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Design Guide for Rural Substations



REA BULLETIN 65-1, 1978

- GOOD DOCUMENT
- UPDATED
- INCORPORATED NEW TECHNOLOGY

SUMMARY OF CHANGES

- CHAPTER 1 - INTRODUCTION
- CHAPTER 2 - GENERAL DESIGN CONSIDERATIONS
- **CHAPTER 3 - DOCUMENTS**
- CHAPTER 4 - PHYSICAL LAYOUT
- **CHAPTER 5 - MAJOR EQUIPMENT**
- CHAPTER 6 - SITE DESIGN
- CHAPTER 7 - STRUCTURES
- CHAPTER 8 - FOUNDATIONS
- **CHAPTER 9 - GROUNDING**
- CHAPTER 10 - INSULATED CABLES AND RACEWAY
- CHAPTER 11 - CORROSION
- **CHAPTER 12 - PROTECTIVE RELAYING**

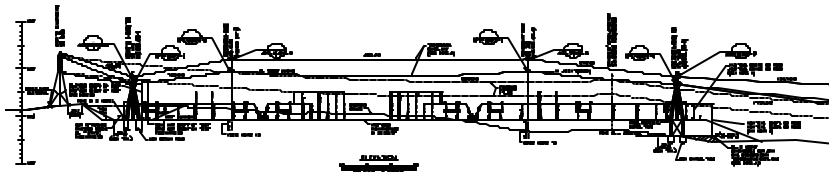
SUMMARY OF CHANGES

- CHAPTER 13 - INSTRUMENTS, TRANSDUCERS, AND METERS
- **CHAPTER 14 - SUBSTATION AUTOMATION - NEW**
- CHAPTER 15 - AC AND DC AUXILIARY SYSTEMS
- **CHAPTER 16 - CONTROL HOUSES**
- **CHAPTER 17 - COMMUNICATIONS**
- CHAPTER 18 - INSPECTION
- CHAPTER 19 - TESTS
- CHAPTER 20 - MAINTENANCE
- CHAPTER 21 - UPRATING AND EXPANDING EXISTING SUBSTATIONS

- APPENDIX A TYPICAL SUBSTATION DRAWING CHECKLIST
- APPENDIX B RUS SUBSTATION DESIGN SUMMARY
- APPENDIX C SAMPLE SUBSTATION SECURITY FENCE SPECIFICATION
- APPENDIX D RISA-3D INPUT AND OUTPUT FOR A SIMPLE “T” STRUCTURE
- APPENDIX E SPECIFICATION FOR PROCURING GEOTECHNICAL SUBSURFACE INVESTIGATION
- APPENDIX F STANDARD DEVICE FUNCTION NUMBERS
- APPENDIX G SUGGESTED SUFFICE LETTERS

CHAPTER 3: DOCUMENTS

- DRAFTING PRACTICES
- SYMBOLS
- APPENDIX A - DRAWING CHECKLIST
- APPENDIX B - DESIGN SUMMARY



COMPUTER-AIDED DESIGN AND DRAFTING (CADD)

- SEVERAL PACKAGES AVAILABLE
- PRE-PLANNING IS CRITICAL
- GOOD MANUAL DETAILING PRACTICES STILL APPLY
- BE CAREFUL WITH TRANSLATIONS BETWEEN PACKAGES

CHAPTER 4: PHYSICAL LAYOUT

- LIGHTNING - ROLLING SPHERE METHOD
- TABLES - UPDATED FOR 345 kV
- FENCE - ADDED SAFETY CLEARANCES
- APPENDIX C - FENCE SPECIFICATION





CHAPTER 5: MAJOR EQUIPMENT

- TRANSFORMERS
- POWER CIRCUIT BREAKERS
- CAPACITORS
- SURGE ARRESTERS
- PICTURES AND EXAMPLES

TRANSFORMERS

- UPDATED RATINGS
– 55 VS. 65 DEGREE C



POWER CIRCUIT BREAKERS

- INTERRUPTING MEDIUM
 - OIL VS. VACUUM/SF6 GAS
- RATINGS
- OPERATING MECHANISMS
 - SOLENOIDS VS. PNEUMOHYDRAULIC

CAPACITORS

- SWITCHING TRANSIENTS
 - RESONANCE
- METAL ENCLOSED CAPACITOR BANKS
- FUSING
 - INTERNALLY FUSED
 - FUSELESS

SURGE ARRESTERS

- SILICON-CARBIDE VALVE ARRESTERS
- METAL OXIDE ARRESTERS
 - ZINC OXIDE VALVE
 - GREATER NON-LINEAR VOLT-CURRENT CHARACTERISTIC

CHAPTER 7: STRUCTURES

- WIND LOADS
- COMPUTER PROGRAMS
- APPENDIX D - RISA 3D



CHAPTER 8: FOUNDATIONS

- DRILLED SHAFTS
- APPENDIX E -
GEOTECHNICAL
SERVICES
SPECIFICATION



CHAPTER 9: GROUNDING

- 95% REWRITE
- SIMPLIFIED DESIGN
EQUATIONS
- NEW TOUCH & STEEL
EQUATIONS
- CURRENT DIVISION



GROUNDING

- SOIL RESISTIVITY
 - SINGLE-LAYER VS. TWO LAYER MODEL
- FAULT CURRENT
 - SPLIT FACTOR
 - DECREMENT FACTOR
- NEW EQUATIONS

CHAPTER 12: PROTECTIVE RELAYING

- NEW RELAY TYPES
- APPENDIX F - DEVICE FUNCTION NUMBERS
- APPENDIX G - SUGGESTED SUFFICE LETTERS



RELAY TYPES



WHAT'S THE SAME?

- DESIGN OBJECTIVES
- ABNORMAL CONDITIONS TO DETECT
- BASIC CONFIGURATION OF A RELAY
- BASIC PROTECTIVE SCHEMES
- COMMUNICATIONS USED WITH PROTECTION
- INTENDED RESULTS

WHAT'S NEW?

- EQUIPMENT
- OPTIONS

EQUIPMENT

- MICROPROCESSOR RELAYS
- COMMUNICATIONS MEANS
- PROCESSING CAPABILITY
- DATA AVAILABILITY
- COST

OPTIONS

- PROTECTIVE SCHEME SELECTION
- APPLY MORE SOPHISTICATED SCHEMES
- DATA INPUT
- COMMUNICATIONS
- FEATURES: HOW MANY TO USE?

CHAPTER 13: INSTRUMENTS, TRANSDUCERS, AND METERS

- MICROPROCESSORS

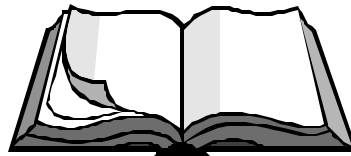


CHAPTER 14: SUBSTATION AUTOMATION

- NEW CHAPTER
- OPEN VS PROPRIETARY SYSTEMS
- ARCHITECTURE
- DATA ACQUISITION AND CONTROL ELEMENTS

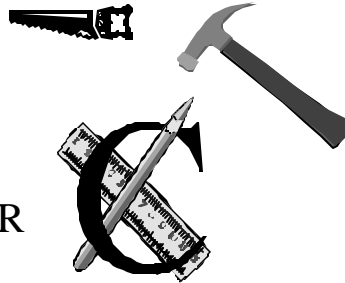
SUBSTATION AUTOMATION “DEFINITION”

- OPTIMIZE SUBSTATION OPERATIONS
- FACILITATE REMOTE MONITORING & CONTROL
- STATE OF THE ART
 - COMPUTERS
 - COMMUNICATIONS
 - NETWORKING
- COST EFFECTIVE

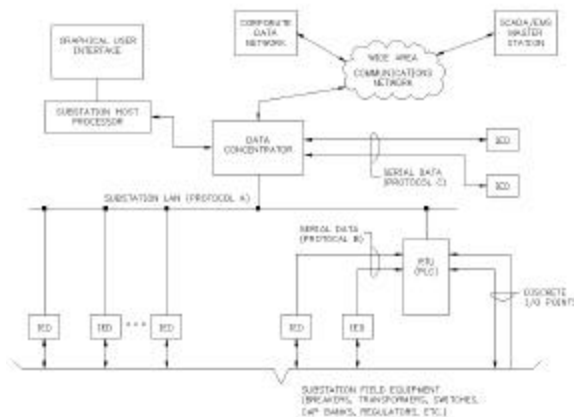


SUBSTATION AUTOMATION TOOLS

- INTELLIGENT ELECTRONIC DEVICES (IED'S)
 - RELAYS
 - METERS
 - CONTROLLERS
- DATA CONCENTRATOR
- HOST PROCESSOR



SUBSTATION AUTOMATION ELEMENTS



CAUTION

- AUTOMATION SYSTEMS ARE IN DEVELOPMENT
- ONE MANUFACTURER'S PROTOCOL WILL **NOT** NECESSARILY TALK TO ANOTHER'S
- SOME IED'S REQUIRE SPECIFIC SOFTWARE FOR COMMUNICATION
- GET REFERENCES 'OR'
- INITIATE YOUR OWN RESEARCH PROJECT

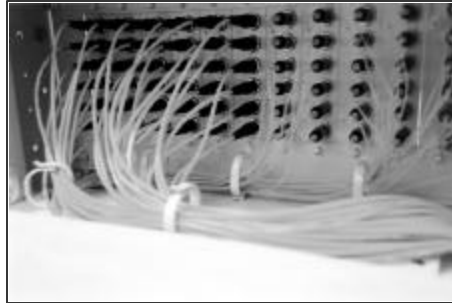
CHAPTER 16: CONTROL BUILDING

- PRE-MANUFACTURED



CHAPTER 17: COMMUNICATIONS

- DIGITAL MICROWAVE
- FIBER
- SATELLITE



CHAPTER 18: INSPECTION

- INSPECTION TECHNOLOGY MATRIX



CHAPTER 20: MAINTENANCE

- RELIABILITY CENTERED
MAINTENANCE

