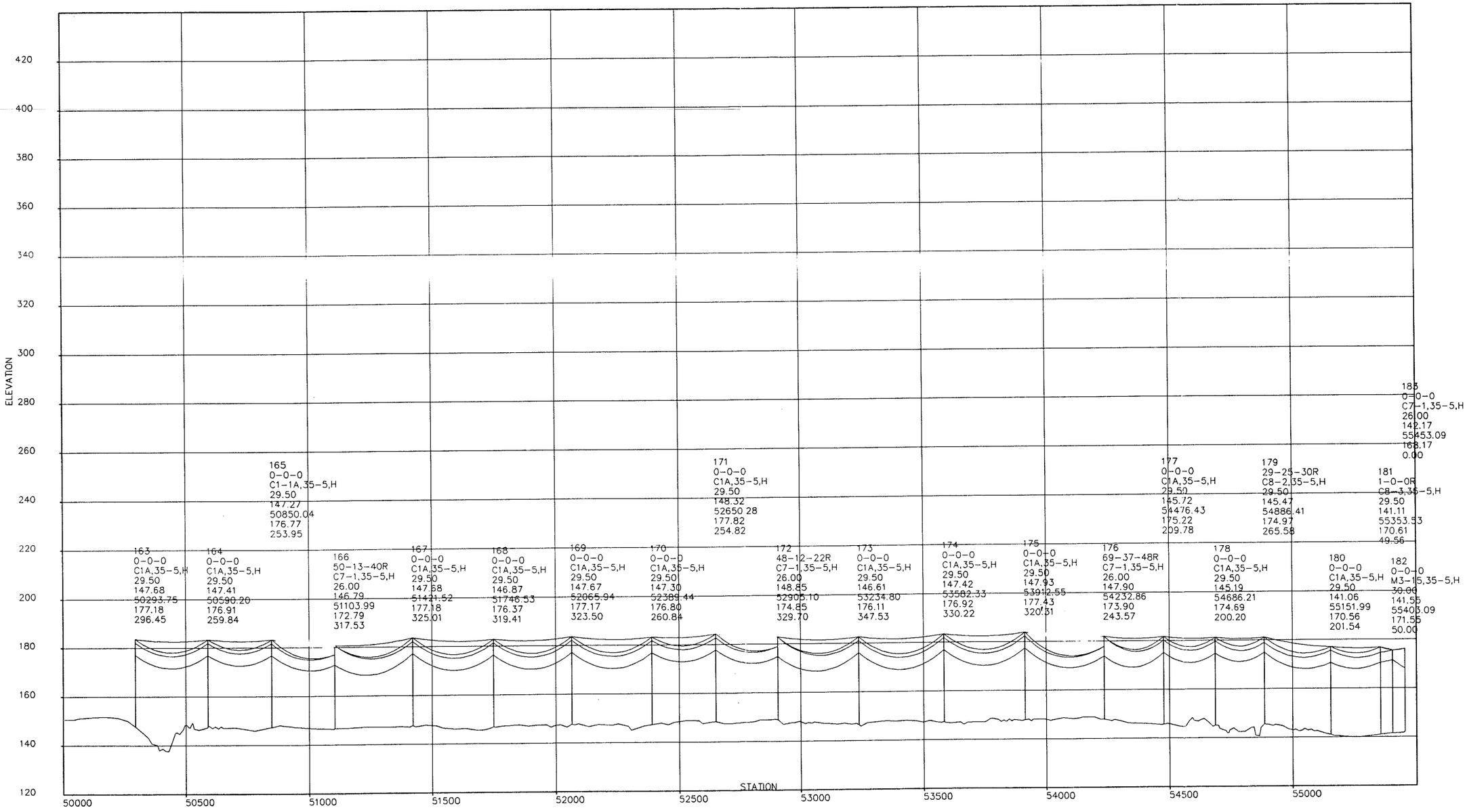
POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

Wed Nov 20 16:32:55 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

ALASKA ENERGY AUTHORITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877



POWER ENGINEERS INC.
P.O. BOX 1066
HAILEY, IDAHO 83333
(208)788-3456

Wed Nov 20 16:33:03 1991
Scale:
Vertical 1" = 20'
Horizontal 1" = 200'

SHUNGNAK - KOBUK TIE LINE

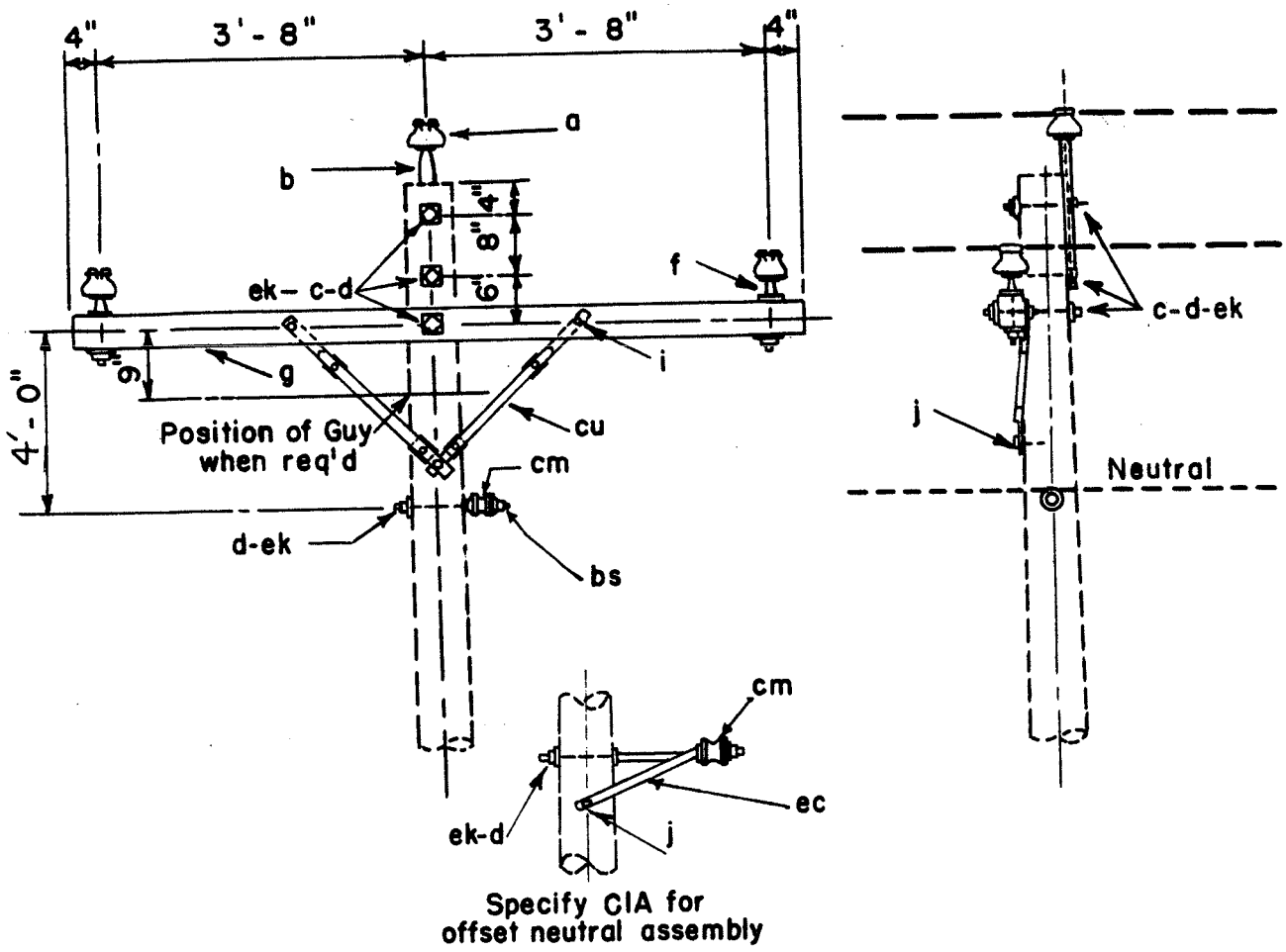
7.2/12.5KV DISTRIBUTION LINE
PROFILE DRAWING

Sheet 11 of 11

ALASKA ENERGY AUTHORTITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869
(907)561-7877

PART VI

CONSTRUCTION DETAIL DRAWINGS



Specify CIA for offset neutral assembly

ITEM	NO.	MATERIAL
a	3	Insulator, pin type
b	1	Pin, pole top, 20"
c	3	Bolt, machine, 5/8" x req'd length
d	5	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole
f	2	Pin, crossarm, steel, 5/8" x 10 3/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'-0"
ek		Locknuts, as required
cm	1	Spool insulator

ITEM	NO.	MATERIAL
cu	2	Brace, wood, 28"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4" (CI only)
bs	1	Bolt, single upset, (CI only)
ec	1	Bracket, offset neutral (CIA only)
j	3	Screw, lag, 1/2" x 4" (CIA only)

DESIGN LIMITS

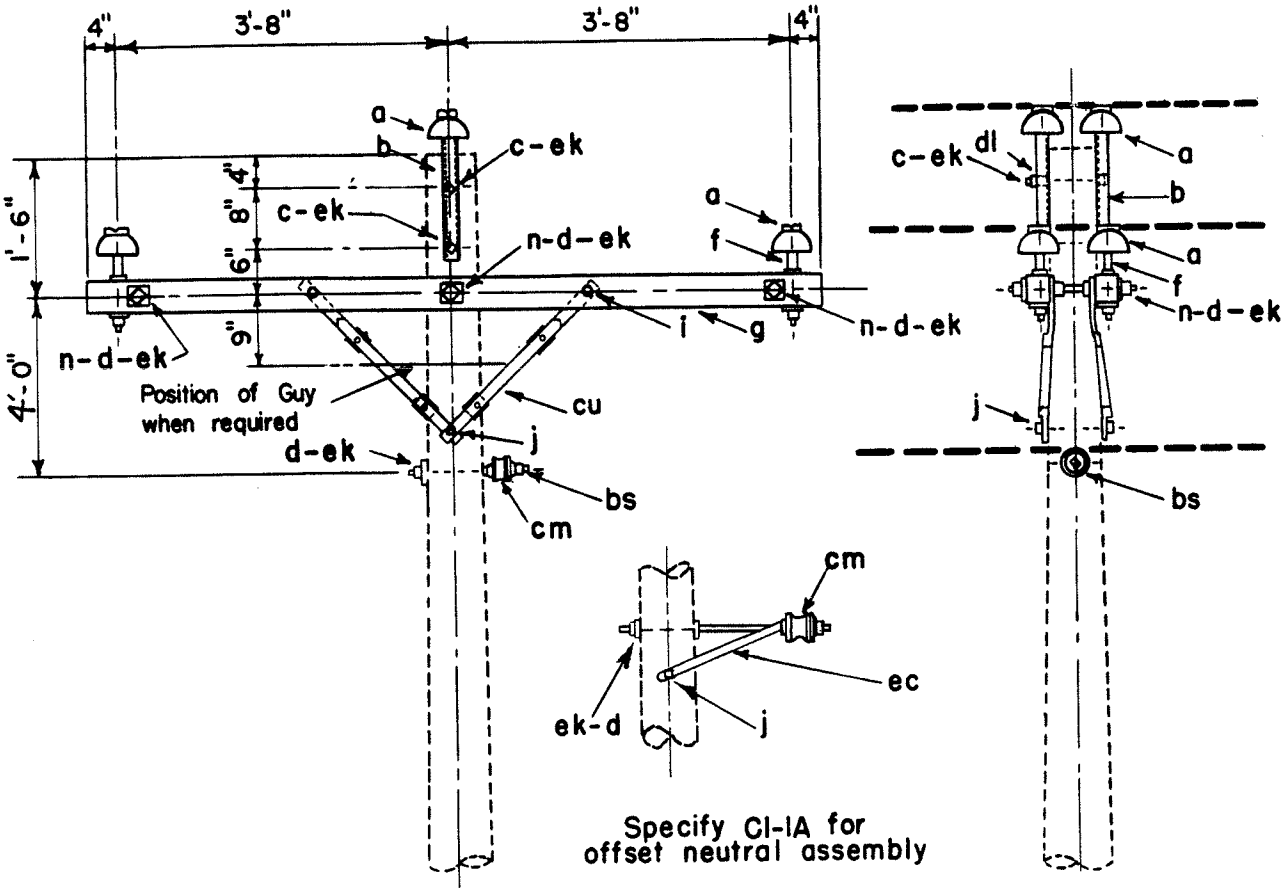
Max. transverse load: 500 lbs. per conductor

Max. line angle within load limits: 5°

12.5 / 7.2 kV
3-PHASE CROSSARM CONSTRUCTION
SINGLE PRIMARY SUPPORT

Apr., 1983

CI, CIA



Specify CI-IA for offset neutral assembly

ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
a	6	Insulator, pin type	i	4	Bolt, carriage, 3/8" x 4 1/2"
b	2	Pin, pole top, 20"	j	2	Screw, lag, 1/2" x 4" (CI-I only)
c	2	Bolt, machine, 5/8" x req'd. length	n	3	Bolt, double arming, 5/8" x req'd. length
d	11	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole	bs	1	Bolt, single upset, (CI-I only)
f	4	Pin, crossarm, steel, 5/8" x 10 3/4"	dl	2	Pipe spacer, 3/4" dia. x 1 1/2"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"	ec	1	Bracket, offset neutral (CI-IA only)
cu	4	Brace, wood, 28"	j	4	Screw, lag, 1/2" x 4" (CI-IA only)
ek		Locknuts, as required	cm	1	Spool insulator

DESIGN LIMITS

Max. transverse load: 1000 lbs. per conductor

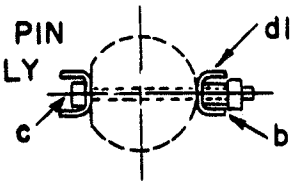
Max. line angle within load limits: 5°

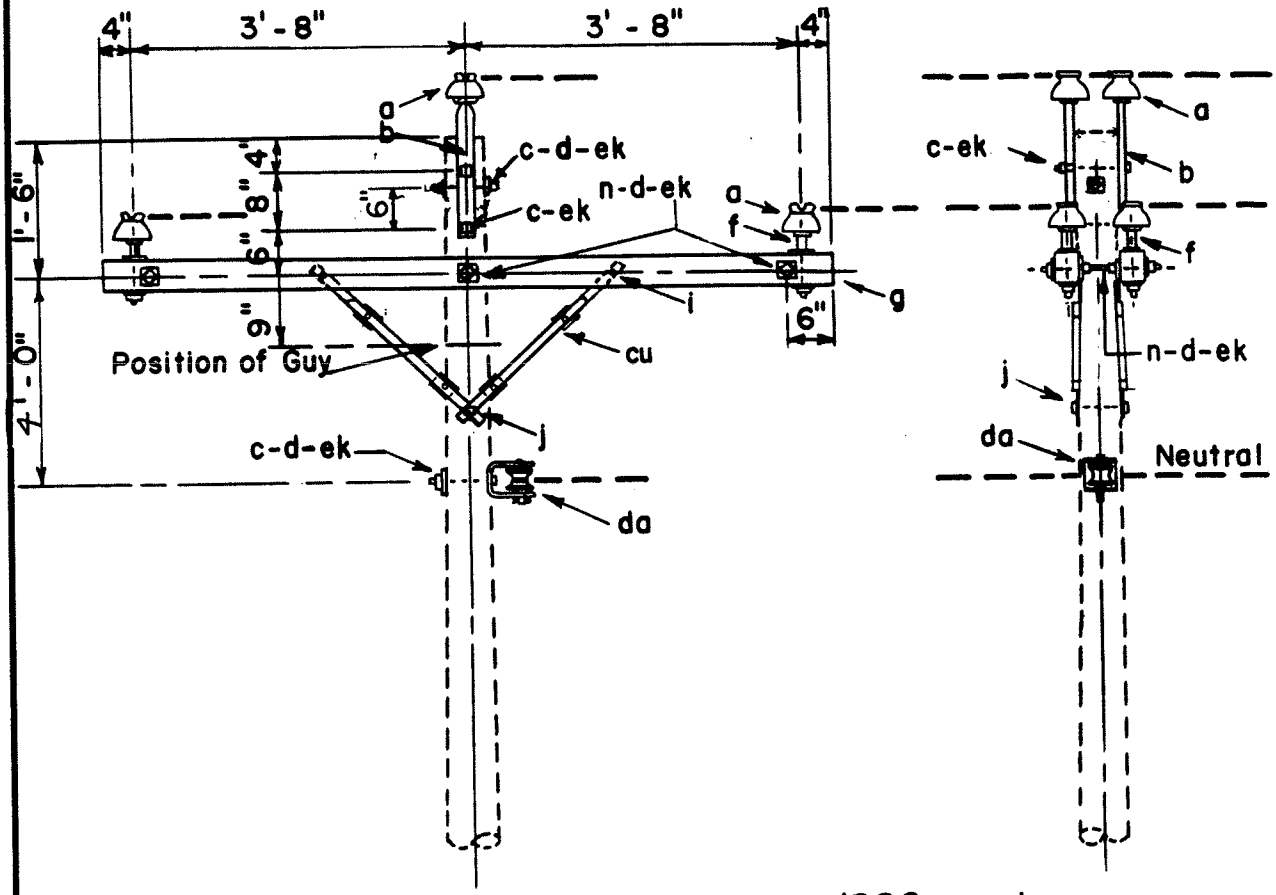
12.5/7.2 kV 3-PHASE CROSSARM CONSTRUCTION DOUBLE PRIMARY SUPPORT

Apr., 1983

CI-I, CI-IA

POLE TOP PIN ASSEMBLY





NOTE: When the transverse load is more than 1000 pounds, substitute C2-1 or C2-2 as required.

ITEM	NO.	MATERIAL		ITEM	NO.	MATERIAL	
a	6	Insulator, pin type		i	4	Bolt, carriage, 3/8" x 4 1/2"	
b	2	Pin, pole top, 20"		j	2	Screw, lag, 1/2" x 4"	
c	4	Bolt, machine, 5/8" x req'd length		n	3	Bolt, double arming, 5/8" x req'd l'gth	
d	13	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole		da	1	Bracket, insulated	
f	4	Pin, crossarm, steel, 5/8" x 10 3/4"		dl	2	Pipe, spacer, 3/4" dia. x 1 1/2"	
g	2	Crossarm, 3 5/8" x 4 5/8" x 8' - 0"		ek		Locknuts, as required	
cu	4	Brace, wood, 28"					

DESIGN LIMITS

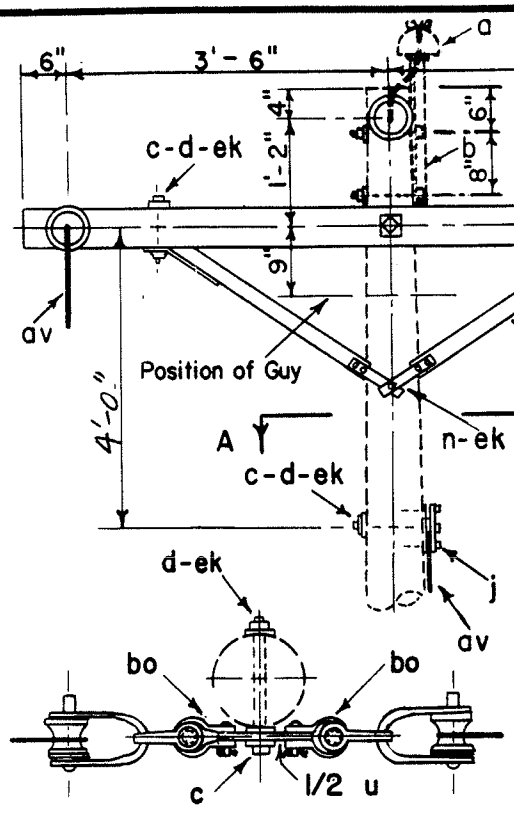
Max. transverse load: 1000 lbs. per conductor

Max. line angle within load limits: 20°

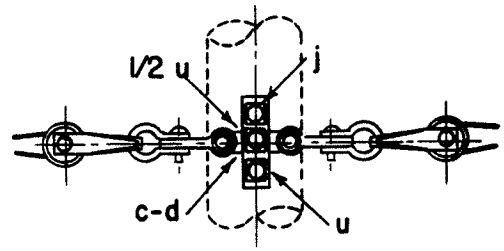
12.5/7.2 kV - 3 PHASE
CROSSARM CONSTR. DOUBLE PRIMARY SUPPORT

Apr., 1983

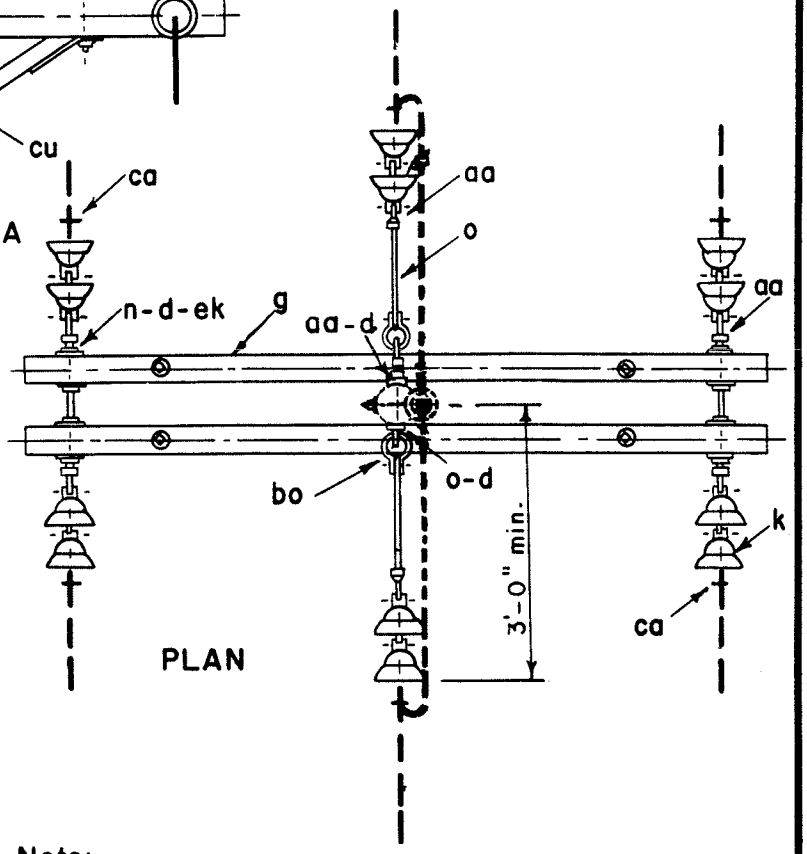
C 2



SECTION A-A



ELEVATION



PLAN

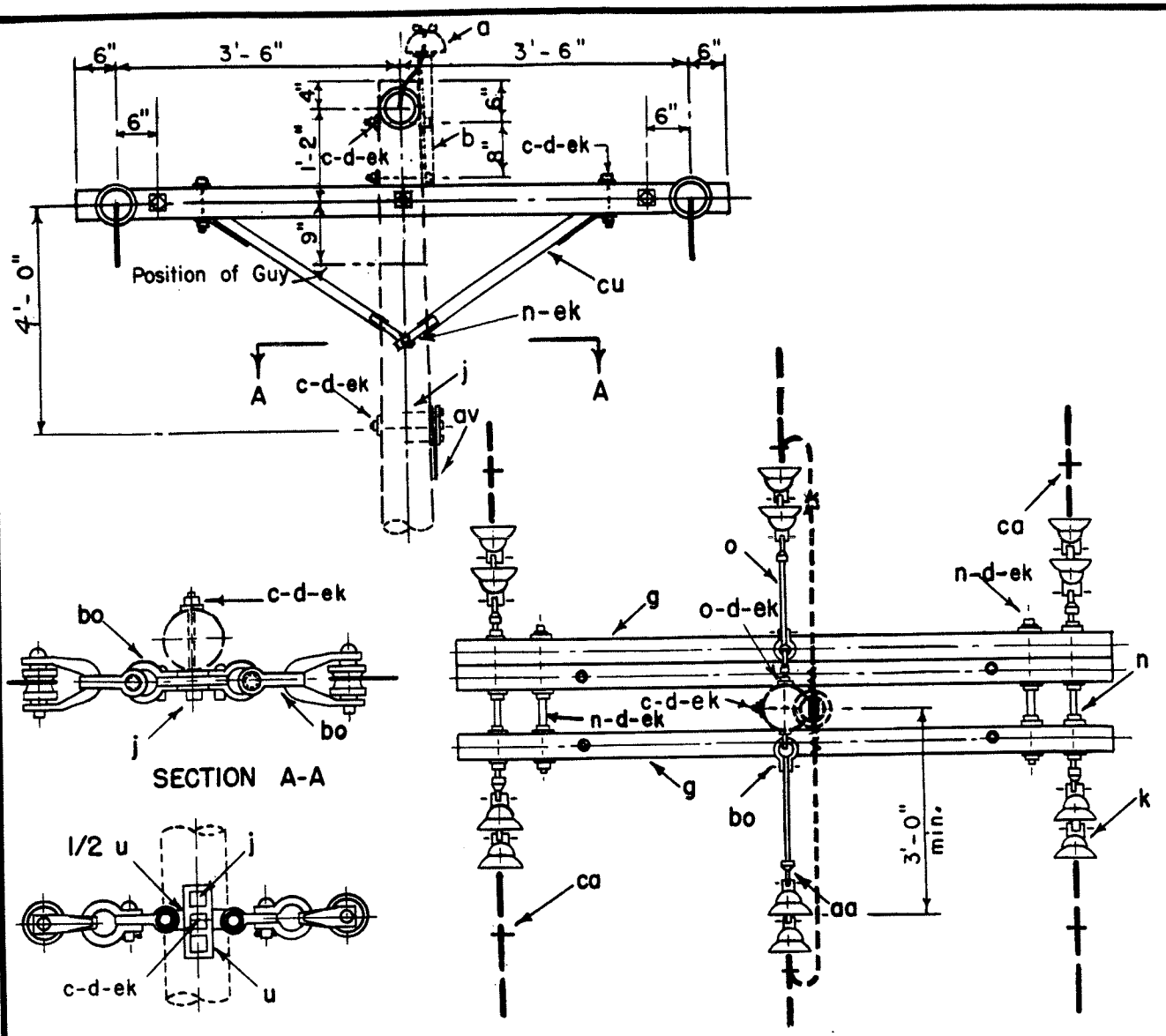
Note:
Item ca is shown on assembly drawings M42-3, M42-13, and M42-21.

ITEM	NO.	MATERIAL		ITEM	NO.	MATERIAL	
				o	3	Bolt, eye, 5/8" x req'd. length	
c	1	Bolt, machine, 5/8" x req'd. length		p		Connectors, as req'd.	
c	4	Bolt, machine, 1/2" x req'd. length		u	1 1/2	Clamp, guy, 6" heavy duty	
d	13	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole		aa	7	Nut, eye, 5/8"	
d	4	Washer, rd., 1 3/8" dia., 9/16" hole		av		Jumpers	
				bo	6	Shackle, anchor	
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"		ca	6	Deadend assembly, primary	
j	2	Screw, lag, 1/2" x 4"		cc	2	Deadend assembly, neutral	
k	12	Insulator, suspension		cu	2	Brace, wood, 60" span	
n	4	Bolt, double arming, 5/8" x req'd. length		ek		Locknuts	

12.5/7.2 kV, 3-PHASE
CROSSARM CONSTRUCTION-DEADEND (DOUBLE)
(LARGE CONDUCTORS)

Apr., 1983

C8-2



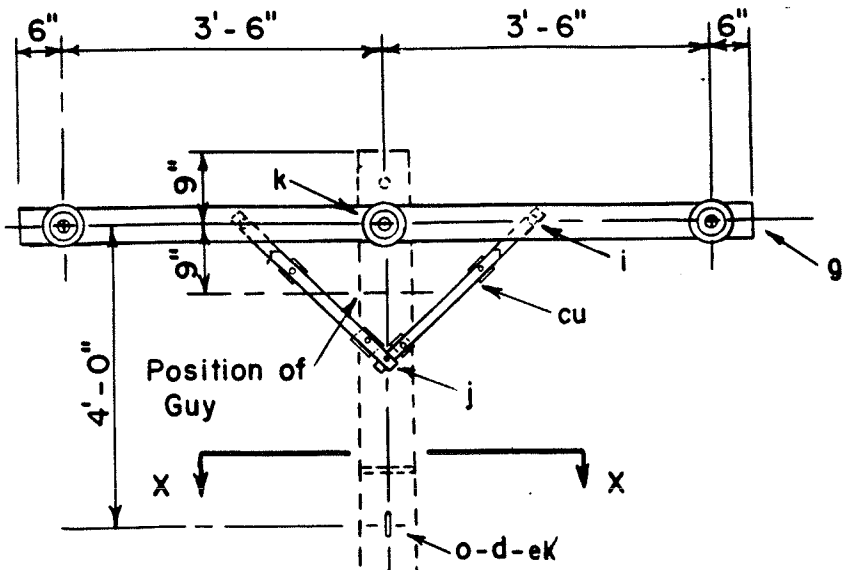
NOTE:
Items ca and cc are shown on assembly drawings M42-3, M42-11, M42-13, and M42-21.

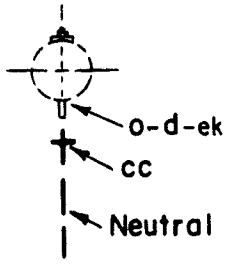
ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
			o	3	Bolt, eye, 5/8" x req'd. length
c	1	Bolt, machine, 5/8" x req'd. length	p		Connectors, as req'd.
c	4	Bolt, machine, 1/2" x req'd. length	u	1 1/2	Clamp, guy, 6" heavy duty
d	21	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole	aa	7	Nut, eye, 5/8"
d	4	Washer, rd., 1 3/8" diam., 9/16" hole	av		Jumpers, as required
			bo	6	Shackle, anchor
g	3	Crossarm, 3 5/8" x 4 5/8" x 8' - 0"	ca	6	Deadend assembly, primary
j	2	Screw, lag, 1/2" x 4"	cc	2	Deadend assembly, neutral
k	12	Insulator, suspension	cu	2	Brace, wood, 60" span
n	6	Bolt, double arming, 5/8" x req'd. length	ek		Locknuts, as required

12.5/7.2 kV,- 3 PHASE
CROSSARM CONSTRUCTION, DEADEND (DOUBLE)
LARGE CONDUCTORS WITH UNBALANCED LOADS

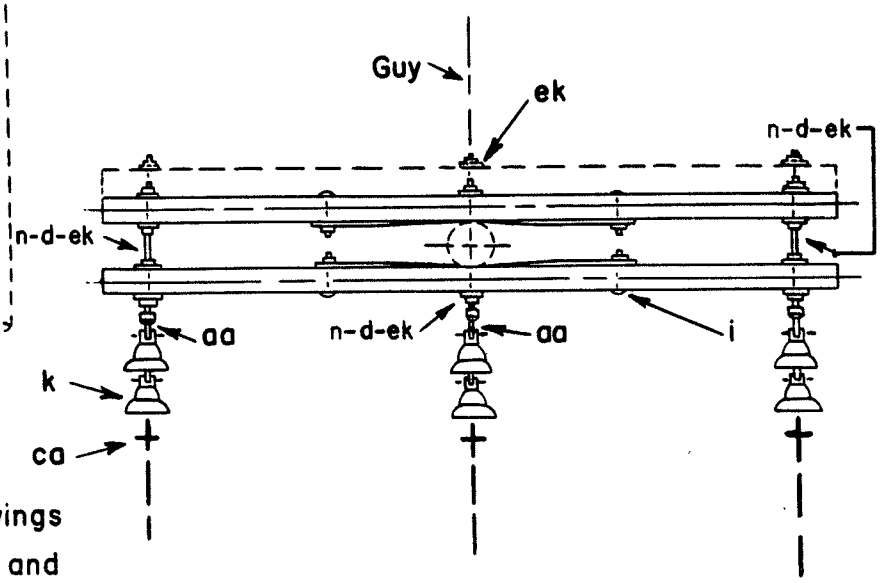
Apr., 1983

C8-3





SECTION X-X



PLAN

NOTES:

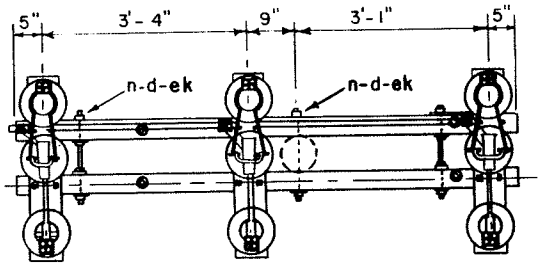
1. See dwg. E5-1 for crossarm loading limitations.
2. Designate as C7-1 for assembly with three crossarms.
3. Items ca and cc are shown on assembly drawings M42-3, M42-11, M42-13, and M42-21.

ITEM	NO.	MATERIAL		ITEM	NO.	MATERIAL	
d	11	Washer, 2¼" x 2¼" x 3/16", 13/16" hole		n	3	Bolt, double arming, 5/8" x req'd l'gth	
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"		o	1	Bolt, eye, 5/8" x req'd length	
cu	4	Brace, wood, 28"		aa	3	Nut, eye, 5/8"	
i	4	Bolt, carriage, 3/8" x 4½"		ca	3	Deadend assembly, Primary	
j	2	Screw, lag, ½" x 4"		cc	1	Deadend assembly, Neutral	
k	6	Insulator, suspension		ek		Locknuts, as required	

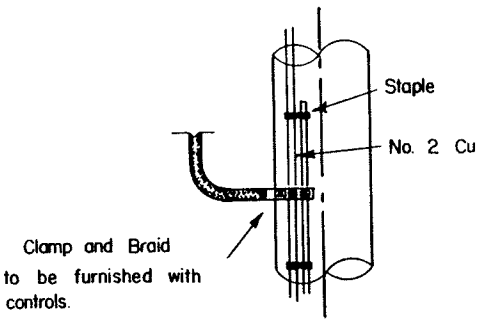
12.5/7.2 kV, 3-PHASE CROSSARM CONSTRUCTION DEAD END (SINGLE)

Apr., 1983

C7, C7-1

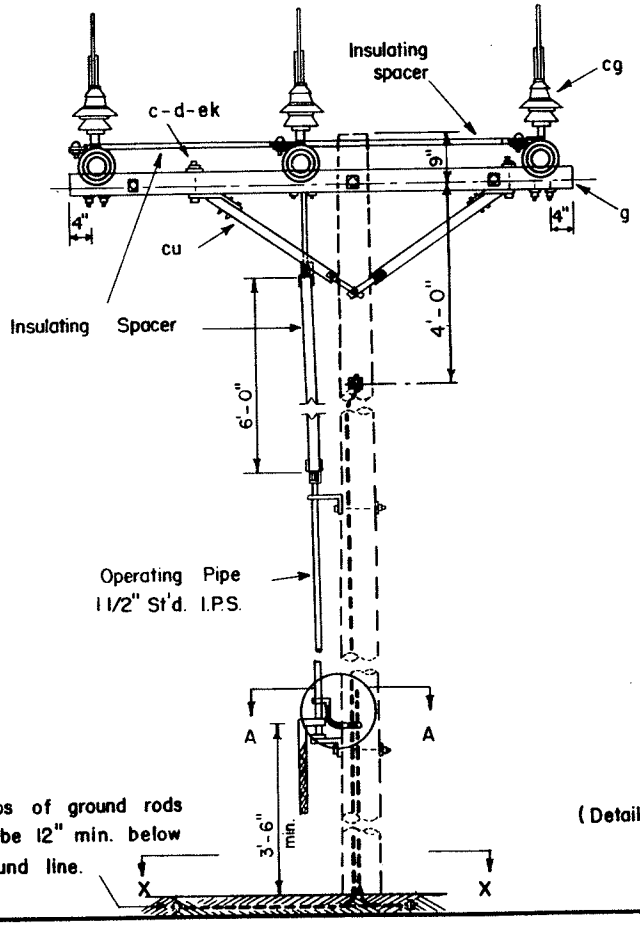


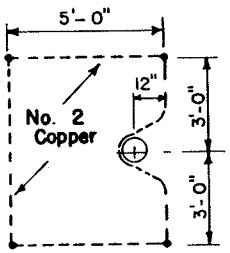
PLAN VIEW
OF SWITCH ARRANGEMENT



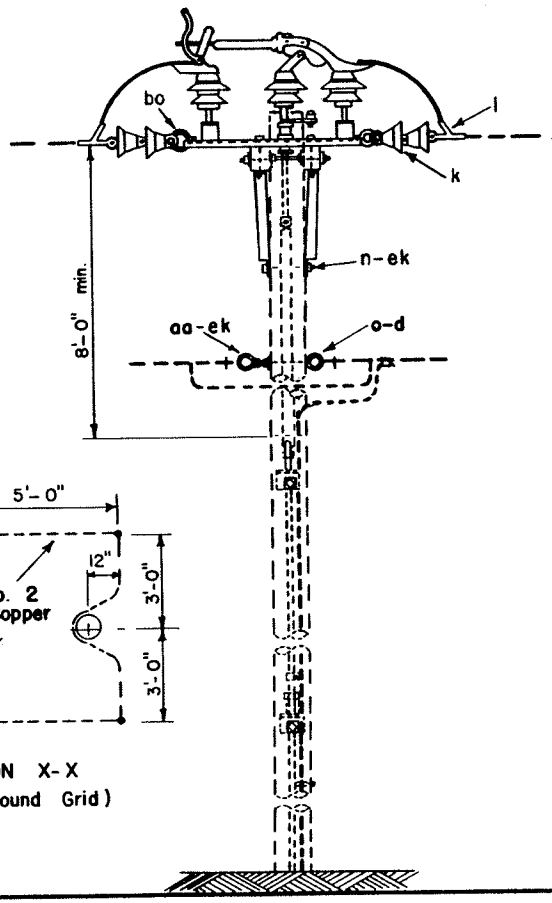
DETAIL OF A-A

ITEM	NO.	MATERIAL
c	14	Bolt, machine, 5/8" x req'd. length
c	2	Bolt, machine, 1/2" x req'd length
d	25	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole
d	4	Washer, rd., 1 3/8" dia., 9/16" hole
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"
k	12	Insulator, suspension
l	6	Clamp, deadend
n	4	Bolt, double arming, 5/8" x req'd. length
bo	6	Shackle, anchor
cc	2	Deadend assembly, neutral
cg	1	Switch, airbreak, 3 pole unit 15 KV
		with operating mechanism, and insul. spacers
cu	2	Brace, wood, 60" span
o	1	Bolt, eye, 5/8" x required length
ek		Locknuts, as required
aa	1	Nut, eye, 5/8"





SECTION X-X
(Detail of Ground Grid)



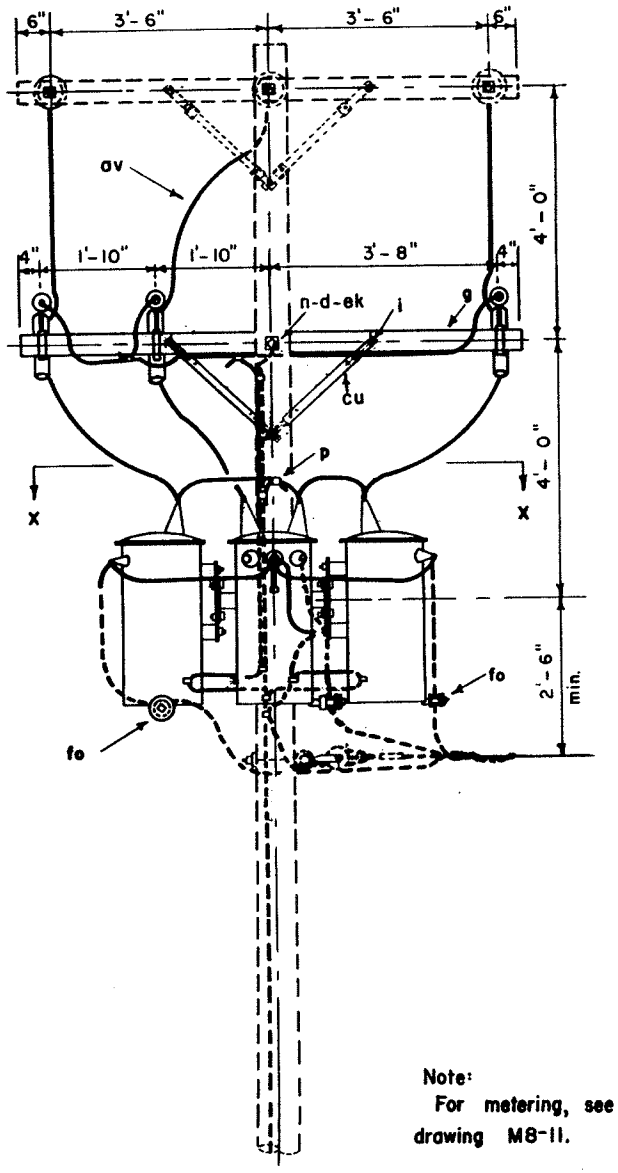
Note:
For ground assembly, see drawings M2-15 and M2-15A.

See drawings M42-3, M42-11, M42-13, M42-21 for item cc.

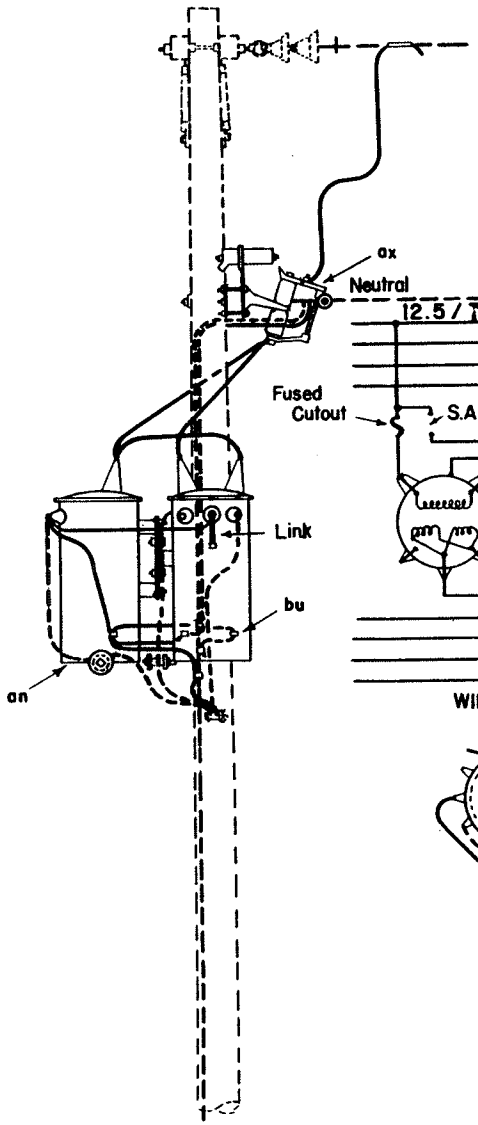
12.5/7.2 kV
SECTIONALIZING AIR BREAK SWITCH

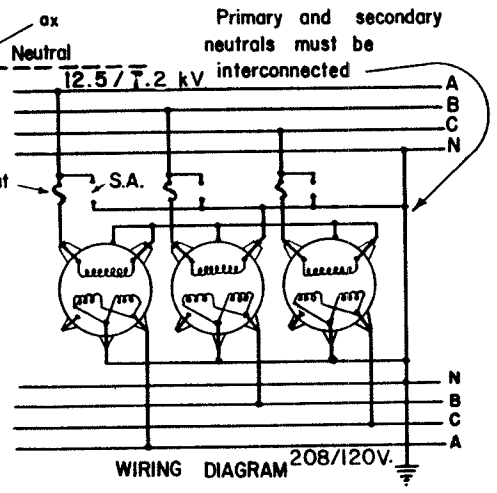
Apr., 1983

M3-15

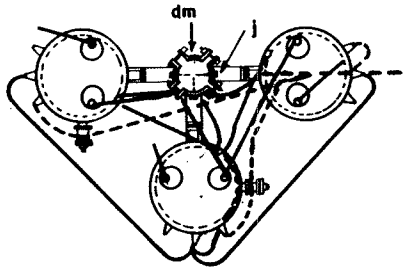


Note:
For metering, see drawing M8-11.





WIRING DIAGRAM



SECTION X-X

ITEM	NO.	MATERIAL
d	2	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'-0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	4	Screw, lag, 1/2" x 4"
n	1	Bolt, double, arming, 5/8" x req'd. length
p	3	Connector, compression type
p		Connectors, as required
an	3	Transformer, 100 kVA max.
av		Jumper, secondary, weather-proof
av		Jumper, pri. bare, stranded, as req'd
ax	3	Cutout and arrester, combination
bu	3	Connector, transformer grounding *
cu	2	Brace, wood, 28"
dm		Bracket, transformer, cluster and adapter
		plates as required
fo	3	Transformer secondary bracket,
		insulated
	3	Link grounding
ek		Locknuts, as required

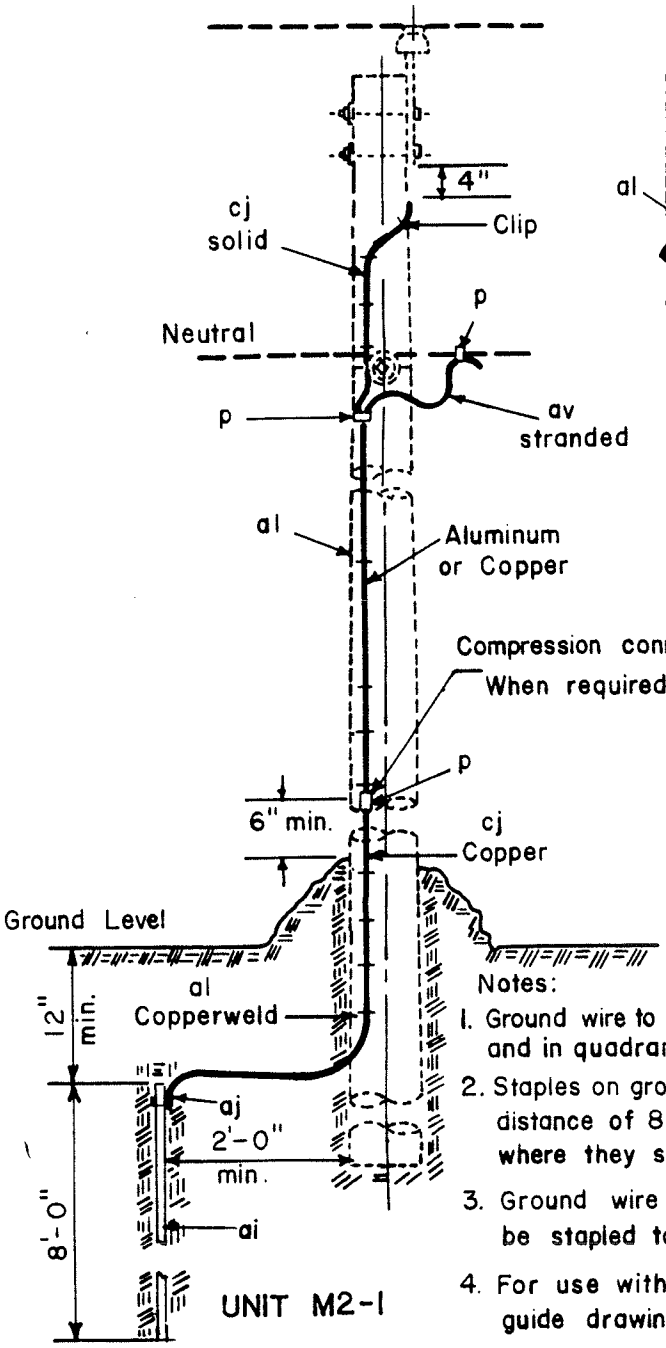
* Specify these items to be furnished by the manufacturer.

Notes:
1. For transformers 50 kVA and larger, use two cluster brackets and dimensions as shown on G310.
2. Single bushing transformers may be used if desired. If used, do not disconnect transformer neutral without first disconnecting primary.
3. Re-connect internal windings of secondary as shown.

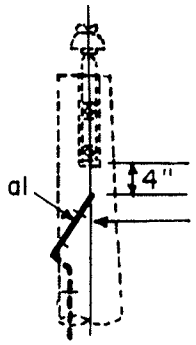
12.5/7.2 kV
THREE TRANSFORMERS, CLUSTER MOUNTED
4-WIRE GROUNDED WYE-GROUNDED WYE
FOR 208/120 VOLT POWER LOADS

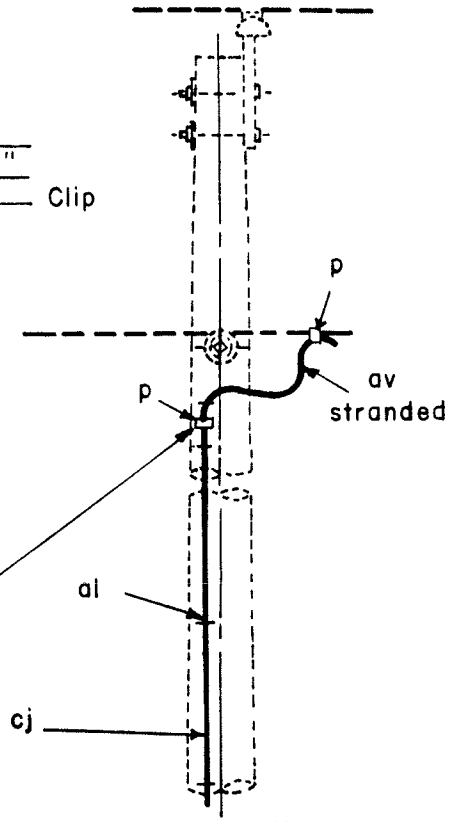
Apr., 1983

G312-75



UNIT M2-I





UNIT M2-II
similar to Unit M2-I
except as shown.

Notes:

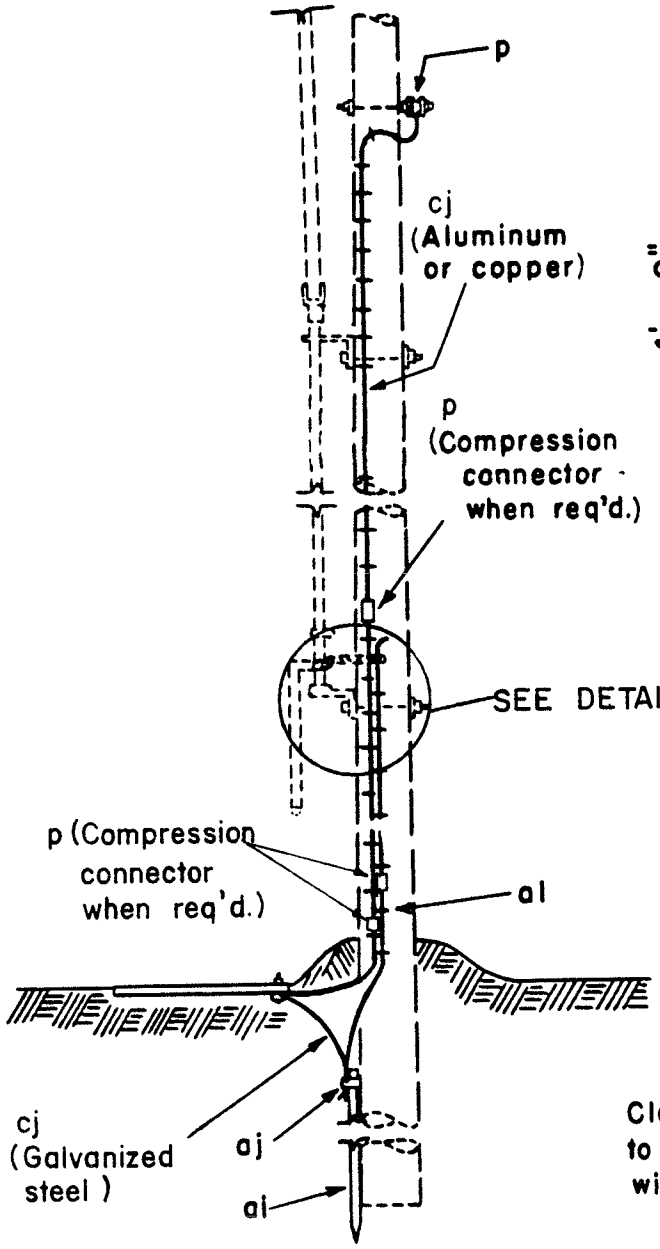
1. Ground wire to be located on same side as Neutral Conductor and in quadrant opposite climbing space or pole top pin.
2. Staples on ground wire shall be 2' apart, except for a distance of 8' above ground and 8' from top of pole where they shall be 6" apart.
3. Ground wire to clear all hardware by 2" min. and shall be stapled to maintain this position.
4. For use with V and 3-phase assemblies refer to guide drawings M30-1 and M30-2.

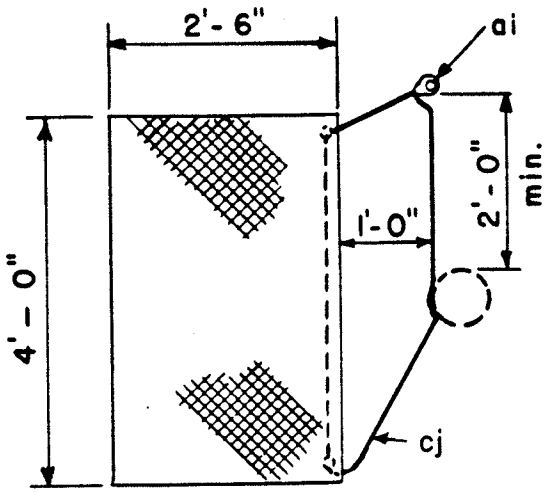
		ASSEMBLY UNIT	
ITEM	MATERIAL	M2-I	M2-II
p	Connector, compression	as req'd.	as req'd.
ai	Rod, ground, 5/8" minimum diameter	1	1
aj	Clamp, ground rod wire	1	1
al	Staples, ground wire (copper or steel to match ground wire)	as req'd.	as req'd.
al	Ground wire clip	1	
cj	Ground wire, minimum No. 6 copper or equiv. conductivity	as req'd.	as req'd
av	Jumper, stranded, min. No 6 copper or equiv. conductivity	as req'd	as req'd

12.5/7.2 kV
GROUNDING ASSEMBLY - GROUND ROD TYPE

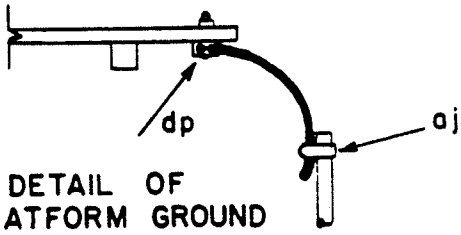
Apr., 1983

M2-II

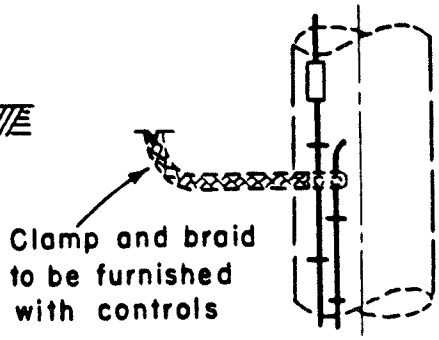




DETAIL OF PLATFORM



DETAIL OF
PLATFORM GROUND



DETAIL

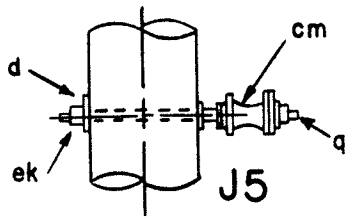
ITEM	NO.	MATERIAL
p		Connectors, as required
ai	1	Rod, ground, 5/8" dia. x 8'-0" (galv.)
aj	1	Clamp, ground rod (galvanized steel)
al		Staples, ground wire, as required (galv.)

ITEM	NO.	MATERIAL
cj		Ground wire, No. 2 copper or equiv.
		conductivity, as required
dp	2	Grounding connector and lockwasher
	1	Iron grounding platform plate (galv.)

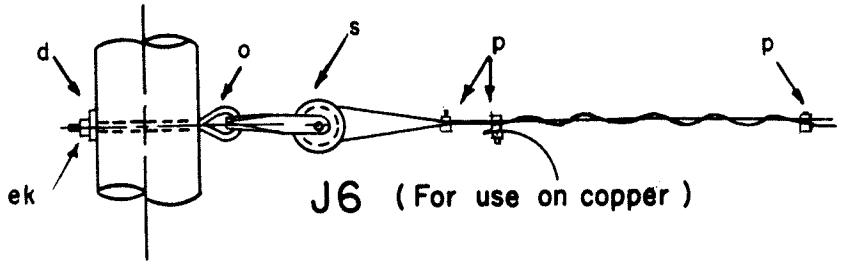
GROUNDING ASSEMBLY – PLATFORM TYPE FOR SECTIONALIZING AIR BREAK SWITCH

Apr., 1983

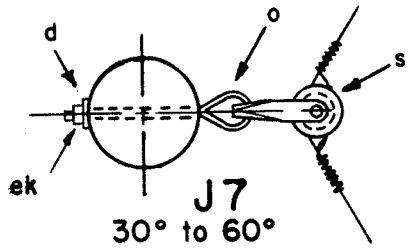
M2 - 15A



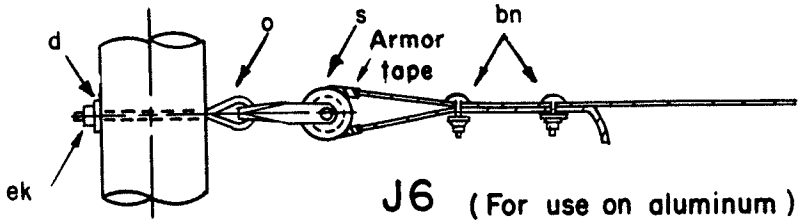
J5



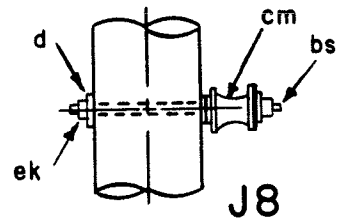
J6 (For use on copper)



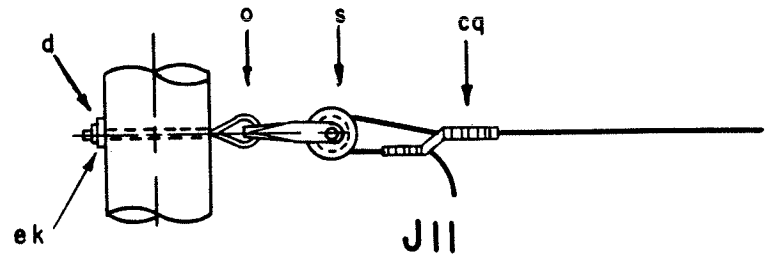
J7
30° to 60°



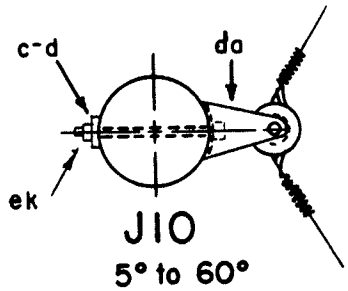
J6 (For use on aluminum)



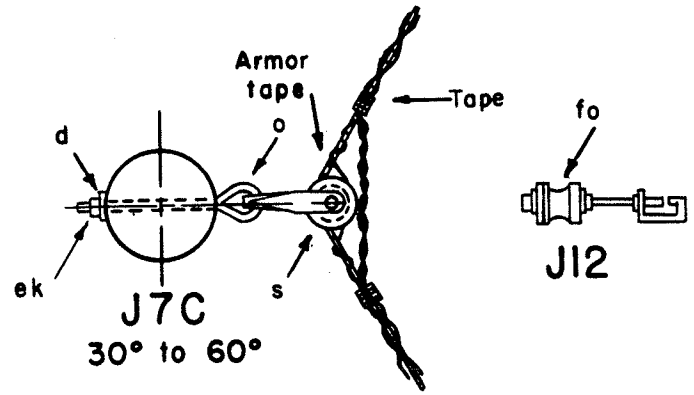
J8



J11



J10
5° to 60°



J7C
30° to 60°

J12

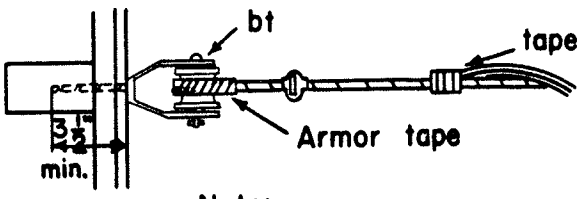
For use on Self Supporting Service Cable

ITEM	NO.	MATERIAL			MATERIAL
c		Bolt, machine, 5/8" x required length	bs		Bolt, single upset
d		Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole	bn		Clamp, loop, deadend
o		Bolt, eye, 5/8" x required length	cq		Sleeve, offset, splicing
p		Connectors, as required	da		Bracket, insulated
q		Bolt, double upset,	fo		Transformer secondary bracket
s		Clevis, secondary, swinging, insulated	ek		Locknuts as required
cm		Insulator, spool			

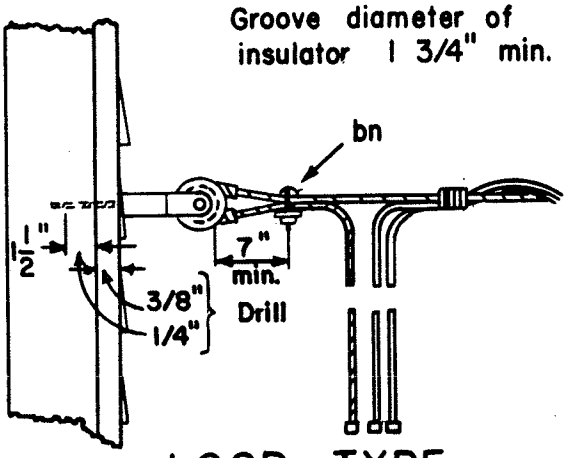
SECONDARY ASSEMBLIES

Apr., 1983

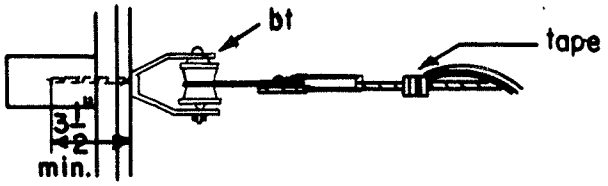
J10

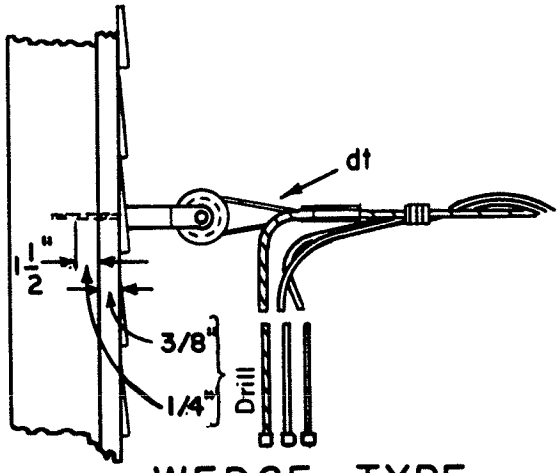


Note:
Groove diameter of insulator 1 3/4" min.

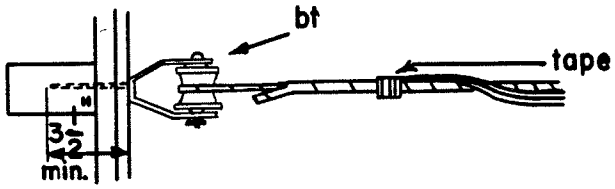


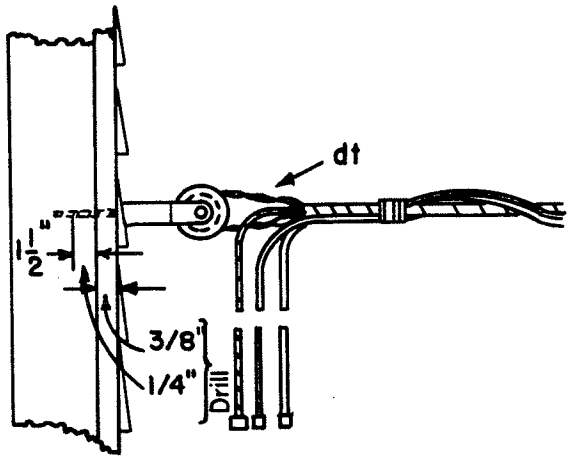
LOOP TYPE



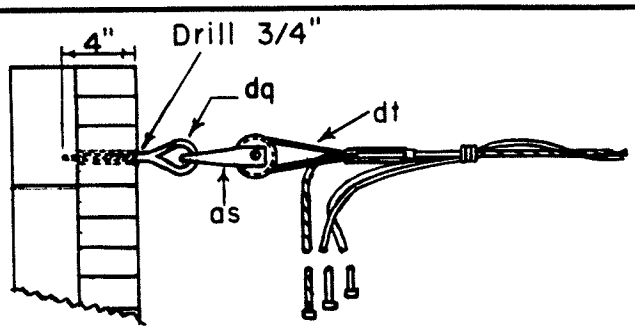


WEDGE TYPE





FORMED TYPE



BRICK OR MASONRY

Notes:

Wedge and formed type service dead-ends in sizes shown on page dt of the List of Materials may be subst. for those shown on K11C, K14C, K15C, and K16C. This type construction should be used for 3 or 4 conductor service cables with bare ACSR neutral. Service connectors to be insulated compression type.

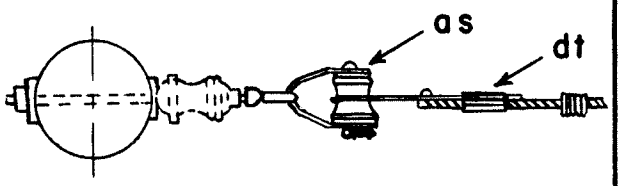
ITEM	MATERIAL
bt	Wireholder, clevis type, insulated.
	#24 woodscrew,
p	Connectors, as required.
bn	Clamp, loop deadend.
as	Clevis, service, insulated

ITEM	MATERIAL
dt	Service deadend, wedge type.
dt	Service deadend, preformed type.
dq	Eye screw, elliptical, 1/2" x 6"
	3/4" x 3 1/2" expansion shield

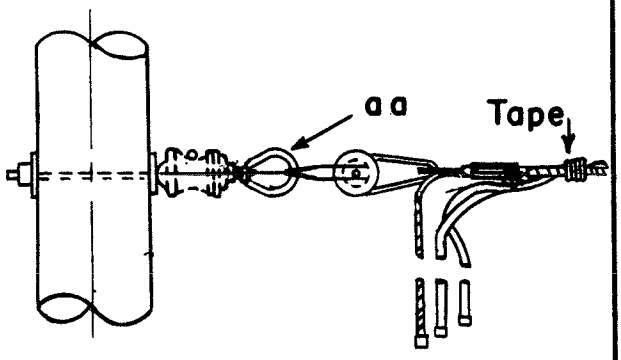
SERVICE ASSEMBLIES, CABLE

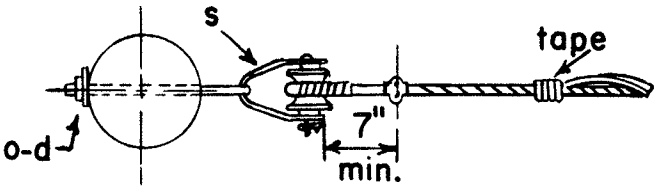
Apr., 1983

K10C

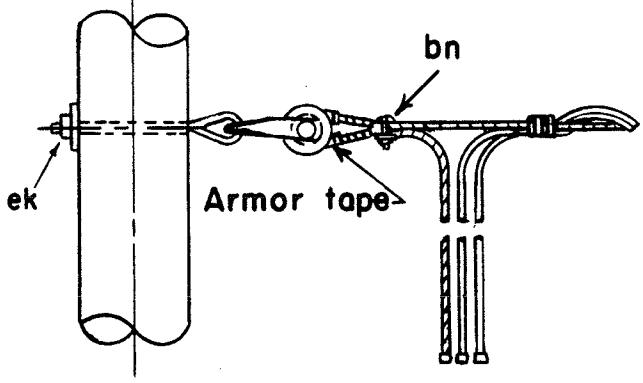


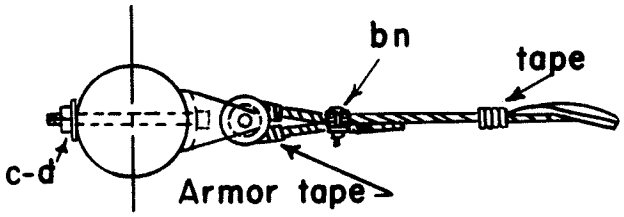
-K15C-

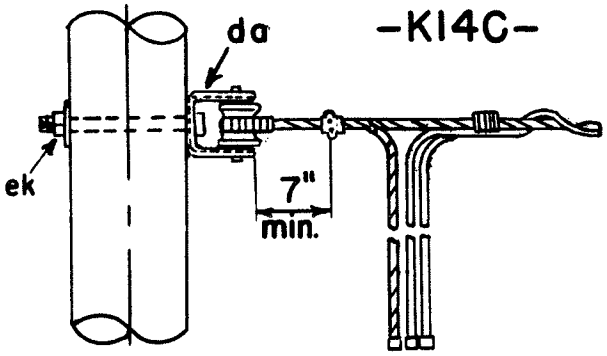




-K11C-







-K14C-

NOTES

This type construction should be used for 3 or 4 conductor service cables with bare A.C.S.R. neutral.

Service connectors to be insulated compression type.

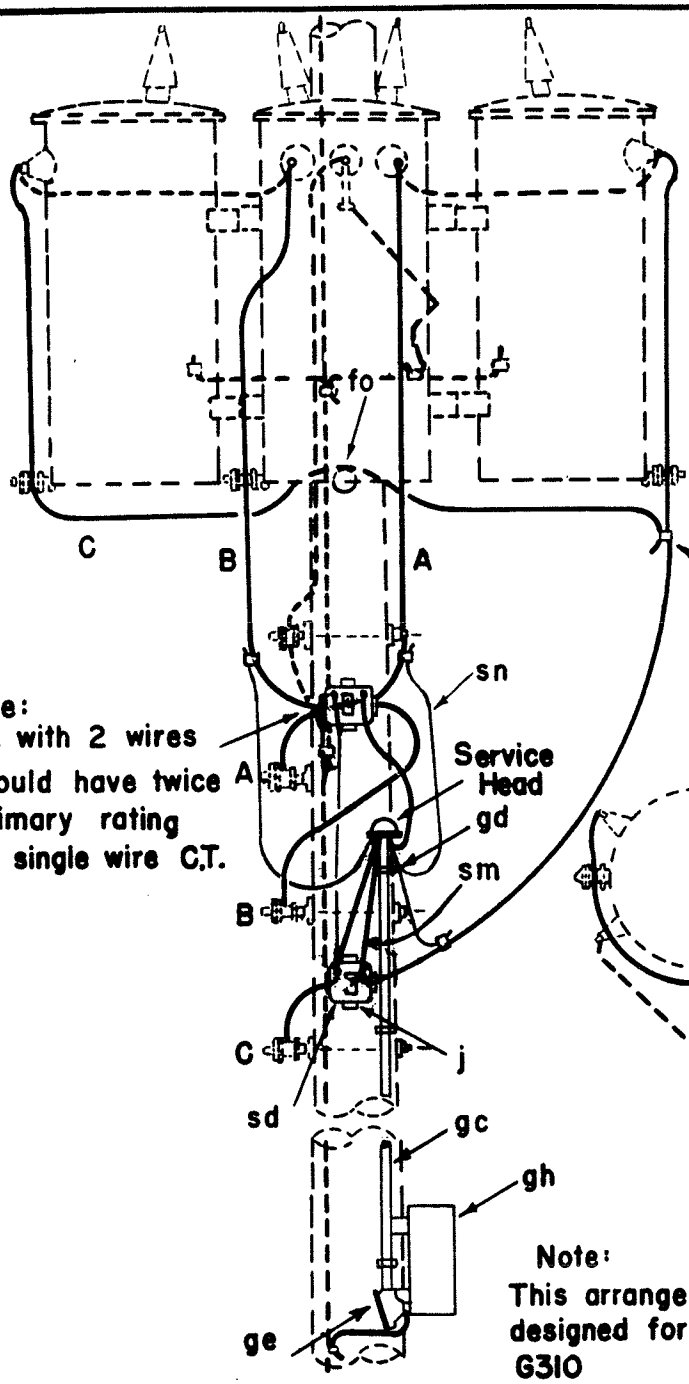
Groove diameter of insulators $1\frac{3}{4}$" minimum for loop deadends.

ITEM		MATERIAL		ITEM		MATERIAL	
c		Bolt, machine, $\frac{5}{8}$" x req'd. length		bn		Clamp, loop deadend	
d		Washer, $2\frac{1}{4}$" x $2\frac{1}{4}$" x $\frac{3}{16}$", $\frac{13}{16}$" hole		da		Bracket, insulated	
o		Bolt, eye, $\frac{5}{8}$" x req'd. length		as		Clevis, service swinging	
s		Clevis, secondary, swinging, insul.		p		Connectors, as required	
aa		Nut, eye		dt		Service deadend	
ek		Locknuts, as required					

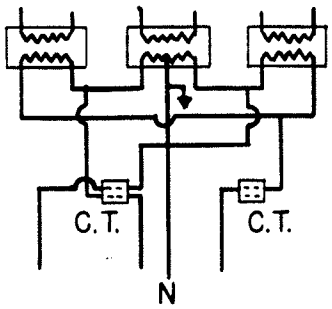
SERVICE ASSEMBLIES, CABLE

Apr., 1983

K14C

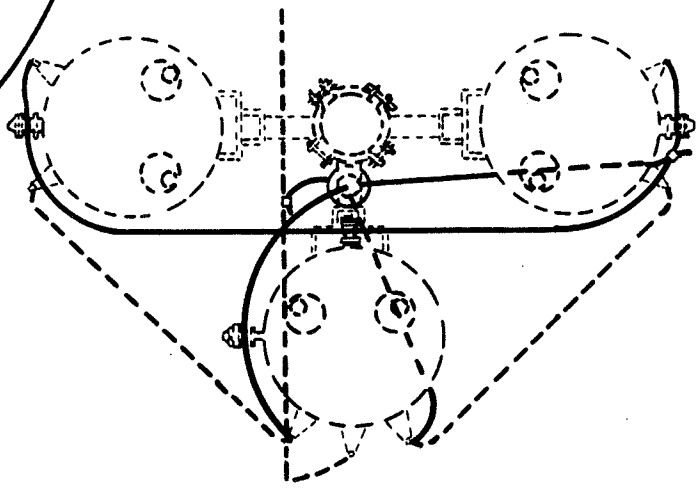


Note:
C.T. with 2 wires should have twice primary rating of single wire C.T.



WIRING DIAGRAM
FOR INSTRUMENT TRANSFORMERS

Note:
For more detailed wiring diagram, see REA Bulletin 161-12



PLAN

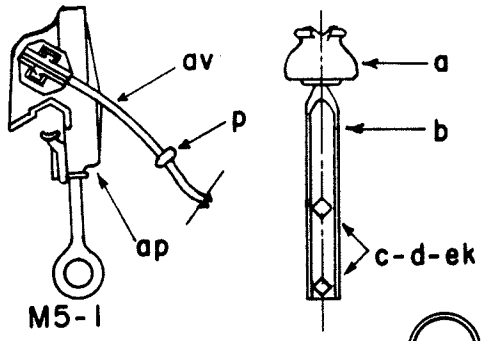
Note:
This arrangement of metering equipment is designed for use with the transformer drawings G310

ITEM	NO.	MATERIAL		ITEM	NO.	MATERIAL	
j	4	Screw, lag, 1/2" x 4"		gh	1	Meter box, meter and test block	
p		Connectors, as required		sd	2	Transformer, current	
					1	Service Head	
gc		Conduit, 1 1/4" as required		sm		Wire, No. 12, insul. for current	
ge	1	Conduit, type "LB"		sn		Wire, No. 14, insul. for potential	
gd		Straps, conduit, as required					
fo	1	Transformer secondary bracket					

SECONDARY METERING GUIDE
THREE PHASE 120/240 VOLTS
4 WIRE DELTA

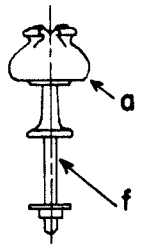
Apr., 1983

M8-6

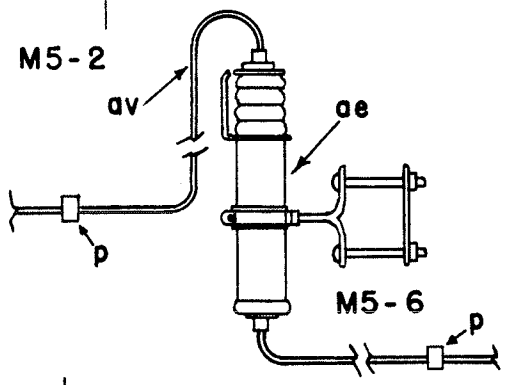


M5-1

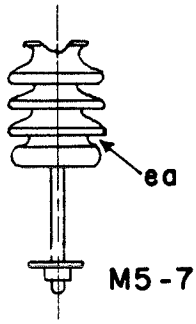
M5-2



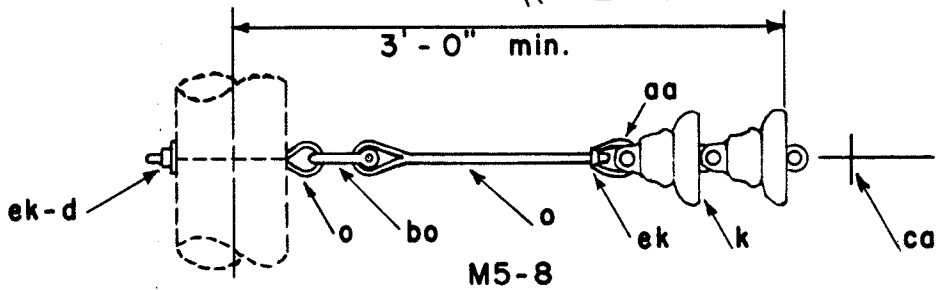
M5-5



M5-6



M5-7



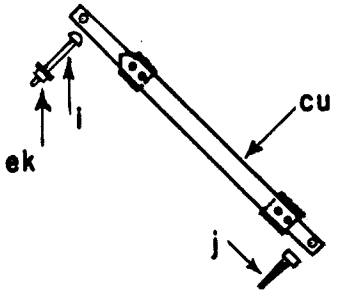
M5-8

ITEM	MATERIAL	M5-1	M5-2			M5-5	M5-6	M5-7	M5-8
a	Insulator, pin type		1			1			
b	Pin, pole top, 20"		1						
c	Bolt, machine, 5/8"x req'd. length		2						
d	Washer, square, 2 1/4"		2					1	1
f	Pin, crossarm, steel, 5/8"x 10 3/4"					1			
k	Insulator, suspension								2
o	Bolt, eye, 5/8"x req'd. length								2
p	Connector	1					2		
aa	Nut, eye, 5/8"								1
ae	Lightning arrester						1		
ap	Clamp, hot line	1							
av	Jumper	1							
bo	Shackle, anchor								1
ea	Insulator, post type, 7" stud							1	
ek	Locknuts, as required								

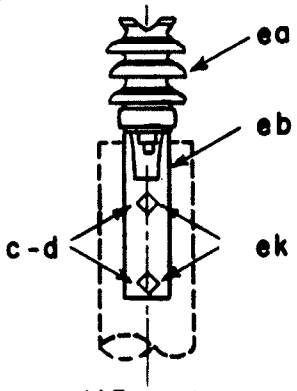
12.5/7.2 kV
MISCELLANEOUS PRIMARY ASSEMBLIES

Apr., 1983

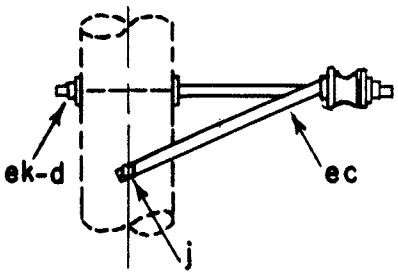
M5-5



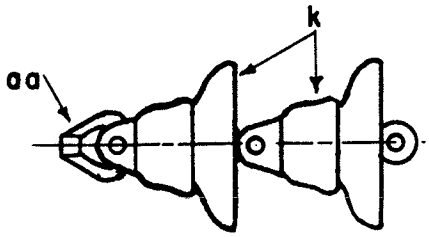
M5 – 17



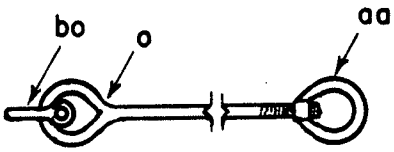
M5 – 18



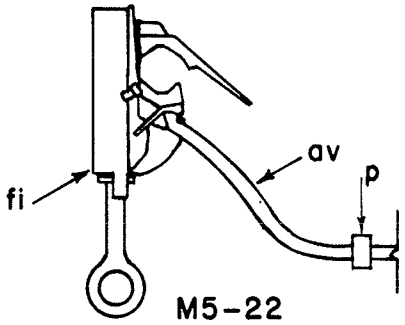
M5 – 19



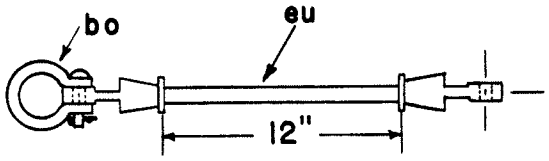
M5 – 20



M5-21



M5-22



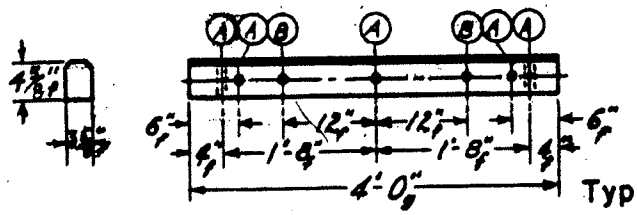
M5 - 23

ITEM	MATERIAL	M5-17	M5-18	M5-19	M5-20	M5-21	M5-22	M5-23
c	Bolt, machine, 5/8"x required length		2					
d	Washer, 2 1/4" square		2	1				
i	Bolt, carriage, 3/8"x 4 1/2"	1						
j	Screw, lag, 1/2" x 4"	1		2				
k	Insulator, suspension				2			
ea	Insulator, post type, 1 3/4" stud		1					
eb	Bracket, for post type insulator		1					
ec	Bracket, offset, neutral, insulated			1				
ek	Locknuts, as required							
cu	Brace, wood, 28"	1						
aa	Eye nut				1	1		
bo	Shackle, anchor					1		1
o	Bolt, eye, 5/8" x reqd. length					1		
fi	Connector, hot line						1	
av	Jumper						1	
p	Connector						1	
eu	Link, extension, insulated							1

MISCELLANEOUS PRIMARY ASSEMBLIES

Apr., 1983

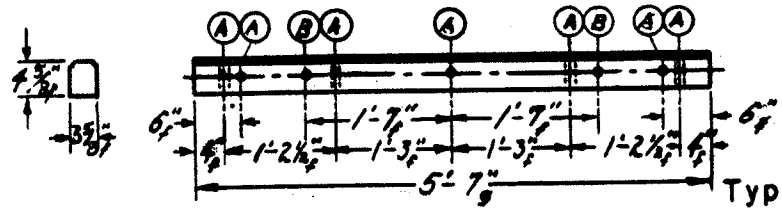
M5-21



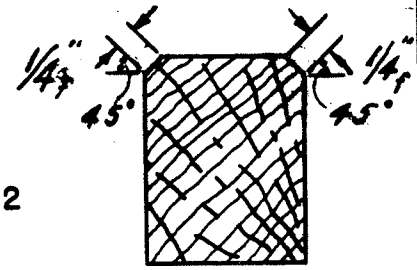
Type 01

TOLERANCES
SIZES OF HOLES

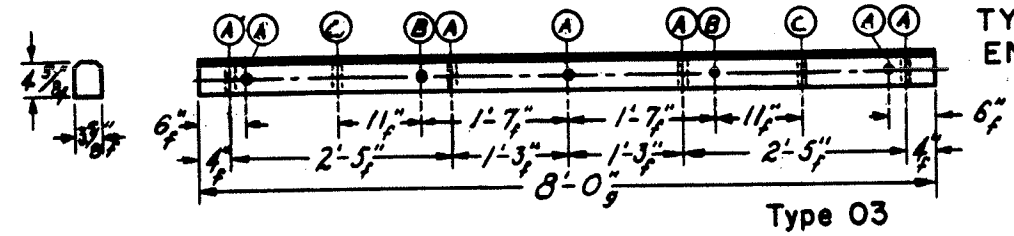
	Nominal	Go	No Go
(A)	1 1/16"	4/8"	3/4"
(B)	2 1/16"	3/8"	1/2"
(C)	3/16"	1/2"	5/8"



Type 02

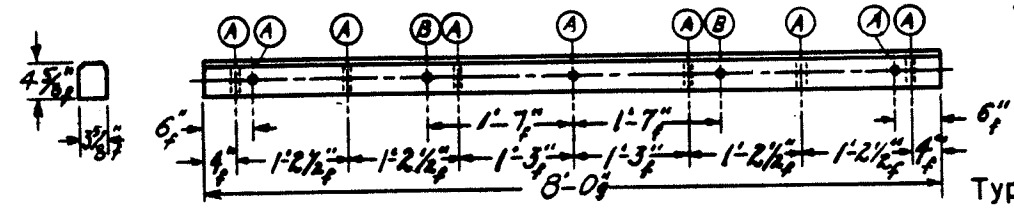


TYPICAL ENLARGED SECTION

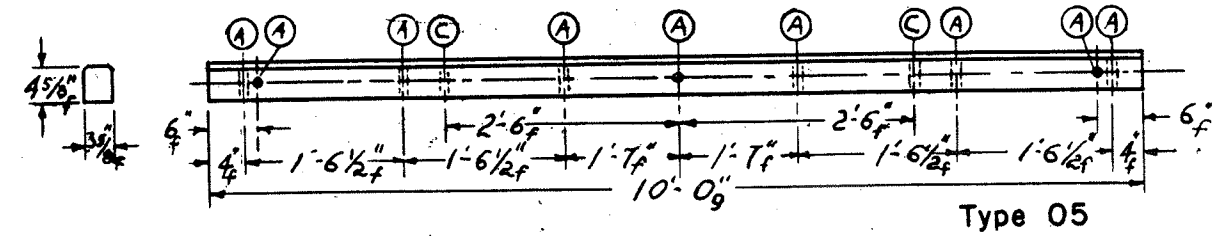


Type 03

f --- ± 1/8"
g --- ± 1/4"



Type 04

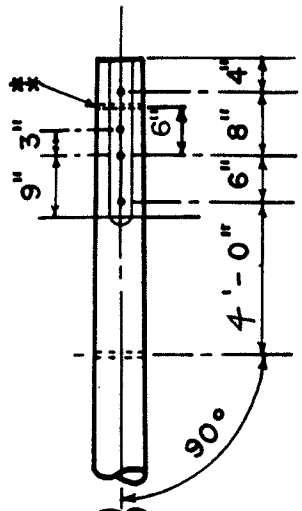


Type 05

CROSSARM DRILLING GUIDE

Apr., 1983

M19



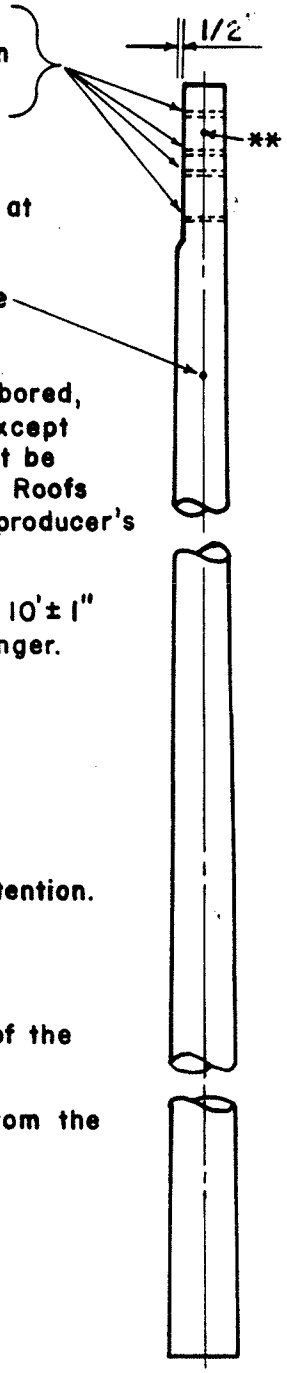
Through-bolt holes must be parallel and in the same plane.

HOLES: Drill 11/16" diameter.

GAINS: Gains are to be flat with plane at right angles to bolt hole.

Neutral bolt hole must be at 90° angle with through-bolt holes.

All poles shorter than 50 feet must be bored, roofed and gained before treatment, except that Class 7 and smaller poles need not be gained unless requested by purchaser. Roofs may be flat or at a 15° angle at the producer's option.



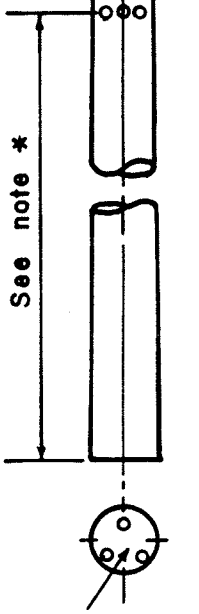
*Bottom of brand or center of metal disk shall be 10'± 1" from pole butt; 14'± 1" mark for poles 55' and longer.

If insured warranted pole, Brand "IW".

Manufacturer's Mark and Date of Treatment, (Month and Year).

Brand with proper length and class.

Brand with species, preservative code and retention.



Tolerance:

Holes

On the gain ± 1/8" from the centerlines of the holes.

On the side opposite the gain ± 1/4" from the centerlines of the holes.

Location – measured from roof
Gain side ± 1/4"
Opposite side ± 1/2"

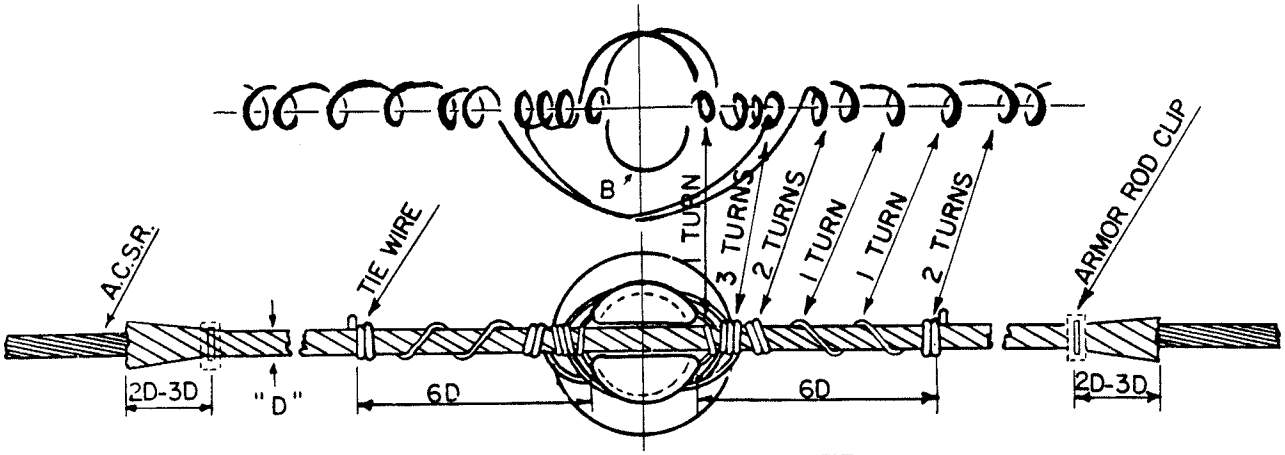
Diameter ± 1/16"
Gains out of parallel ± 1/2"

** Optional, anti-split bolt hole to be drilled only when so specified by the purchaser.

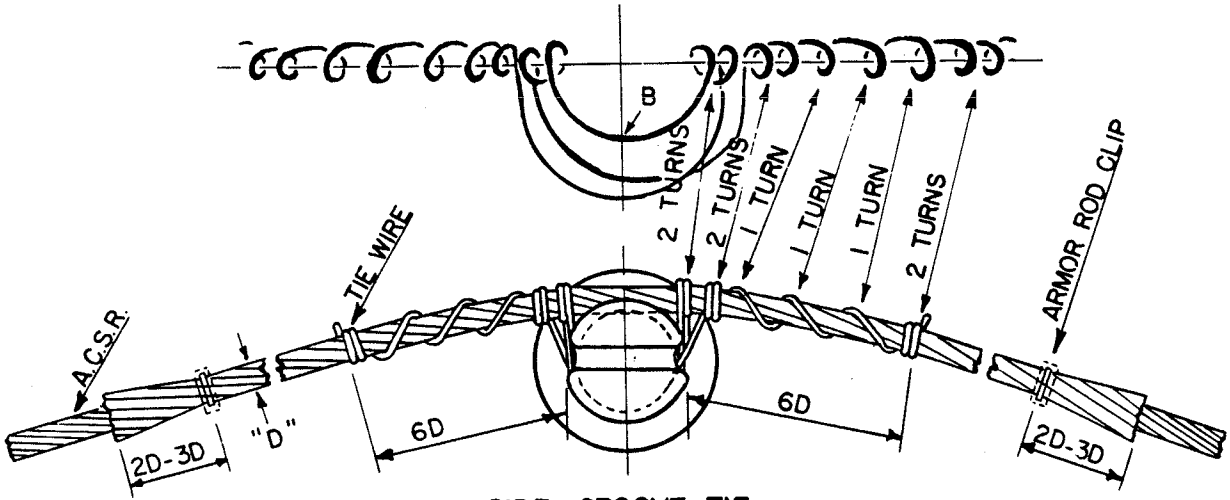
Brand butt with proper length and class

POLE FRAMING GUIDE

Apr., 1983		M20



TOP GROOVE DOUBLE TIE



SIDE GROOVE TIE

Note:

In making ties, start with middle of length of tie wire at position marked "B".

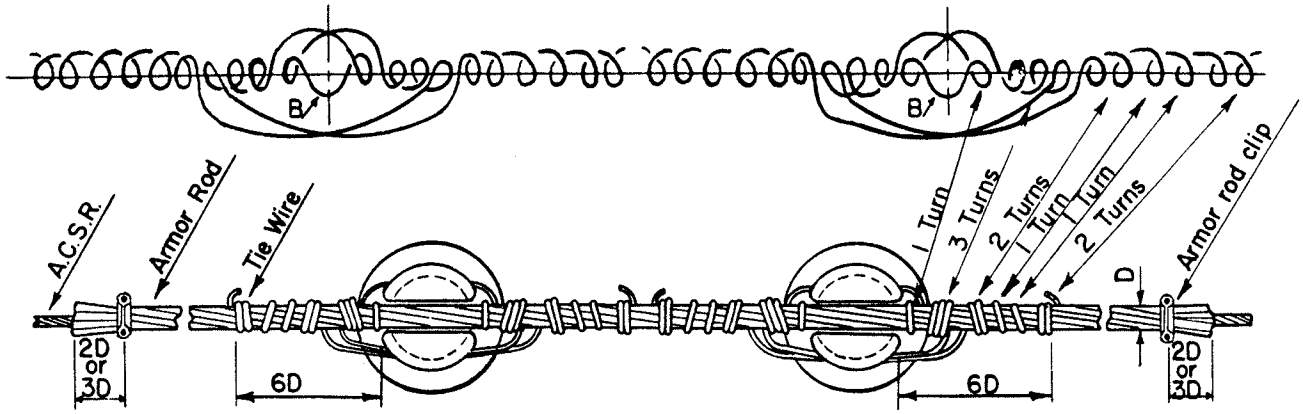
To complete tie, cinch up last two turns at each end with pliers until tie wire is snug and tight.
Use the flat face of the pliers against the armor rods.

A.C.S.R.		ARMOR RODS	TIE WIRE ALUMINUM		A.C.S.R.		ARMOR RODS	TIE WIRE ALUMINUM	
Size	DIAM. INCHES	"D" DIAM. INCHES	Size	LENGTH FEET	Size	DIAM. INCHES	"D" DIAM. INCHES	Size	LENGTH FEET
4/0	0.563	0.939	4	9'3"	1/0	0.398	0.744	4	8'3"
3/0	0.502	0.836	4	8'9"	2	0.325	0.595	4	7'5"
2/0	0.447	0.745	4	8'3"	4	0257	0.555	4	7'3"

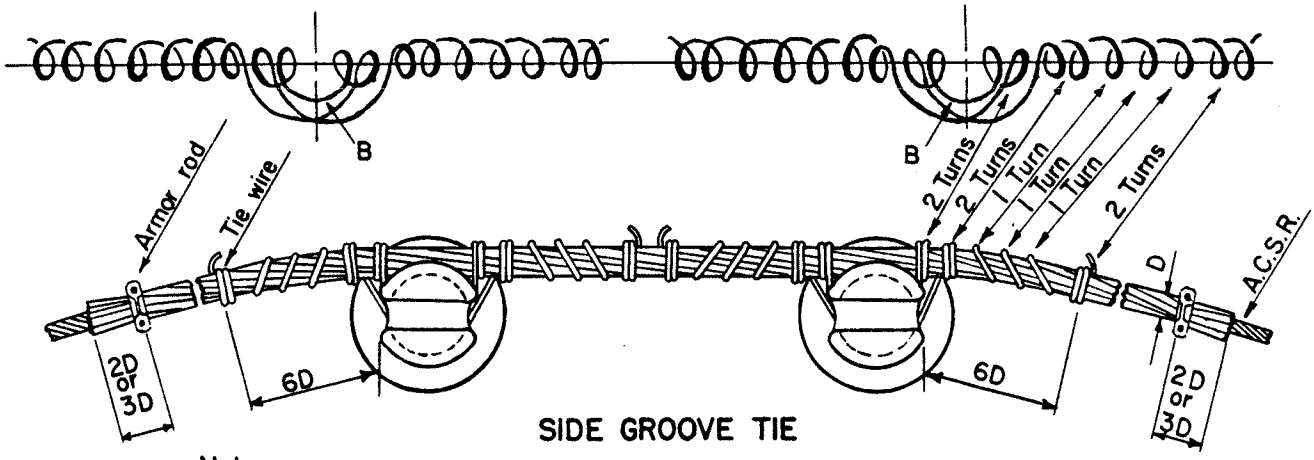
TYING GUIDE, SINGLE INSULATOR,
ALUMINUM TIE WIRE, A.C.S.R. CONDUCTOR,
STRAIGHT OR PREFORMED ARMOR RODS

Jan 1, 1962

M40-10



TOP GROOVE DOUBLE TIE



SIDE GROOVE TIE

Note:

In making ties, start with middle of length of tie wire at position marked "B".

To complete tie, cinch up last two turns at each end with pliers until tie wire is snug and tight.

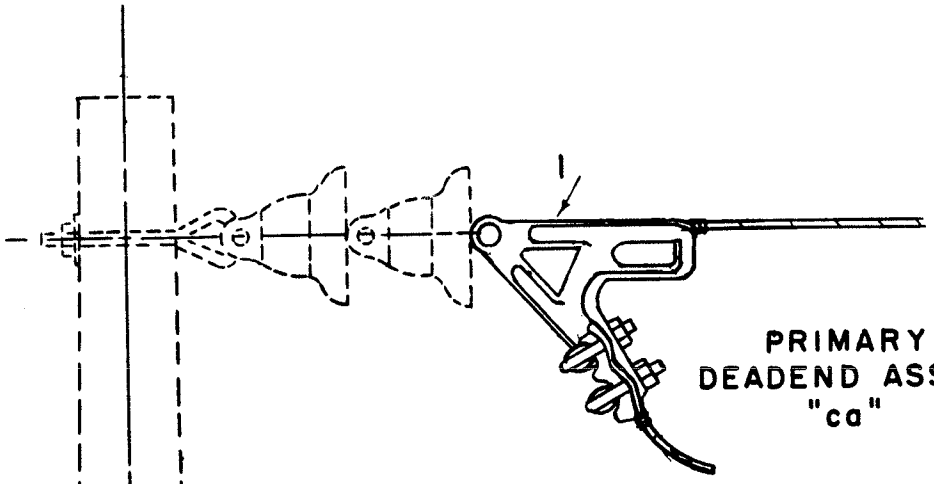
Use the flat face of the pliers against the armor rods.

A.C.S.R.		ARMOR RODS	TIE WIRE ALUMINUM		A.C.S.R.		ARMOR RODS	TIE WIRE ALUMINUM	
SIZE	DIAM. INCHES	"D" DIAM. INCHES	SIZE	LENGTH FEET	SIZE	DIAM. INCHES	"D" DIAM. INCHES	SIZE	LENGTH FEET
4/0	0.563	0.939	4	9'-3"	1/0	0.398	0.744	4	8'-3"
3/0	0.502	0.836	4	8'-9"	2	0.325	0.595	4	7'-5"
2/0	0.447	0.745	4	8'-3"	4	0.257	0.555	4	7'-3"

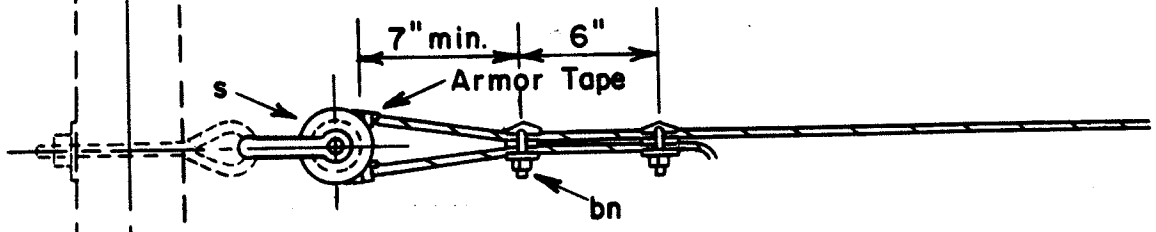
TYING GUIDE, DOUBLE INSULATOR, ALUMINUM TIE WIRE, A.C.S.R. CONDUCTOR, STRAIGHT OR PREFORMED ARMOR RODS

Jan 1, 1962

M40-17



PRIMARY
DEADEND ASSEMBLY
"ca"



NEUTRAL AND SECONDARY
DEADEND ASSEMBLY "cc"

Notes:

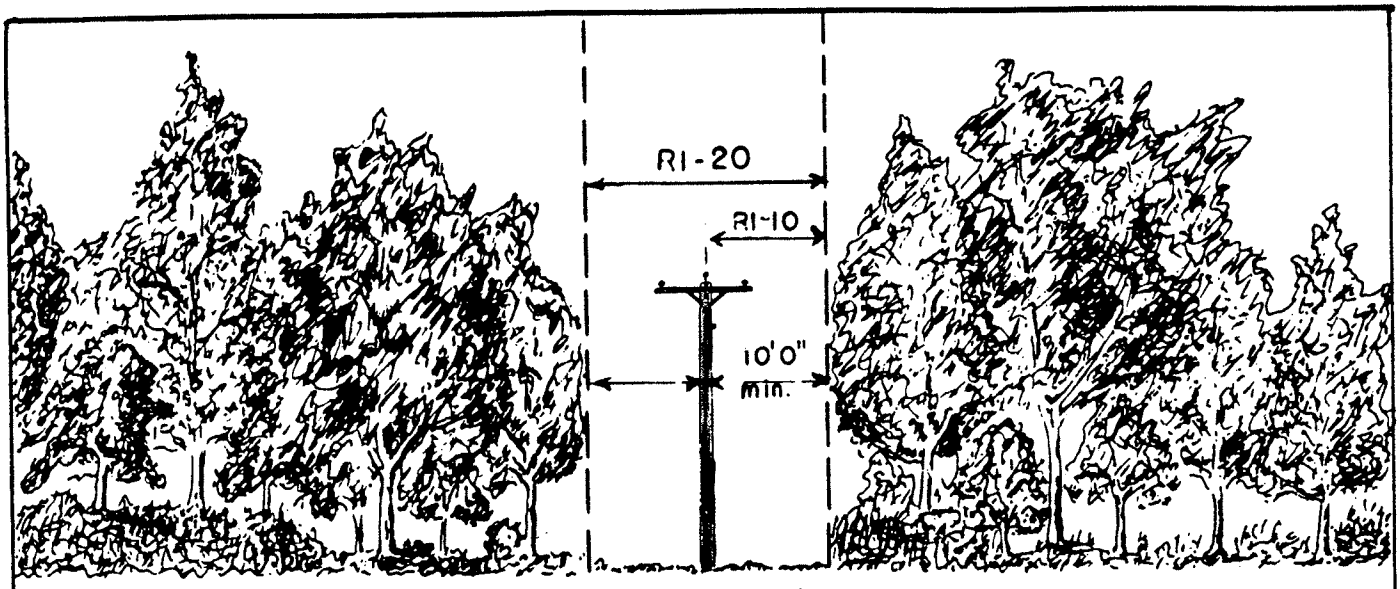
1. - Armor tape wrapping to extend not more than two wraps beyond the mouth of deadend clamp or spool insulator.
2. For 1/0 and larger use spool of 3" min. groove diameter on neutral and secondary deadends.

ITEM		MATERIAL		ITEM		MATERIAL	
l		Clamp, deadend					
s		Clevis, secondary, swinging, insulated					
bn		Clamp, loop deadend					

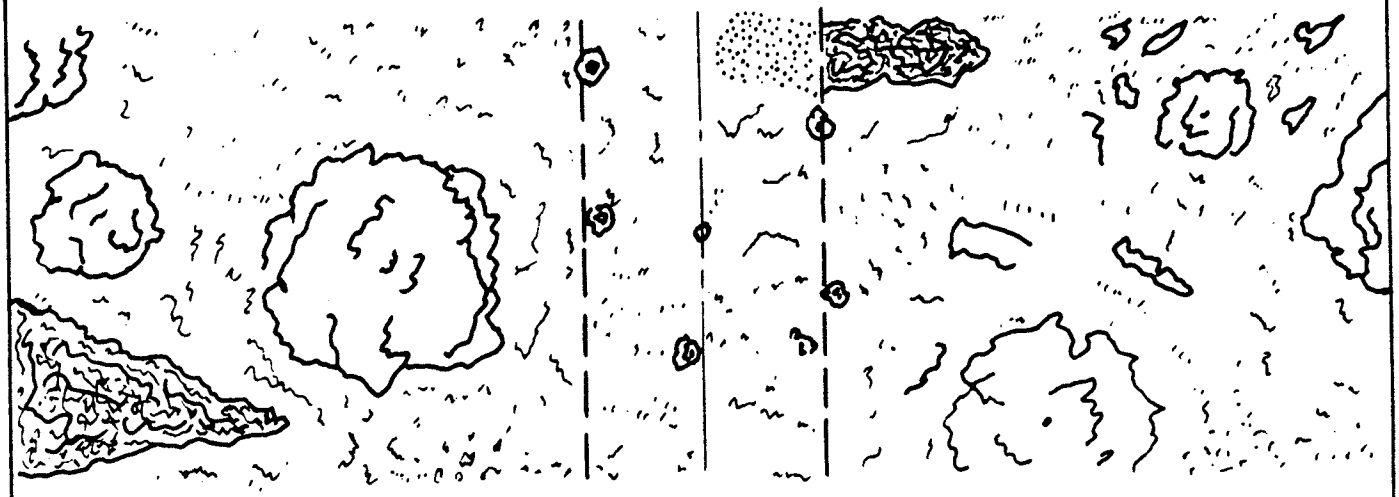
DEADEND ASSEMBLY GUIDE
DEADEND CLAMP METHOD
A.C.S.R. CONDUCTORS

Apr., 1983

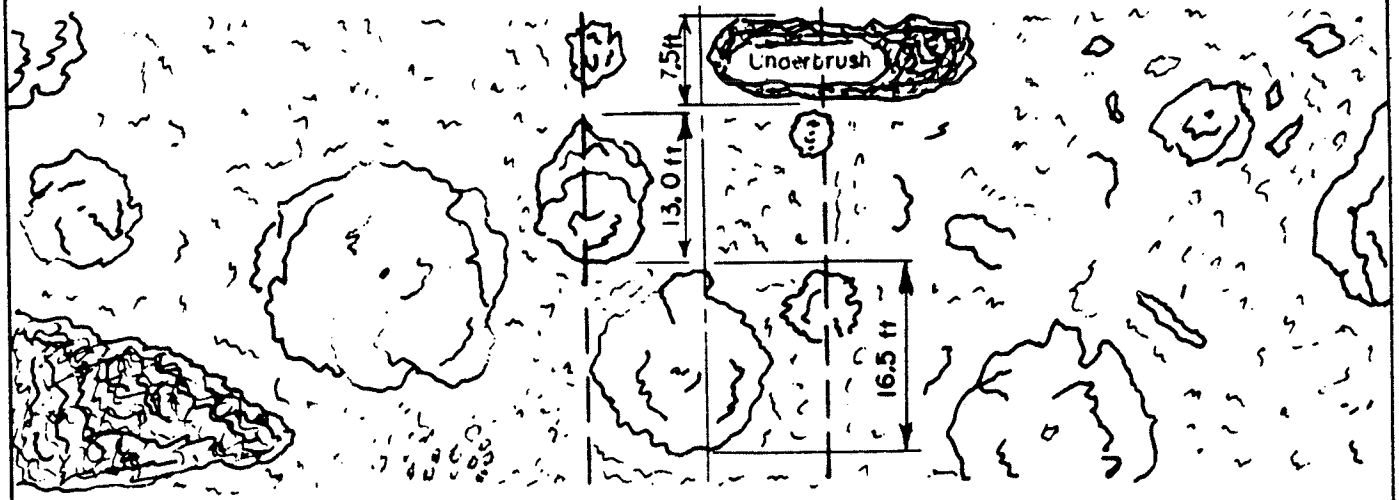
M42-11



ELEVATION



AFTER CLEARING

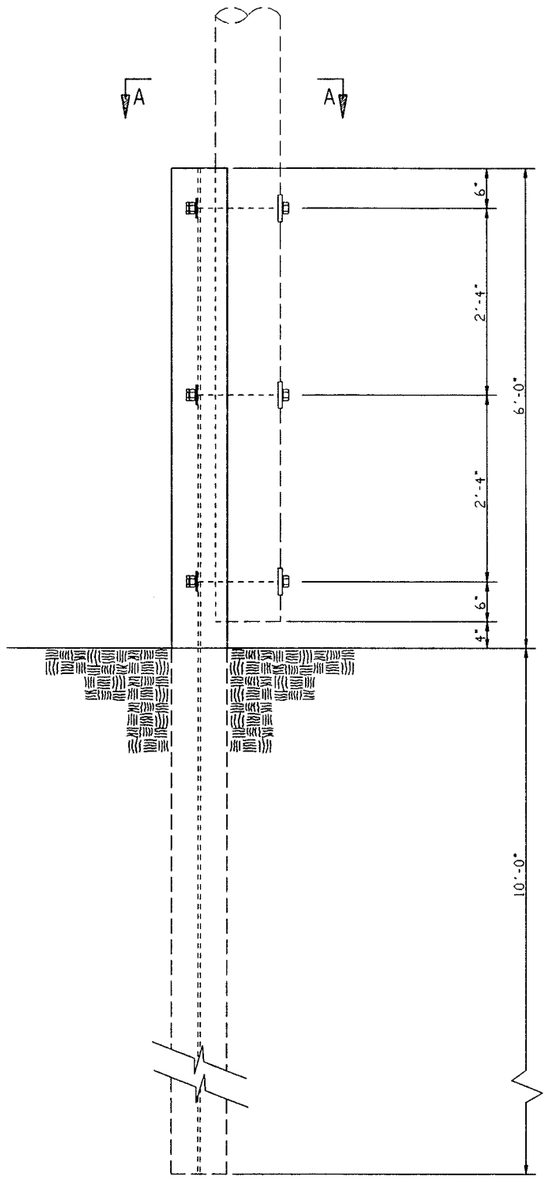


BEFORE CLEARING

CLEARING RIGHT-OF-WAY GUIDE

Jan 1, 1962

R1



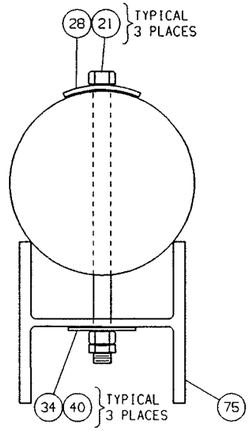
H-PILE

H-PILE FOUNDATION ASSEMBLY

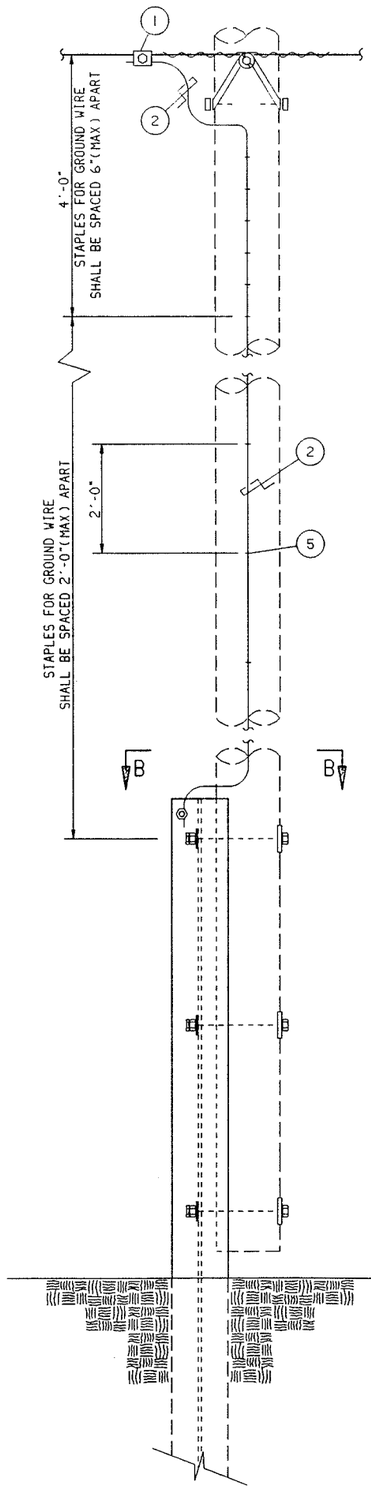
LIST OF MATERIALS H-PILE		
ITEM	QTY	DESCRIPTION
21	3	MACHINE BOLT,3/4"X LG REQD.W/NUT
28	3	CRV WASHER,7/8",4"X 4"X 1/4"
34	3	FLAT SQUARE WASHER,3/4",2 1/4"X 2 1/4"X 3/16"
40	3	MF LOCKNUT,3/4"
75	1	H-PILE,W8X48 ASTM-A36 STEEL,LENGTH SPECIFIED
	*	AS REQUIRED

NOTES

1. THRU-BOLT LENGTHS MAY VARY WITH POLE SIZE.
2. MATERIALS SHOWN ON THE MATERIAL LIST ARE SUBJECT TO SUBSTITUTION. ANY MATERIAL SUBSTITUTIONS SHALL BE IN CONFORMANCE WITH THE CONTRACT DOCUMENTS.



VIEW A-A
(TOP VIEW)



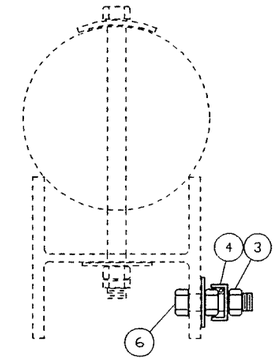
M2-11H

NEUTRAL GROUNDING ASSEMBLY
(H-PILE GROUND)

LIST OF MATERIALS M2-11H		
ITEM	QTY	DESCRIPTION
1	1	PARALLEL GROOVE CLAMP,NO. 2 ACSR TO NO. 6 CU
2	*	NO. 6 CU WIRE,SOFT DRAWN
3	1	SQUARE NUT,5/8"
4	1	BONDING CLIP,5/8"
5	*	STAPLES,CU WIRE,COPPERCOATED,2"X 1/2"X .162"
6	1	MACHINE BOLT,5/8" W/NUT
	*	AS REQUIRED

NOTES

1. THRU-BOLT LENGTHS MAY VARY WITH POLE SIZE.
2. MATERIALS SHOWN ON THE MATERIAL LIST ARE SUBJECT TO SUBSTITUTION. ANY MATERIAL SUBSTITUTIONS SHALL BE IN CONFORMANCE WITH THE CONTRACT DOCUMENTS.



VIEW B-B
(TOP VIEW)

REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
D	REFERENCE DRAWING				
D	ISSUED FOR RECORD	6-20-92	MWM	MWM	MWM
C	ISSUED FOR CONSTRUCTION	-	-	-	-
B	ISSUED FOR BIDDING	-	-	-	-
A	ISSUED FOR APPROVAL	-	-	-	-

REFERENCE DRAWINGS	
TYP	STRUCTURE ASSY DWGS
TYP	DISTRIBUTION DWGS

ALASKA ENERGY AUTHORITY

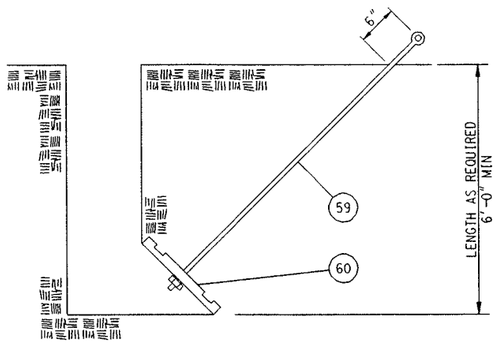
SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION

MISCELLANEOUS ASSEMBLIES
H-PILE & M2-11H

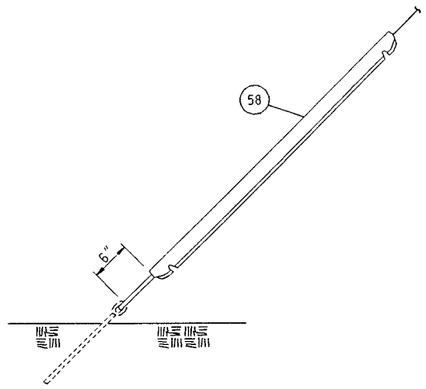
POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. MWM	9-3-91	JOB NO. 128002-01	
DRN. JSH	9-3-91	DRAWING NO. MS01	REV. △
CKD. MWM	6-6-92		
SCALE: NONE			

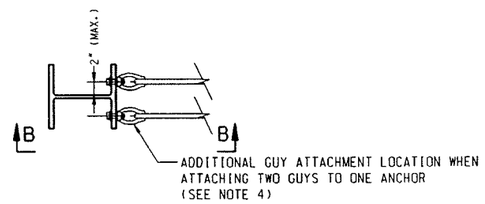
ms01.shn.pre



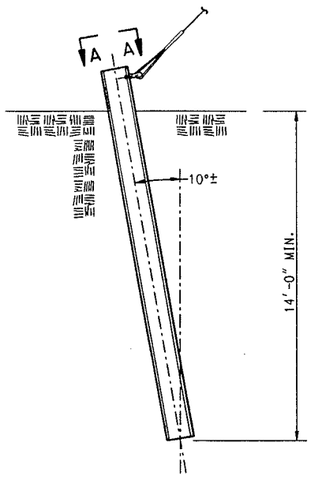
F1-4P
PLATE ANCHOR
(SEE NOTES 1 & 2)



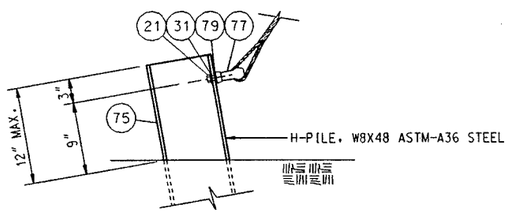
E3-10
GUY GUARD



VIEW A-A
GUY LEAD ATTACHMENTS
(FLANGE SIDE OF ANCHOR)



H-PILE ANCHOR
H-PILE ANCHOR ASSEMBLY



VIEW B-B
GUY LEAD ATTACHMENTS
(SIDE VIEW)

LIST OF MATERIALS F1-4P, E3-10 & H-PILE

ITEM	QUANTITY F1-4P	QUANTITY E3-10	QUANTITY H-PILE	DESCRIPTION
21	-	-	1+	MACHINE BOLT,3/4"X LG REQD
31	-	-	1+	ROUND WASHER,3/4"
58	-	1	-	GUY GUARD,8'-0",STEEL,TAPERED,7/16" EHS
59	1	-	-	ANCHOR ROD,TWINEYE,3/4"X 8'-0"
60	1	-	-	ANCHOR,PLATE,400 SQ.IN.,3/4"
75	-	-	1	H-PILE,W8X48,ASTM-A36 STEEL X LG REQD
77	-	-	1+	THIMBLEYENUT,3/4"
79	-	-	1+	SPRING LOCK WASHER,3/4"

\+ SEE NOTE 4

NOTES

1. IN ALL CASES THE ANCHOR ROD SHALL NOT EXTEND MORE THAN 8 INCHES ABOVE GROUND AFTER LOAD HAS BEEN APPLIED.
2. ALL ANCHOR RODS SHALL BE INSTALLED IN LINE WITH GUY STRAND.
3. ANY MATERIAL SUBSTITUTIONS SHALL BE MADE IN CONFORMANCE WITH THE CONTRACT DOCUMENTS. ALL SUBSTITUTED MATERIALS SHALL MEET APPLICABLE STANDARDS AND ENGINEER'S APPROVAL.
4. WHEN ATTACHING MORE THAN ONE GUY TO AN ANCHOR, ADJUST MATERIAL QUANTITIES ACCORDINGLY.

REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
E	REFERENCE DRAWING				
D	RECORD DRAWING	6-20-92	MWM	-	-
C	ISSUED FOR CONSTRUCTION	-	-	-	-

REFERENCE DRAWINGS	
TYP	STRUCTURE DWG
TYP	PLAN & PROFILE
GD01	GUYING ASSEMBLIES
MS01	MISCELLANEOUS ASSYS

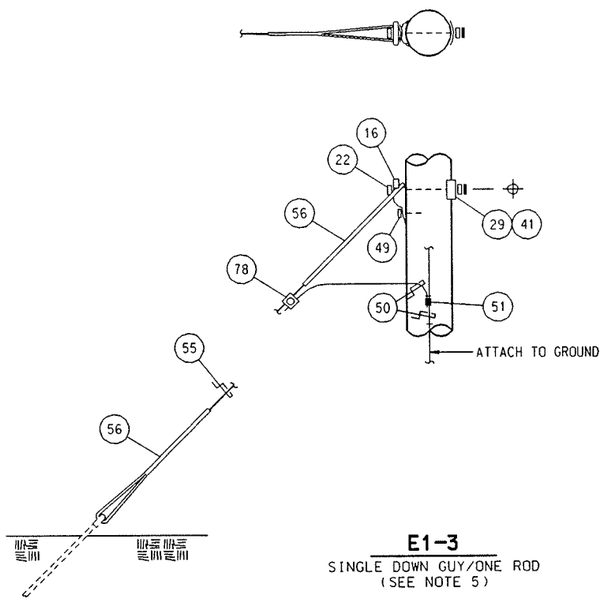
ALASKA ENERGY AUTHORITY

SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION

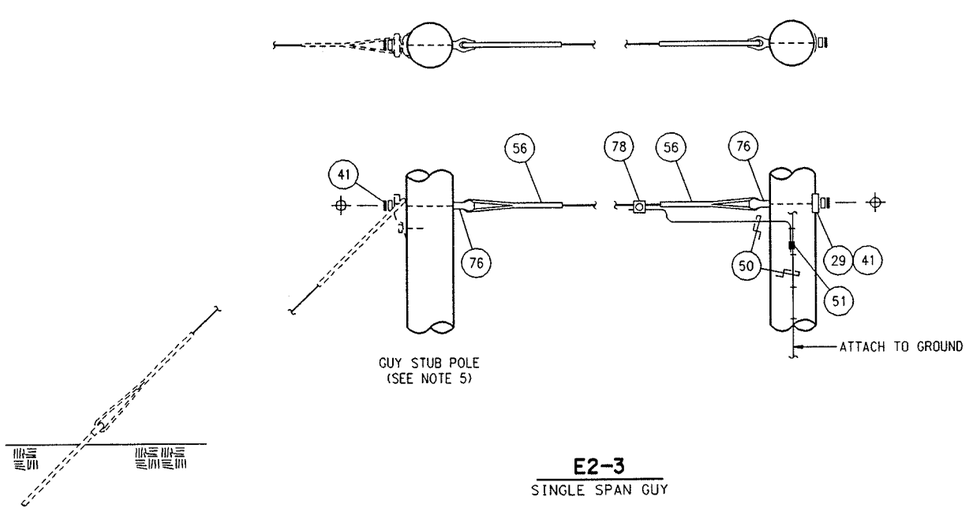
GUYING & ANCHOR ASSEMBLIES
F1-4P, E3-10 & H-PILE

POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. MWM	9-3-91	JOB NO. 128002-01
DRN. JSH	9-3-91	DRAWING NO. AD01
CKD.		REV. C
SCALE: NONE		128gd01.dgn



E1-3
SINGLE DOWN GUY/ONE ROD
(SEE NOTE 5)



GUY STUB POLE
(SEE NOTE 5)

E2-3
SINGLE SPAN GUY

LIST OF MATERIALS E1-3 & E2-3

ITEM	QUANTITY E1-3	QUANTITY E2-3	DESCRIPTION
16	1	-	GUY HOOK,5/8" BOLT
22	1	-	MACHINE BOLT,5/8"X LG REQD
29	1	1	CRV WASHER,5/8",3"X 3"
41	1	2	MF LOCKNUT,5/8"
49	1	-	LAG SCREW,1/2"X 4 1/2"
50	*	*	GROUND WIRE,NO. 6 COPPER,SOFT DRAWN
51	1	1	COMP CONN,NO. 6 SOFT DRAWN CU WIRE
55	*	*	WIRE,GUY STRAND,7/16" EHS,7 STRAND
56	2	2	GUY GRIP,7/16" EHS,FORM TYPE
76	-	2	BOLT,5/8",STRAIGHT THIMBLEYE,LG AS REQD
78	1	1	PARALLEL GROOVE CLAMP,7/16" EHS TO NO. 6 CU

* AS REQUIRED

NOTES

1. THRU BOLT LENGTHS WILL VARY WITH POLE SIZE.
2. FIELD DRILL ALL BOLT HOLES TO SPECIFIED ANGLES.
3. SEE CORRESPONDING STAKING SHEETS, ASSEMBLY DRAWINGS AND GUY ARRANGEMENT DRAWINGS FOR GUY ATTACHMENT LOCATIONS.
4. ANY MATERIAL SUBSTITUTIONS SHALL BE MADE IN CONFORMANCE WITH THE CONTRACT DOCUMENTS. ALL SUBSTITUTED MATERIALS SHALL MEET APPLICABLE STANDARDS AND ENGINEER'S APPROVAL.
5. WHEN E1-3 IS USED WITH E2-3 ASSEMBLY, SUBSTITUTE THE 5/8" MACHINE BOLT WITH 5/8" THIMBLE EYE BOLT ON GUY HOOK ATTACHMENT ON GUY STUB POLE.

REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
A	RECORD DRAWING	6/20/92	MWM	-	-
A	ISSUED FOR CONSTRUCTION	-	-	-	-

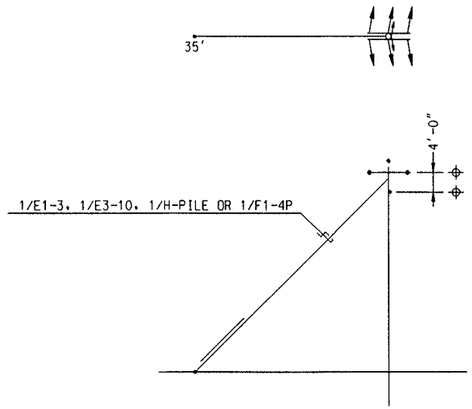
REFERENCE DRAWINGS	
TYP	STRUCTURE DWG
TYP	PLAN & PROFILE
GA01	GUYING ARRANGEMENTS
AD01	ANCHOR ASSEMBLIES

ALASKA ENERGY AUTHORITY
SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION
GUYING ASSEMBLIES
E1-3 & E2-3

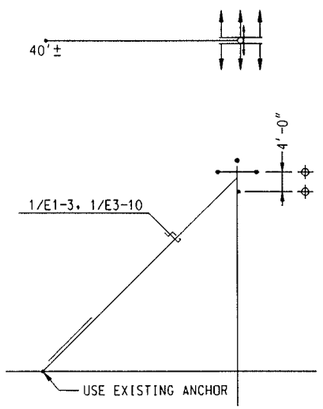
POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. MWM	11-11-91	JOB NO. 128002-01
DRN. JSH	11-12-91	DRAWING NO. GD01
CKD. MWM	6-20-92	REV. A
SCALE: NONE		

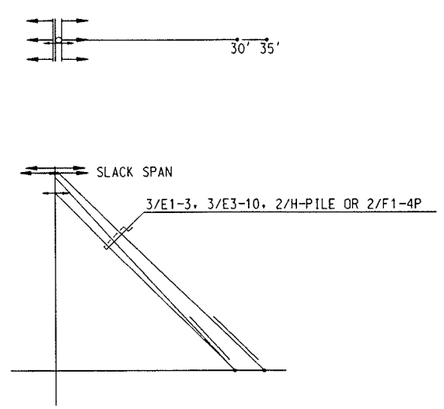
1280gd01.dgn



STRUCTURE C2
(0°-20°)



STRUCTURE 12
(C2)



STRUCTURE C8-3
(0°-DDE, UNBALANCED LOADS)

CONDUCTOR DATA

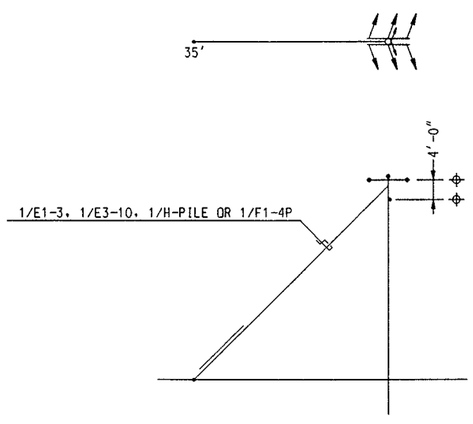
SIZE: NO. 2
NAME: SPARATE
MATERIAL: ACSR
STRANDING: 7/1

DESIGN DATA

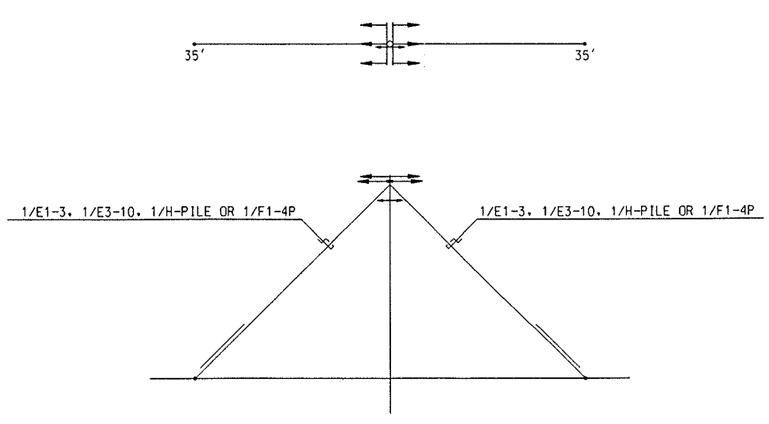
RULING SPAN: 325 FT.
BASE POLE: 35'-5
MIN. GROUND CLEARANCE: 18.5 FT. AT 167 DEGS. F
DISTRIBUTION VOLTAGE: 7.2/12.5KV
ZONE LOADING: .5" ICE, 4 LBS. WIND AT 0 DEGS. F (NESC HEAVY)
GUY DESIGN TENSION:2182 LBS. (1" ICE)

NOTES

1. SEE STAKING SHEETS FOR ADDITIONAL GUYING INFORMATION.
2. ANCHOR LOCATIONS ARE FIELD STAKED. EXCEPT FOR C8-2 (0°-DDE) STRUCTURE.



STRUCTURE C8-2
(20°-40°)



STRUCTURE C8-2
(0°, DDE)

REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
D	RECORD DRAWINGS	6/20/92	MWM	—	—
A	ISSUED FOR CONSTRUCTION	—	—	—	—

REFERENCE DRAWINGS	
TYP	STRUCTURE DWG
TYP	PLAN & PROFILE

ALASKA ENERGY AUTHORITY

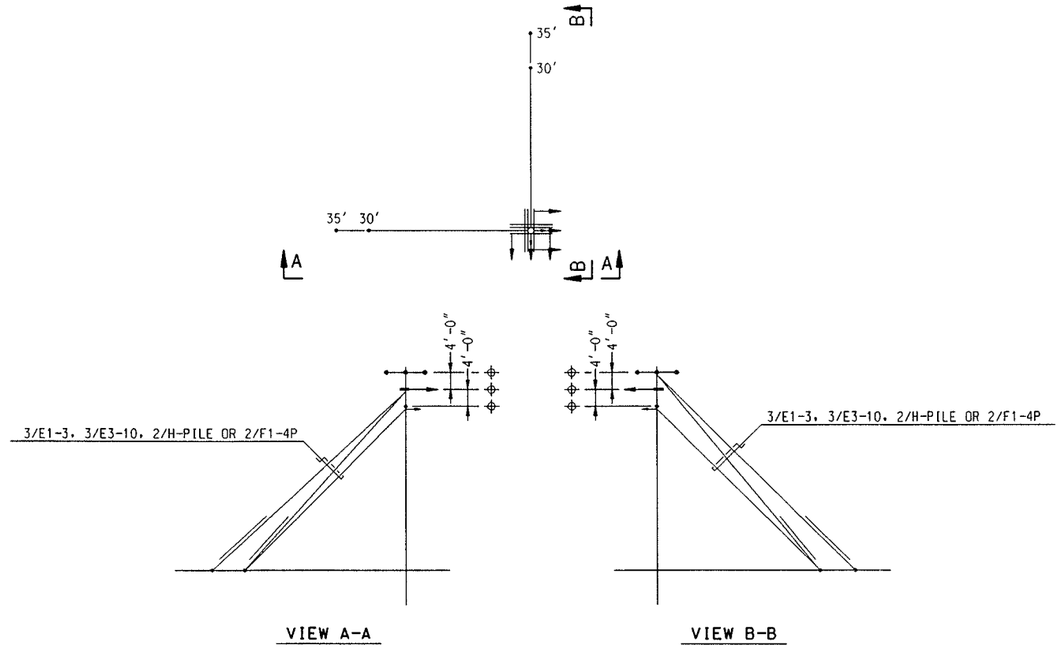
SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION

GUYING ARRANGEMENTS
C2, C8-2 & C8-3

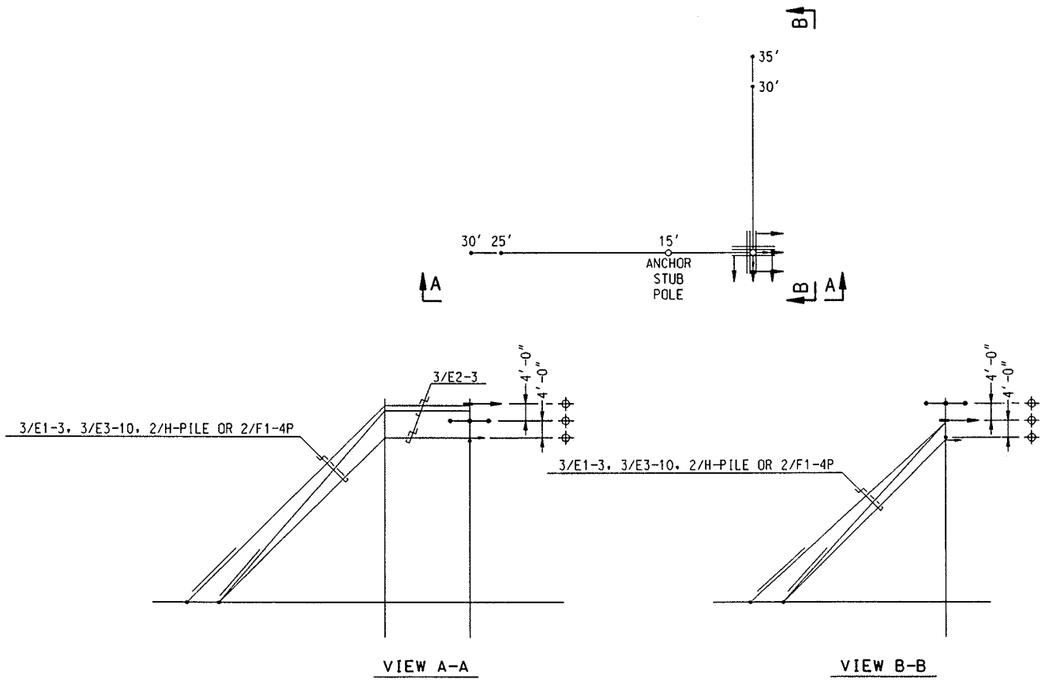
POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. MWM	11-13-91	JOB NO. 128002-01
DRN. JSH	11-13-91	DRAWING NO. GA01
CKD. MWM	6/20/92	REV. D
SCALE: NONE		

128ga01.dgn



STRUCTURE C7-1
(60°-90°, DDE BUCKARM)



STRUCTURE C7-1
(40°-60°, DDE BUCKARM)

CONDUCTOR DATA

SIZE: NO. 2
NAME: SPARATE
MATERIAL: ACSR
STRANDING: 7/1

DESIGN DATA

RULING SPAN: 325 FT.
BASE POLE: 35'-5
MIN. GROUND CLEARANCE: 18.5 FT. AT 167 DEGS. F
DISTRIBUTION VOLTAGE: 7.2/12.5KV
ZONE LOADING: .5" ICE, 4 LBS. WIND AT 0 DEGS. F (NESC HEAVY)
GUY DESIGN TENSION:2182 LBS. (1" ICE)

NOTES

1. SEE STAKING SHEETS FOR ADDITIONAL GUYING INFORMATION.
2. ANCHOR LOCATIONS ARE FIELD STAKED. EXCEPT FOR C8-2 (0° DDE) STRUCTURE.

REV	DESCRIPTIONS	DATE	BY	CKD.	APPD.
B	RECORD DRAWING	6/20/92	MWM	—	—
A	ISSUED FOR CONSTRUCTION	—	—	—	—

REFERENCE DRAWINGS	
TYP	STRUCTURE DWG
TYP	PLAN & PROFILE

ALASKA ENERGY AUTHORITY
SHUNGNAK - KOBUK TIE LINE
7.24/12.47KV DISTRIBUTION
GUYING ARRANGEMENTS
STRUCTURE C7-1

POWER ENGINEERS
3940 GLENBROOK DRIVE
HAILEY, IDAHO 83333

DSGN. MWM	11-13-91	JOB NO. 128002-01	
DRN. JSH	11-13-91	DRAWING NO. GA02	REV. B
CKD. MWM	6-20-92		
SCALE: NONE			

1280g02.dgn

PART VII

APPENDIX

SHUNGNAK GENERATION BUILDING LAYOUT SKETCHES

POWER ENGINEERS

BY MWM DATE 11/27/91

SUBJECT SHUNGNAK-KOBUK TIE LINE PROJECT
SHUNGNAK GEN BLDG

JOB. NO. 128002
SHEET NO. 1 OF 2
CK. BY _____ DATE _____

SHUNGNAK GENERATION

* STR 1A LOCATION.
RESTAKE STR 1A 5' NORTH OF CURRENT STAKED LOCATION
MAINTAIN 15' WEST OF SHED.

* REF DRAWING NO. 01

POWER ENGINEERS

BY MWM DATE 11/27/91

SUBJECT SHUNGNAK - KOBUK TIE LINE PROJECT SHUNGNAK GEN BLDG

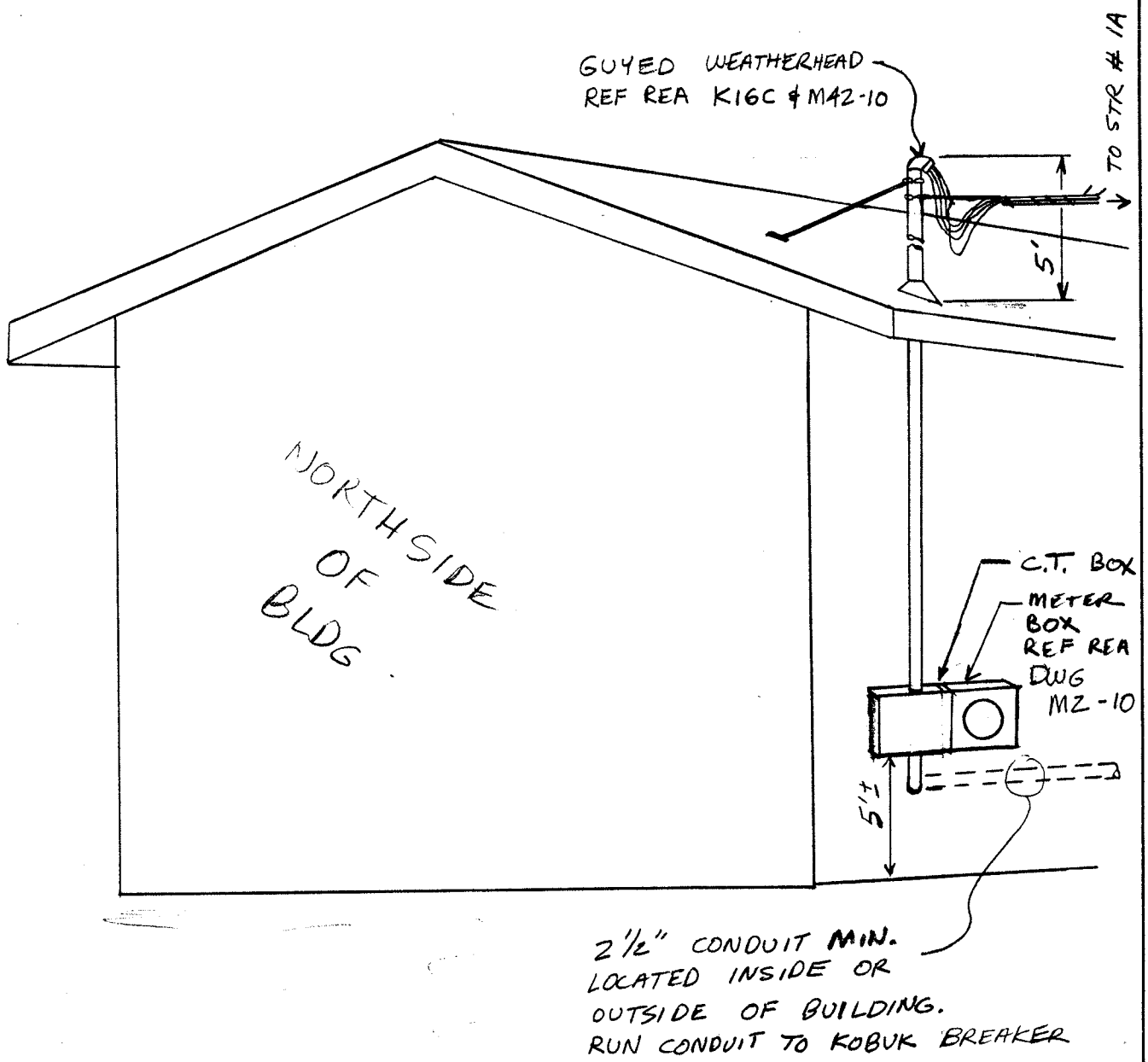
JOB. NO. 128002

SHEET NO. 2 OF 2

CK. BY _____ DATE _____

SHUNGNAK GENERATOR BUILDING
SERVICE WIRE ATTACHMENT

VIEW A-A



SHUNGNAK GENERTOR BUILDING
(LOOKING SOUTH EAST)

KOBUK AIRSTRIP MARKER BALL INSTALLATION SKETCH

Engineers Incorporated

SUBJECT SHUNGNAK-KOBUK TIE LINE PROJECT — MARKER BALL LOCATIONS

JOB. NO. 128002-02

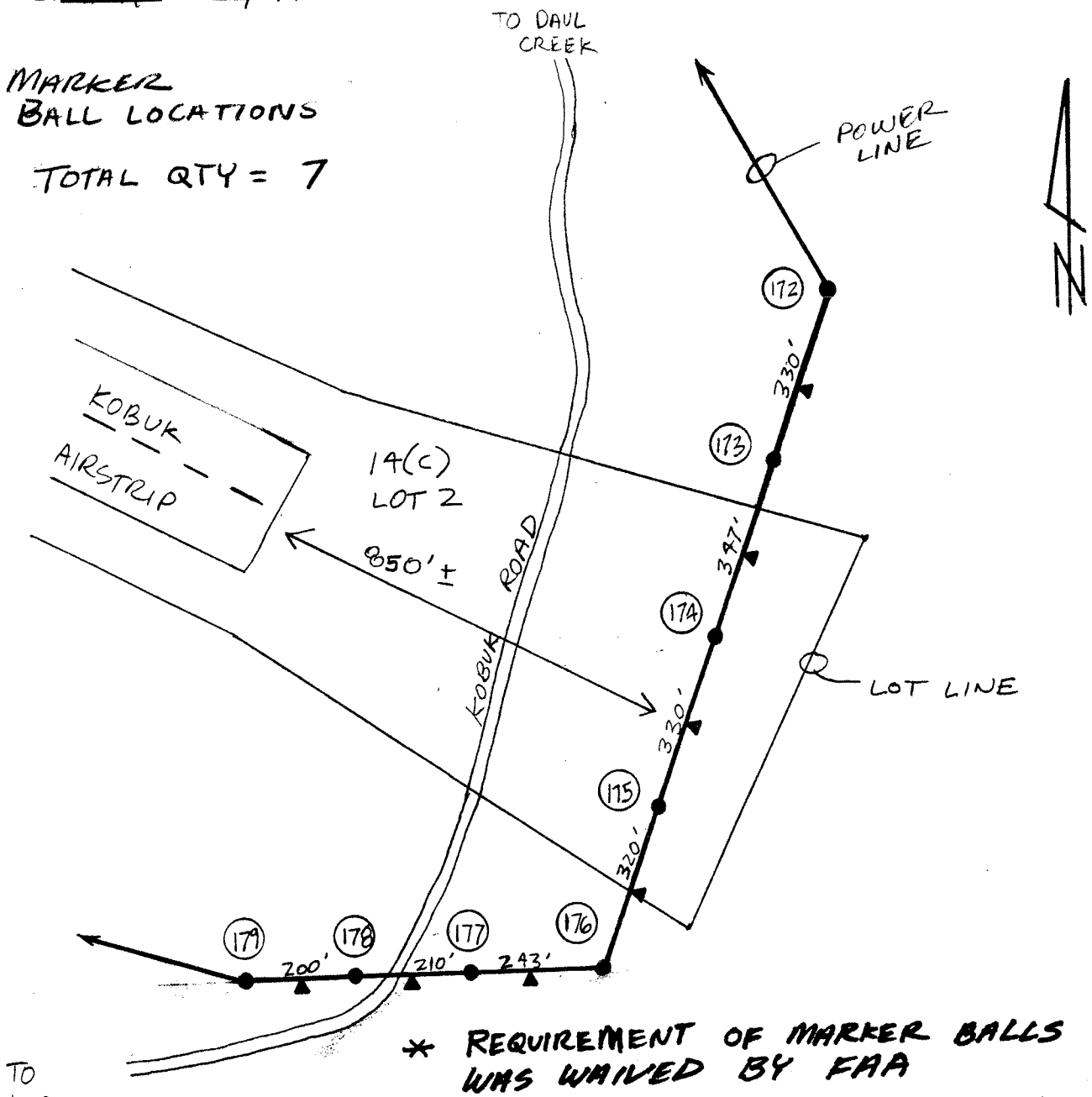
SHEET NO. ___ OF ___

BY MMM DATE 12/4/91

CK. BY ___ DATE ___

MARKER BALL LOCATIONS

TOTAL QTY = 7



* REQUIREMENT OF MARKER BALLS WAS WAIVED BY FAA

* MARKER BALLS WERE NOT INSTALLED

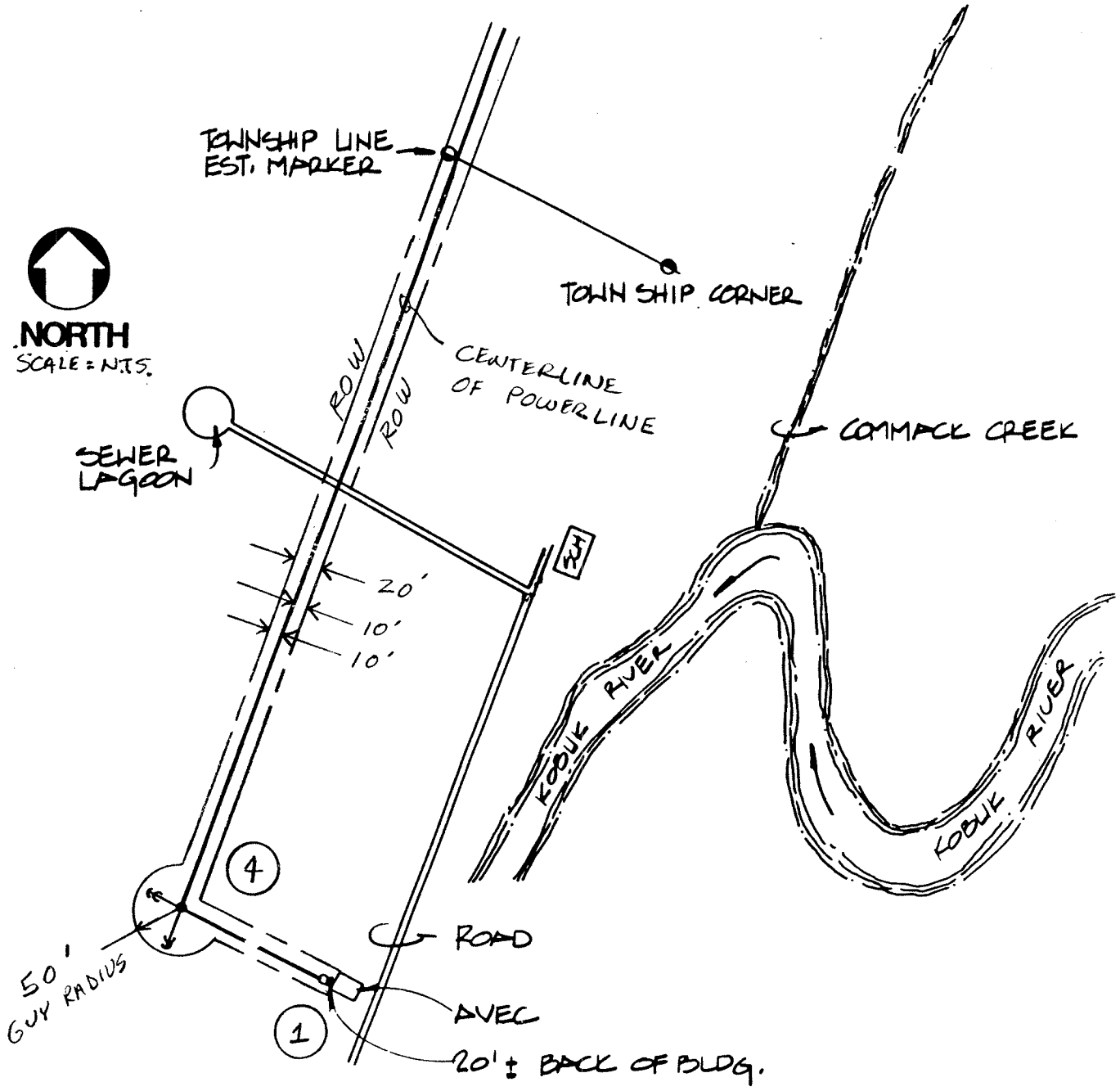
LEGEND

● = STRUCTURE LOCATION

(172) = STRUCTURE NUMBER

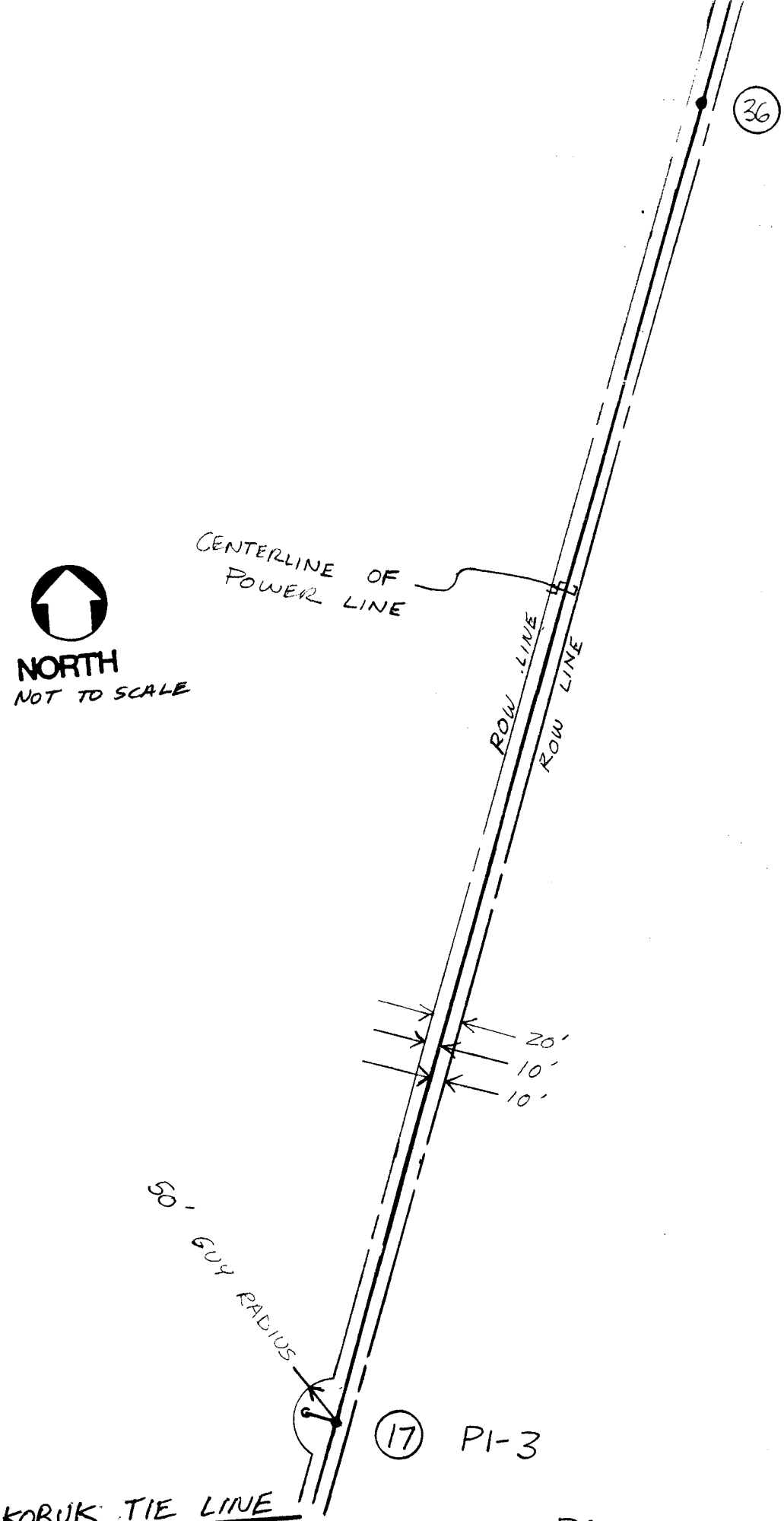
▲ = MARKER BALL LOCATION (ONE PER SPAN, LOCATED IN MID SPAN ON NEUTRAL CONDUCTOR)

RIGHT OF WAY SKETCHES

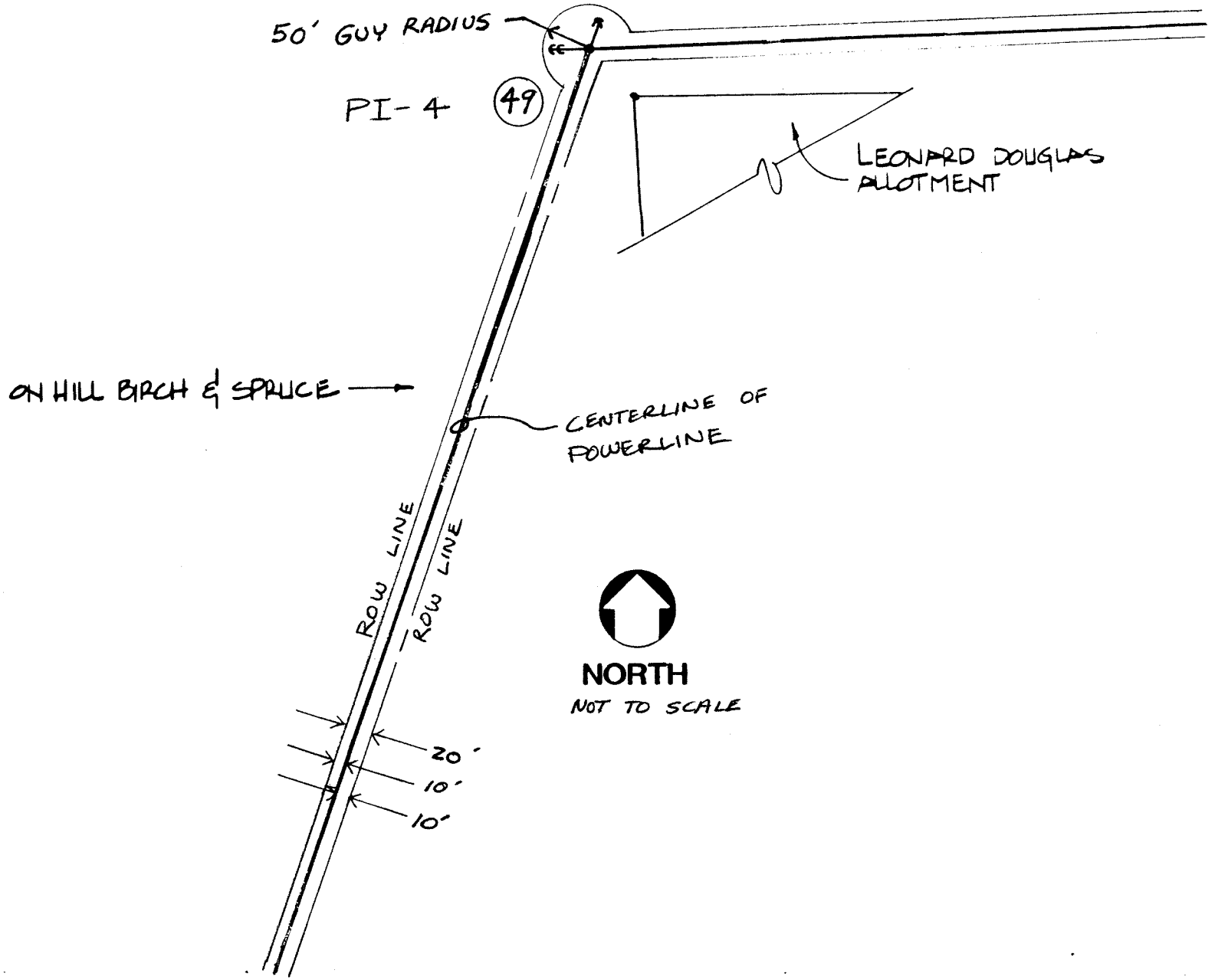


SHUNGNAK- KOBUK TIE LINE

R-O-W SKETCH 9/30/91

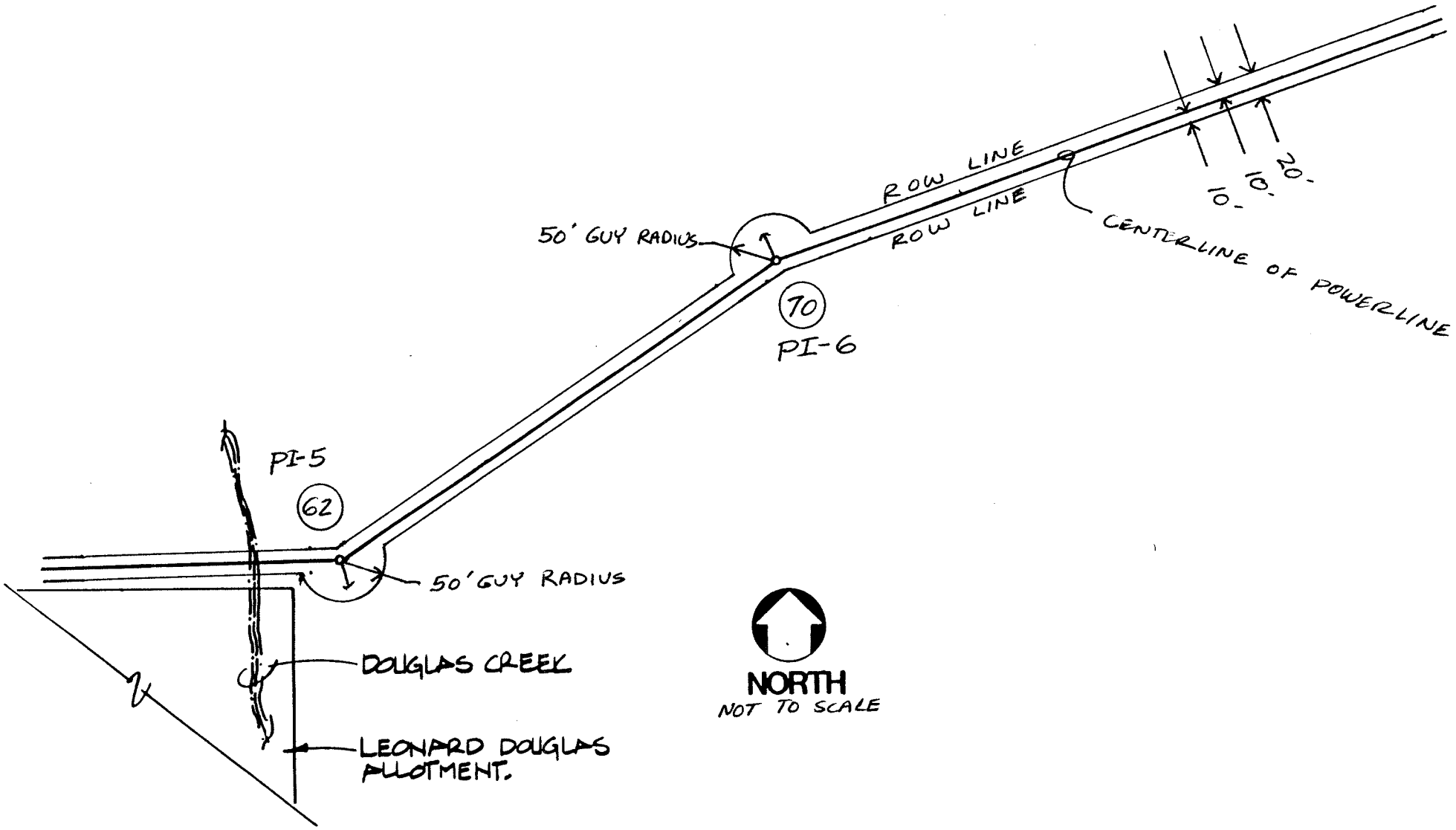


SHUNGNAK - KOBUK TIE LINE
R-O-W SKETCH 9/30/91



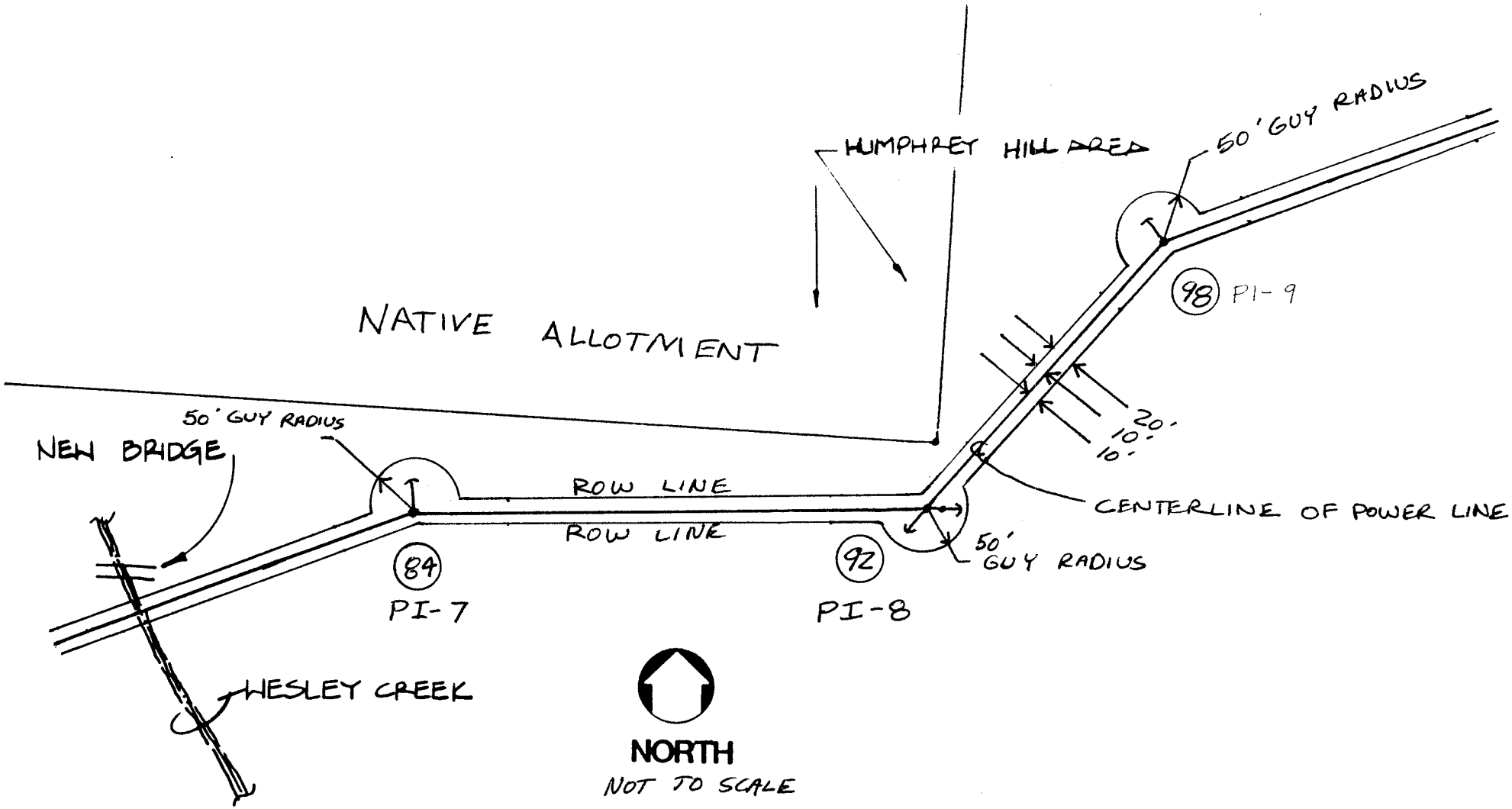
SHUNGNAK - KOBUK TIE LINE

R-O-W SKETCH 9/30/91



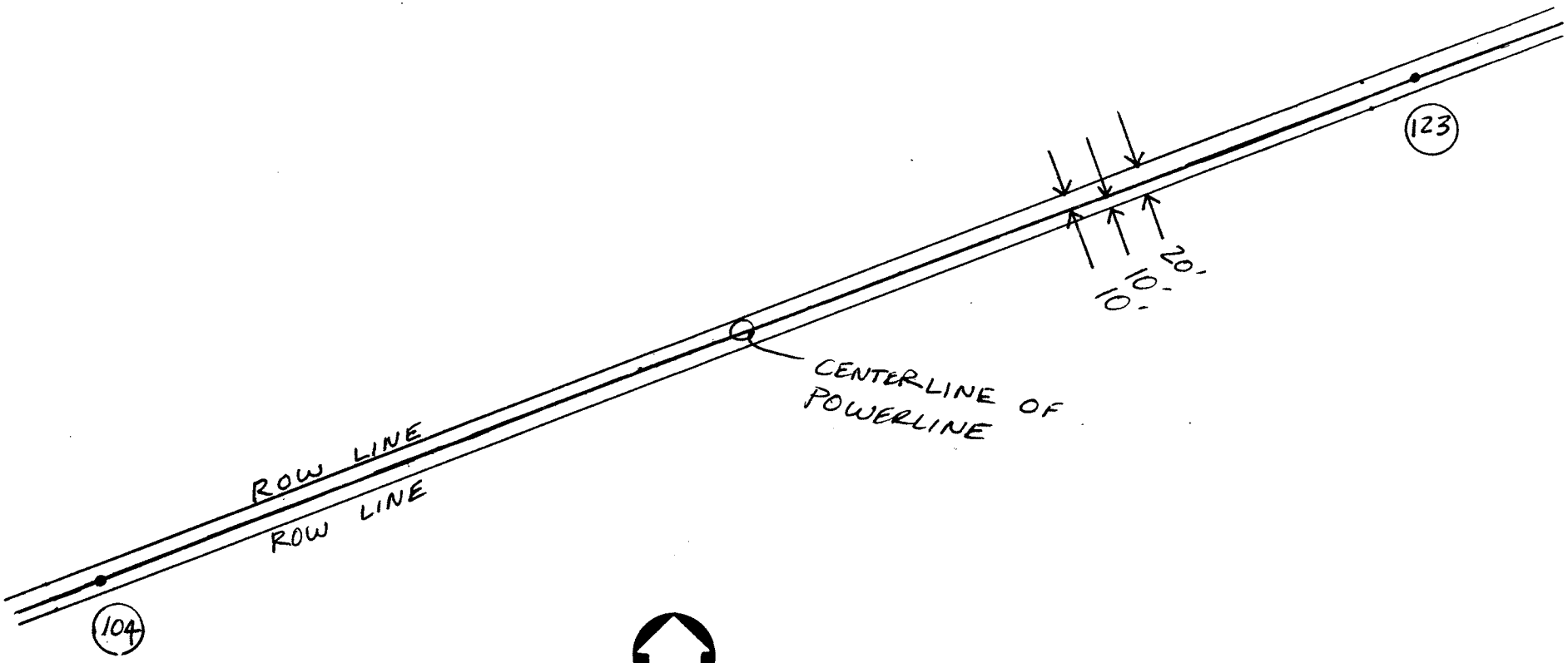
SHUNGNAK - KOBUK TIE LINE

ROW SKETCH 9/30/91



SHUNGNAK- KOBUK TIE LINE

ROW SKETCH 9/30/91

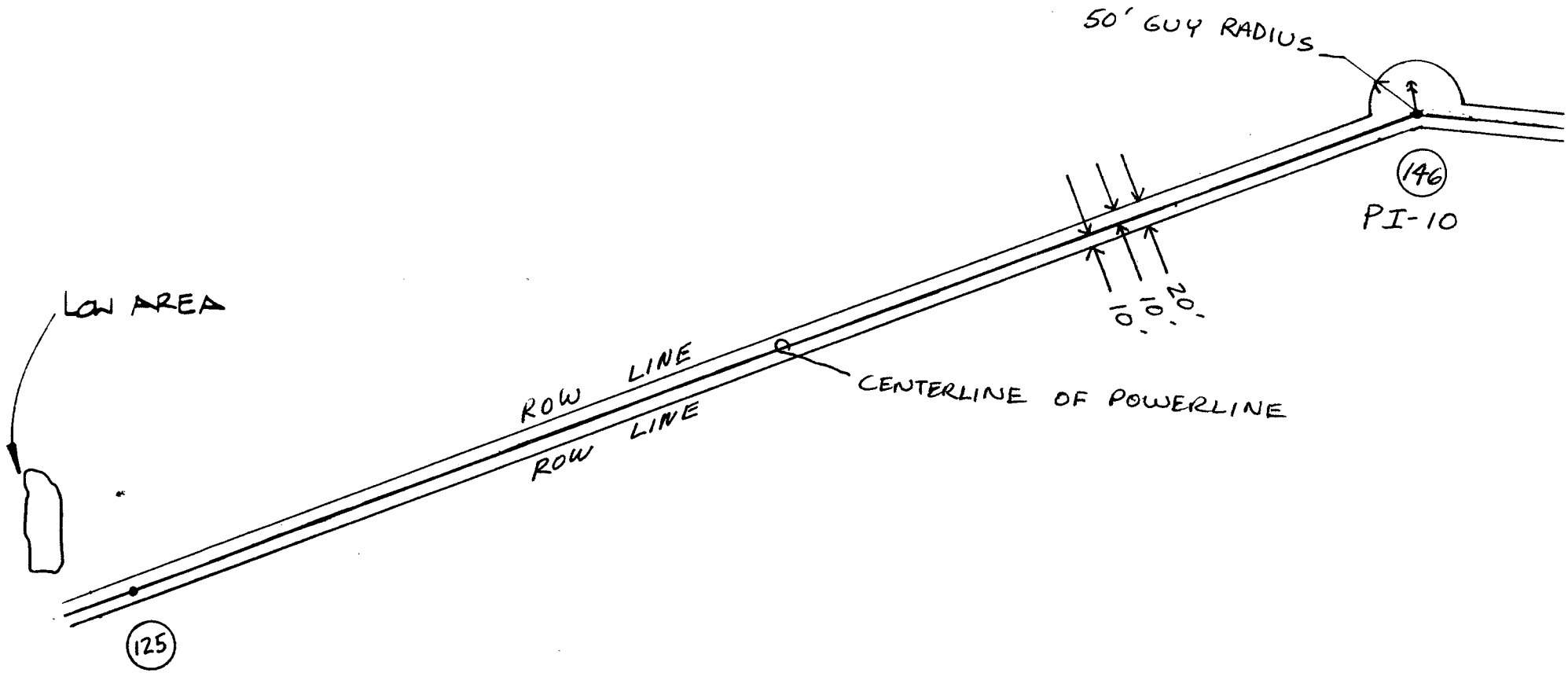


NORTH

NOT TO SCALE

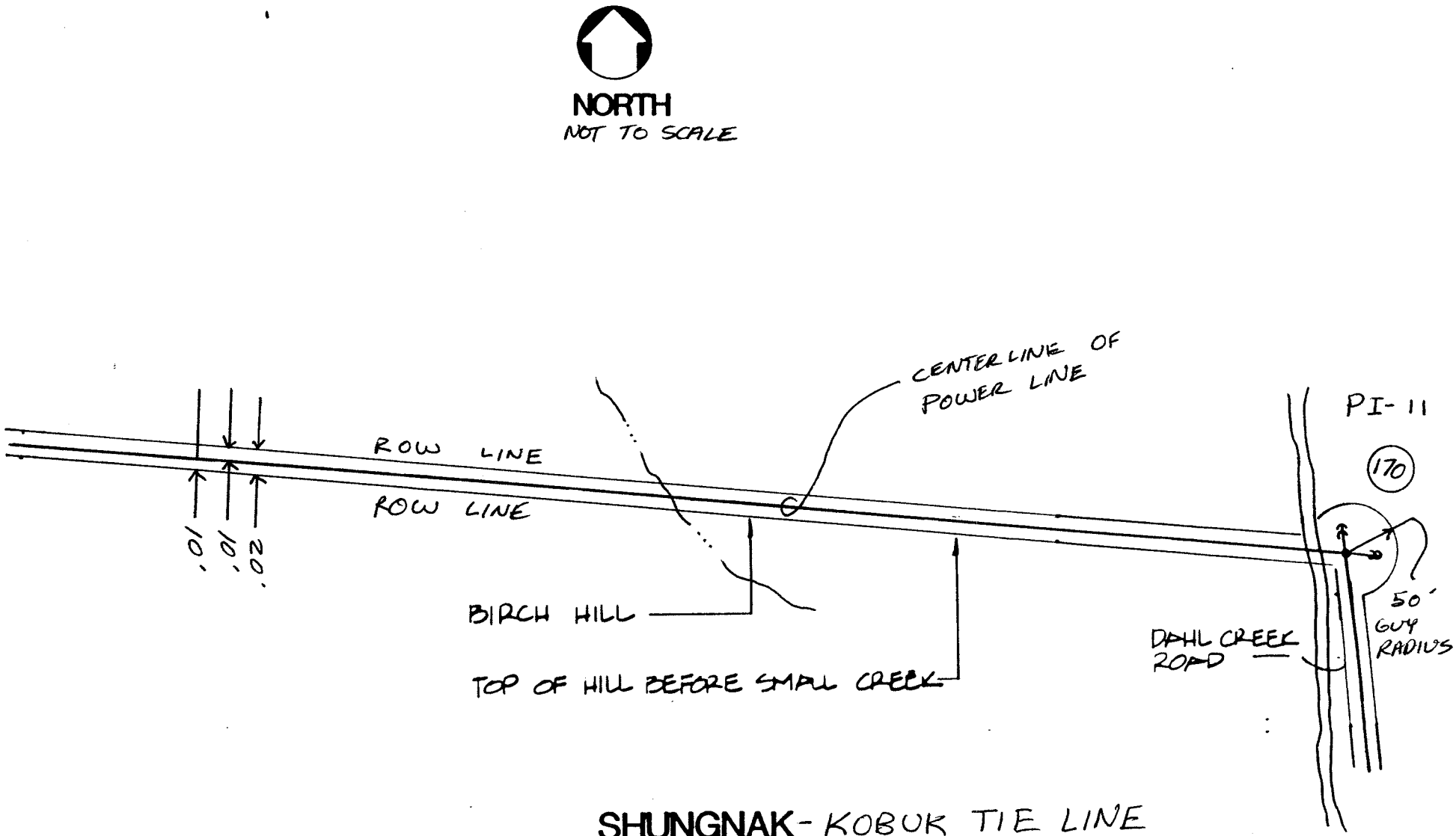
SHUNGNAK - KOBUK TIE LINE

ROW SKETCH 9/30/91



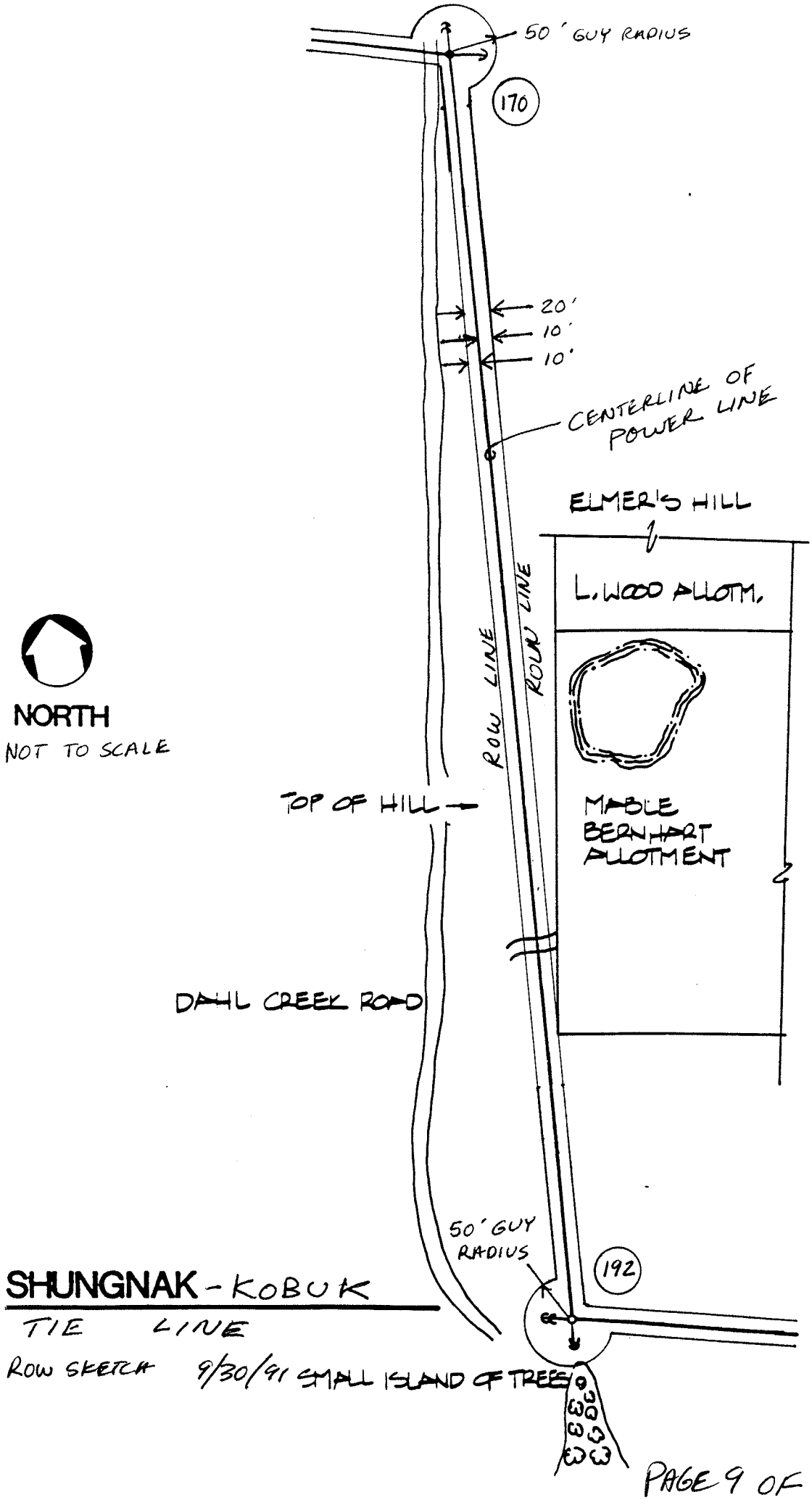
SHUNGNAK - KOBUK TIE LINE

ROW SKETCH 9/30/91



SHUNGNAK - KOBUK TIE LINE

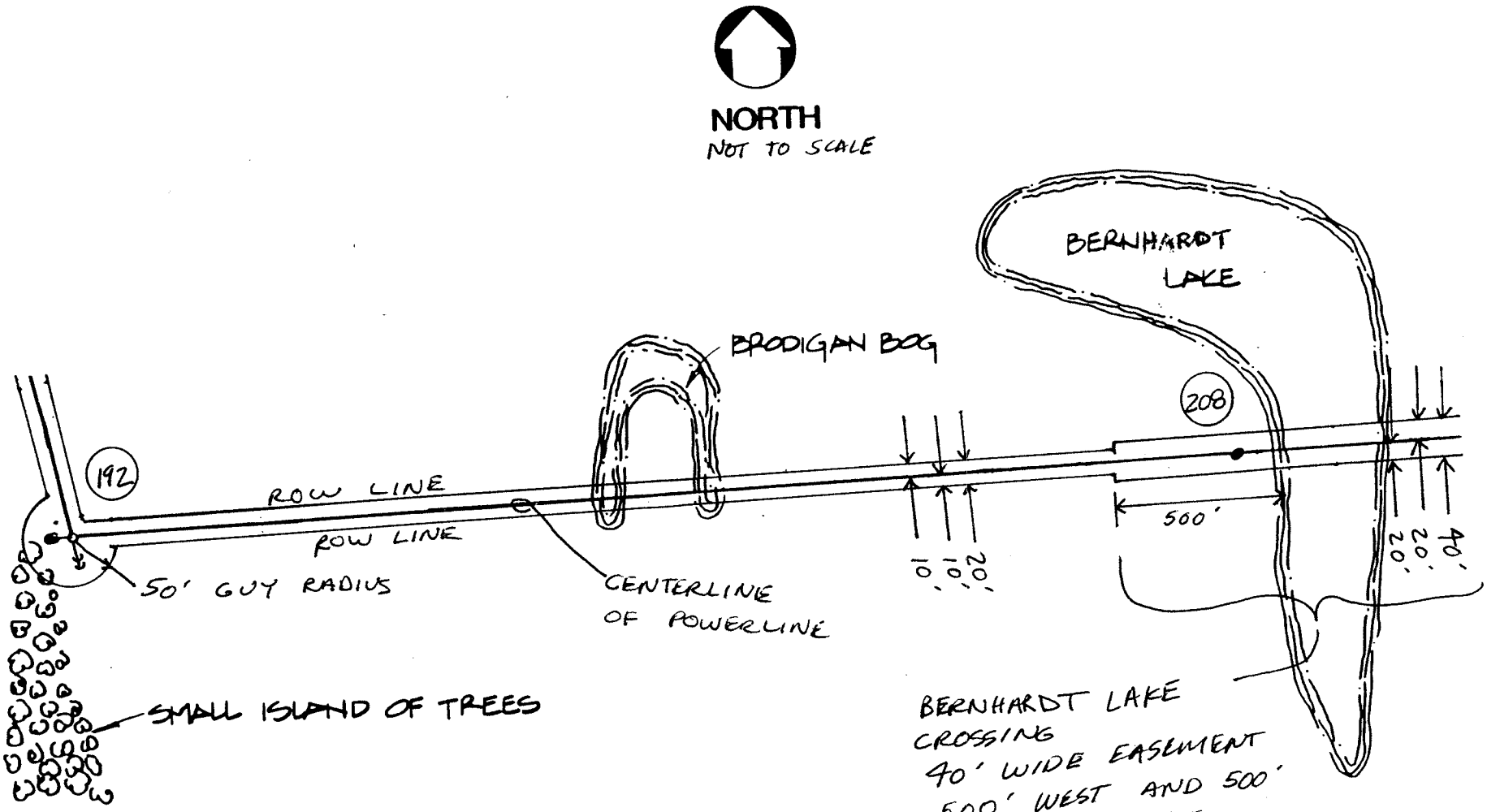
ROW SKETCH 9/30/91



SHUNGNAK - KOBUK

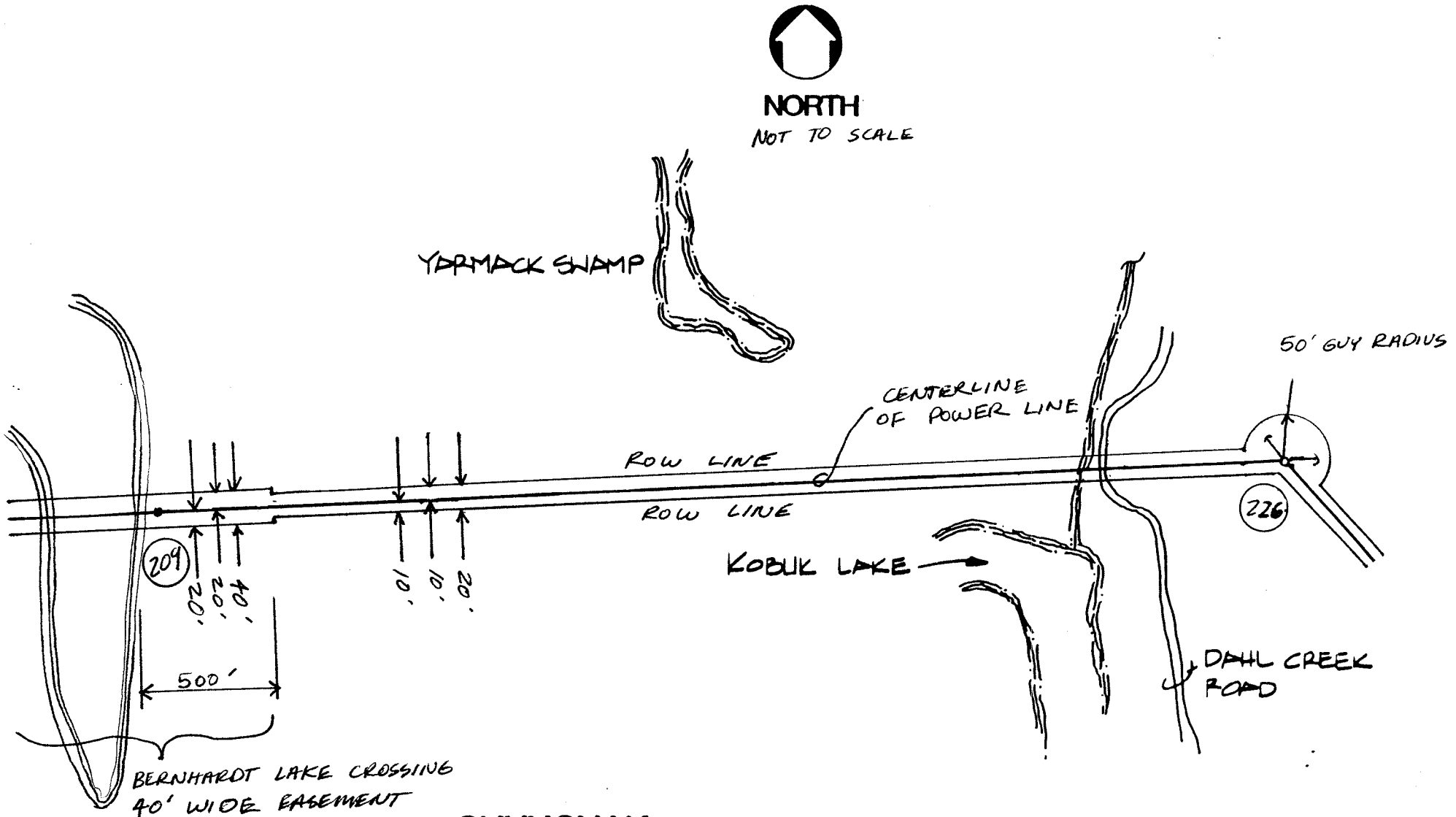
TIE LINE

ROW SKETCH 9/30/91 SMALL ISLAND OF TREES



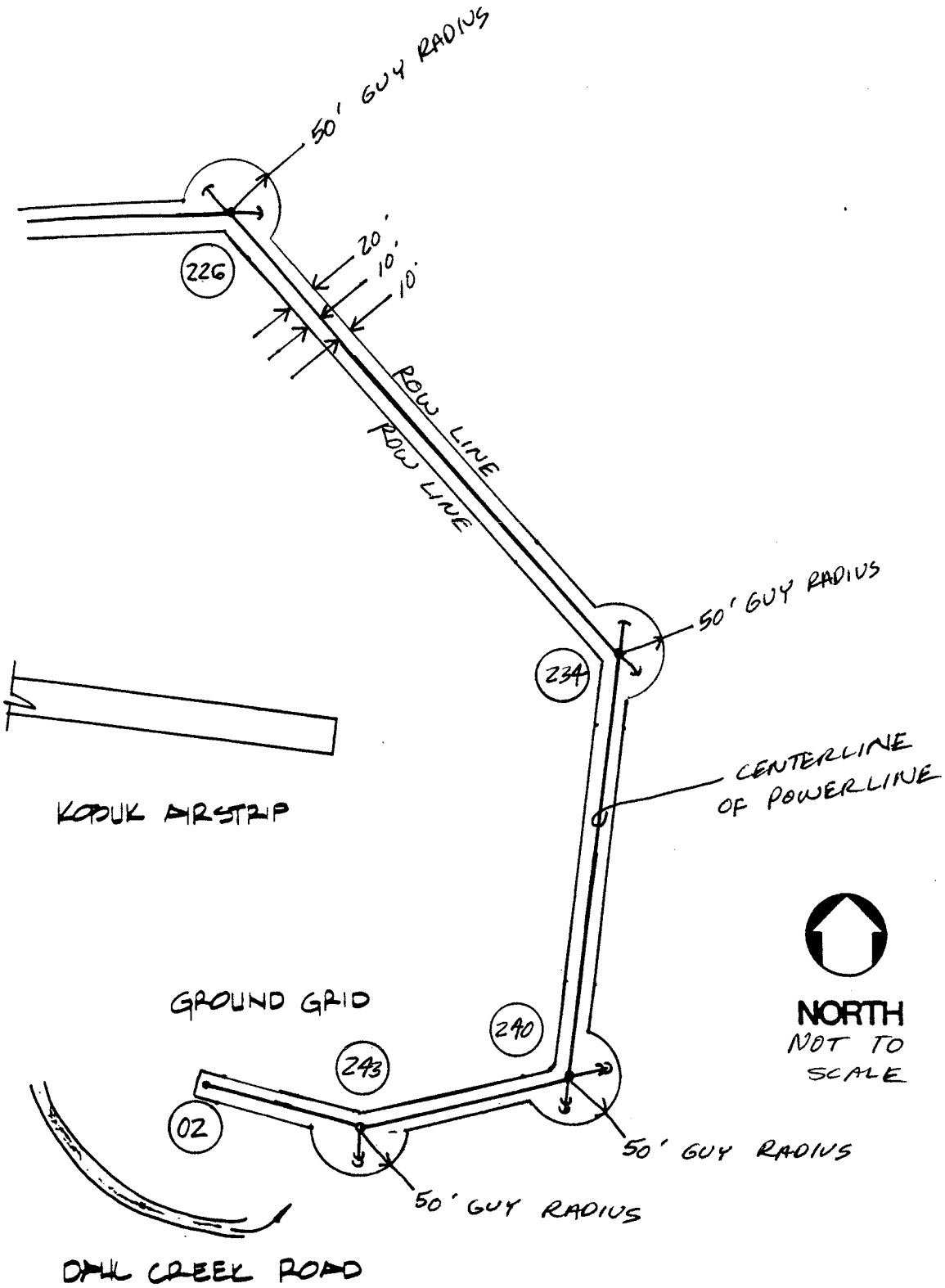
SHUNGNAK - KOBUK TIE LINE

ROW SKETCH 9/30/91



SHUNGNAK - KOBUK TIE LINE

ROW SKETCH 9/30/91



SHUNGNAK– KOBUK TIE LINE

ROW SKETCH 9/30/91