CONFORMANCE TESTING OF SUBSCRIBER CABLES

GENERAL

CONTENTS

1. INTRODUCTION

1.01 This section and the associated sections listed in paragraph 1.03 describe the conformance tests that should be made on new, extended, and/or rearranged subscriber cables after all splicing work has been completed, but before the facilities are released for customer use.

1.02 This section has been reissued to:

(a) Add information regarding the Defective Pair File.

(b) Delete the classification of defective pairs as Type A (service-affecting) and Type B (service-degrading).

(c) Add reference to the Plant Costs Results Plan for work unit credits allowed for conformance testing.

(d) Make certain tests mandatory which previously were optional.

Revision arrows are used to emphasize the more significant changes.

1.03 The associated sections in this series are:

SECTION	TITLE
330-300-526	Administrative Procedures
330-300-527	Test Procedures, Analysis, and Categorization of Pairs.

2. GENERAL

2.01 The objective of conformance testing is to minimize the number of defects and transmission irregularities introduced into new and existing cable facilities as a result of a current construction work order. This will be accomplished by:

(a) Reviewing the design of the entire cable from the wire center to the farthest terminal prior to issuing a construction work order.

(b) Identifying existing design deviations when making the above review and incorporating corrections into the construction work order.

(c) Correcting design deviations that are caused by record errors which have been identified by current instrument tests.

(d) Clearing existing defects when they are at the same location as current construction work.

(e) Clearing construction defects attributable to the current work before the work order can be closed out.

(f) ➧Clearing other existing defects when service conditions and economical considerations require, as determined through the Defective Pair Administration Plan.➧

(g) Posting conformance testing results to the Exchange Customer Cable Records (ECCRs) for administrative purposes pending corrective action.

(h) ♦Posting all appropriate test data to the Defective Pair File.♦

2.02 Subscriber cable, for the purpose of this and associated sections, is that part of the exchange cable plant that extends from the wire center main frame protectors to a serving terminal. Similar tests for toll and exchange trunk cables are described in Sections 330-300-500 through -504.

2.03 Conformance tests ♦for exchange feeder and/or distribution cables♦ ***shall be*** performed on:

- All new, extended, and/or rearranged ♦(see note)♦ loaded cables
- All nonloaded cables initially terminated on the main frame
- ♦Existing nonloaded cables when 2000 feet or more of new cable is added or 50 pairs or more are rearranged.

Note: Rearranged, for the purpose of this section, is defined as any work operation where existing cable pairs are involved in splicing activities (eg, cable pair transfers, load or unload cable pairs, energize pairs, etc).♦

2.04 Conformance tests ***are not*** required on nonloaded cables when less than 2000 feet of cable is added or less than 50 pairs rearranged.

2.05 In all cases, the conformance tests shall be made only when specifically requested by the outside plant engineer (OPE). When the construction work order involves an existing cable, ***only*** the complements directly associated with the extension and/or rearrangement must be tested. It is important that all pairs in the requested complements be tested, since it is the intent of this procedure to identify and correct specific defects rather than simply to estimate the overall quality of the facility.

2.06 The overall administration of these procedures is the responsibility of the outside plant engineering organization. The OPE identifies the work orders to be tested, reviews the test results, suggests corrective action, and oversees closing of the work order.

2.07 Economic studies indicate that when this plan is fully implemented, the dollar savings will be more than twice the cost of implementing it. The major portion of these savings comes from an increase in the number of usable pairs. A lesser portion of the savings comes from a reduction in the number of trouble reports for transmission and noise.

3. SOURCE OF DEFECTS

3.01 Defects and transmission irregularities in new or rearranged subscriber cable occur for various reasons. Some of these are:

(a) Manufacturing deviations which occur in cables, loading coils, and build-out capacitors. Quality control procedures keep these deviations minimal.

(b) Design deviations are introduced by the OPE, usually because of record or human error. Typical design deviations are incorrect load spacing, excessive bridged tap, and excessive far-end sections.

(c) Construction deviations typically occur as shorts, opens, grounds, crosses, splits, unbalances, and loading coils not wired in properly, omitted, or installed at incorrect intervals.

3.02 For the purpose of conformance testing, it is convenient to group transmission irregularities with defects and divide them into dc and ac types. The ac-type defect usually occurs during the construction phase and appears as shorts, opens, grounds, crosses, and splits. These are most often found by the splicers as they check their work and are usually corrected immediately. For several reasons, the dc defect is usually not detected and therefore not corrected by the splicer. This type of defect is detrimental to transmission and most commonly occurs in loaded plant where coils are omitted, misplaced, or wired incorrectly.

4. TESTING

4.01 Paraphrasing the objective of conformance testing, it is to minimize the number of defects introduced into a new or rearranged cable, ***regardless of cause.*** Consequently, as much emphasis must be placed on verifying the total loop design as on instrument testing. The obvious reason is to prevent design deviations from being constructed. The probability of design deviations is reduced by having the OPE examine the makeup of the cable from the wire center to the farthest distribution point in the complements. This is facilitated by having the OPE prepare a legible straight-line drawing called a "complement diagram." The complement diagram also provides the conformance tester with enough data to perform the instrument tests.

4.02 ➧To assist in determining whether defects are in the new or existing portion of the cable facilities, the tester will be provided with the results of all preliminary tests performed on the respective complement(s), eg, tests of defective pairs listed on Form E4108 and/or construction completion tests.➧

4.03 Instrument testing has ➧two➧ distinct purposes:

(1) ***Identify*** defective pairs within the cable complement.

(2) ***Locate*** the specific source of ac and/or dc faults.

4.04 Depending on the length of the cable, one of three different test procedures is used. A brief description is as follows:

(1) The procedure for nonloaded cable is to check the design with respect to the appropriate design criteria, using the complement diagram. The tester tests for shorts, grounds, opens, unbalances, and electrical length.

(2) The procedure for cables with up to six loading points ➧(short loaded cable)➧ is a design check, using a complement diagram. The tester ➧must➧ test for dc defects. In addition, an open circuit impedance test is made from the main frame with an impedance level tracer (or equivalent) to verify the structural makeup of the pair. The impedance level tracer ➧in conjunction with an artificial cable kit (or a test set equivalent to this combination) is used to measure the location of ac-type defects.➧

(3) The procedure for cables with more than six loading points ➧(long loaded cable)➧ is a design check, using a complement diagram and the tests for defects. Two-man tests are required on these longer cables to make structural echo return loss measurements. These tests are an indicator of cable condition. Tests for noise, insertion loss, and loop resistance also are made.

4.05 ➧The tester provides pertinent information regarding test results for use in analysis and location of the defects.➧

5. RESULTS AND ANALYSIS

5.01 The results of the tests are summarized using the forms provided in Section 330-300-526. These forms are forwarded without delay so they can be analyzed and corrective action initiated.

5.02 The OPE should analyze the results and indicate which defects are to be cleared immediately and which can be deferred. Factors that normally affect the consideration are the percentage of defective pairs, percent spare pairs, nature of the defect, and locations. The objective is to have no more than 1 percent of the pairs defective ➧(due to design or construction activity)➧ in new or rearranged cable work. Deviations from this objective must be approved by higher levels of engineering management. (See Section 330-300-526.)

6. REFERENCES

6.01 While the procedures described in these sections can work autonomously, they have been designed to coordinate with and add support to the following documents, which also deal with the quality of construction and engineering work.

SECTION	TITLE
620-050-020	Cable Transfer Administration
620-050-030	Quality Review Plan—Administration and Procedures
620-050-031	Quality Review Plan—Inspection Reference Material
680-300-012	Preparation of Cable Transfers—Conventional and Photocopy Methods

SECTION	TITLE
—	Defective Pair Administration Plan, December, 1972
—	Plant Costs Results Plan

6.02 The Bell System Practices listed in Table A contain detailed information on topics in this section and the associated sections listed in paragraph 1.03.

♦ TABLE A ♦

SECTION	ISS	DATE	TITLE
103-106-110	2	May 1964	J99254C (54C) Return Loss Measuring Set, Description
103-106-115	3	Nov 1975	KS-20501 Return Loss Measuring Set, Description and Operation
103-109-100	3	July 1978	1A/1B Artifical Cable Kit, 4096-Type Network
103-611-100	4	April 1968	3A and 3B Noise Measuring Sets
106-230-100	3	Oct 1969	KS-14959 Test Set (Portable Wheatstone Bridge), Description and Use
106-230-105	4	Sept 1966	96A Test Set, Description and Maintenance
106-340-110	2	Sept 1965	Delcon 4910F, Open Fault Locator, Description and Maintenance
330-300-520	1	Feb 1971	Return Loss Test — Local Exchange Cables, Subscriber Long Route Design
330-450-100	1	March 1965	Fault Location on Cable Pairs Using Voice-Frequency Sweep Test Sets — General Theory
330-450-504	1	June 1965	Trouble Location Tests on Cable Using Voice-Frequency Sweep Tests at Main Frame
330-450-507	1	July 1965	Voice-Frequency Sweep Tests — Detailed Analysis
332-852-101	3	March 1974	4066A Network
634-300-511	2	Feb 1979	AT-8592 L1A and L1B Test Sets, Pair Tester, Description and Use
634-305-501	11	Dec 1976	Fault Location Using Breakdown Test Set KS-14103 L5
634-305-510	1	Dec 1967	Locating Open Faults Using Delcon 4910B Open Fault Locator
634-305-514	1	May 1973	Locating Faults Using the Dynatel 710A Test Set, Description and Use
634-310-500	3	Dec 1965	Locating Faults With KS-14969 Wheatstone Bridge
634-310-501	3	Sept 1966	Locating Faults With the 96A Test Set
902-115-101	3	March 1965	Application of Resistance Design to Subscriber Loop Plant
902-215-120	2	May 1979	Design Rules, Engineering and Transmission Considerations, Subscriber Long Route Design
856-100-100	2	June 1976	Universal Cable Circuit Analysis Program (UNICCAP) — Description and Use
870-850-100	3	Jan 1970	Noise Engineering — Subscriber Loop Measurement and Evaluation of C Message Weighted Noise