

## APPARATUS

### GENERAL REQUIREMENTS AND DEFINITIONS

#### 1. GENERAL

**1.01** This section covers general requirements and definitions. It also supplements and forms a part of those sections in the Plant Series which cover apparatus requirements and which refer to this section. The information in this section also applies to circuit requirement tables and other approved sources of information giving apparatus requirements.

**1.02** This section is reissued to revise the requirement covering release current flow application, and to revise the definition of Electrically Energized.

**1.03** Unless otherwise specified in the individual sections, the information shown on circuit drawings, circuit requirement tables, AEC0 adjustment sheets, or WEC0 job specifications takes precedence over the information contained in the individual sections.

**1.04** *Gauges and methods* are given in BSP sections for the convenience of the telephone company. Their use is not binding on the WEC0 installer.

**1.05** *Sequence of Adjusting Procedures:* The requirements and the corresponding adjusting procedures are given in the order which experience has indicated to be the proper sequence to follow in readjusting the apparatus. Where two or more requirements are covered by the same adjusting procedure, the headings associated with the procedure are connected with a bracket since the procedures for meeting these requirements are interdependent. When readjusting to meet any one of the requirements, consideration must be given to the other requirements.

**1.06** *Reports to Supervisors:* Where individual sections direct that when certain conditions are encountered they should be referred to the supervisor, the corrective action usually requires an extensive replacement. The supervisor

will determine what action is necessary and whether it may be handled on an immediate or a deferred basis.

**1.07** *Gauges to Be Used When Checking Pressure and Tension Requirements:* Unless otherwise specified, a gauge shall be used which will indicate the specified tension at or near the upper limit of the scale in order to minimize errors due to estimating points between scale divisions. For example, to read a value of seven grams use a gauge having a 10-gram scale, not one with a 100-gram scale.

#### **1.08** *Use of Coil-Type (push-pull) Tension Gauges*

(a) *79A, 79B, and 79C Gauges:* These gauges are calibrated for horizontal use. They may, however, be used in a vertical position by determining the weight of the plunger and making allowances for this weight in obtaining the true reading. To do this, hold the gauge in a vertical position and determine the weight of the plunger. When measuring downward pressure, reverse the position of the gauge. The true pressure is the sum of the indicated reading and the weight of the gauge plunger. When measuring tensions (pulling upward), do not reverse the position of the gauge after determining the weight of the plunger. The tension is the difference between the indicated reading and the weight of the plunger.

(b) *79D, 79E, and 79F Gauges:* These gauges are designed for use in either the vertical or horizontal position. Before using the gauge, hold it in the position in which it is to be used and turn the indicator on the plunger assembly until the reference mark on the indicator coincides with the zero mark on the scale. The gauge will then give a true reading of the pressure or tension required.

**1.09** *Use of Fan-Type Gauges (60-, 62-, 68-, 70-, and 158-type gauges):* These gauges are designed for use in either the vertical or horizon-

tal position. When using these gauges with the fan held in a vertical position, note the position of the reed with respect to the zero mark and make an equivalent allowance when reading the tension indicated. When measuring spring tensions, hold the gauge in such a position that the reed and the spring whose tension is to be measured are practically in a straight line, as gauged by eye. Do not attempt to push the gauge in a straight line but rotate the body of the gauge in the direction to measure the tension, always keeping the reed in line with the part being checked. Unless otherwise specified, apply the tip of the reed to the free end of the spring, taking care that the flat surface at the end of the reed is in approximately the same plane as the surface of the spring. If the tension cannot conveniently be measured by holding the gauge as specified above, the gauge may be held at an angle to the length of the spring, taking care to apply it so that the flat surface at the end of the reed is in the same plane as the surface of the spring whose tension is being measured.

#### Definitions

**1.10 Electrically Operated:** Electromagnetic apparatus is said to be electrically operated if, when sufficient current is connected to its winding, the armature or magnetically actuated part assumes its operated position as defined in the individual sections.

**1.11 Electrically Energized:** Electromagnetic apparatus is said to be electrically energized (for the purpose of the individual sections) if, when sufficient current is connected to its winding, the armature assumes a position against a gauge inserted between the armature and the core.

**1.12 Reliable Contact:** If necessary to check for a reliable contact, this may be done by bridging a receiver across made contacts through which current is flowing. Absence of fluttering in the receiver is evidence of a reliable contact. If fluttering is present, the contact is unreliable. A lamp shall be used for the purpose when it is so specified in the individual BSP.

**Caution:** Take care to prevent acoustic shocks when using a headset to check contacts carrying high voltages.

**1.13 Nonclick on keys** means that, when the lever of a key is restored unrestrained from the operated to the normal position, it shall neither break any closed contacts nor make any open contacts on the opposite spring combination. A click in a receiver with battery connected in circuit with the contact or contacts involved indicates failure to meet the requirement.

**1.14 Normal sequence on keys** means that all the normally closed contacts operated directly by a plunger spring of an individual assembly shall break before the normally open contacts of the assembly directly associated with that plunger spring make. This sequence applies only on break-make combinations which are operated directly by a plunger spring or by another spring which is actuated by the plunger spring by means of a stud.

**1.15 Cross sequence on keys** means that all the normally closed contacts operated by the throw of the lever or depression of the plunger shall break before any of the normally open contacts make. This sequence applies only on break-make combinations which are operated directly by a plunger spring or by another spring which is actuated by the plunger spring by means of a stud.

## 2. GENERAL REQUIREMENTS

### General

**2.01** The requirements covered in each section shall be considered both *test and readjust requirements* unless specifically designated as one or the other.

**2.02 Test requirements** shall be used to determine whether or not the apparatus is in proper condition for delivery to the customer. *Test requirements* are also the objective of current maintenance tests and inspections.

**2.03 Readjust requirements** shall be met in readjusting the apparatus. Unless otherwise specified in the individual sections, these requirements apply to all apparatus of the type or types covered therein.

**Mechanical**

**2.04 Mean Readjustment:** Unless otherwise specified, where there is a maximum and a minimum limit for the requirement, an effort should be made in readjusting a piece of apparatus to work to the mean of the limits.

**2.05 One Limit Readjustment:** Unless otherwise specified, where a readjust requirement specifies only one limit (either a maximum or a minimum limit), it is advisable to readjust well within the limit, consistent with meeting other requirements. For example, if a minimum contact pressure is specified, the spring should be readjusted to a higher pressure.

**2.06 Adjustments Affected by Other Readjustments:** When making any readjustments, all other adjustments that may be directly affected shall be checked to the readjust requirements and readjustments made if necessary.

**2.07 Measurement of Contact Pressure and Spring Tension**

(a) **Contact Pressure:** Contact pressure is the pressure between contacts. Unless otherwise specified, contact pressure shall be measured as close to the contact as possible between the contact and the free end of the spring. It shall be measured on normally closed contacts with the apparatus normal and on normally open contacts with the apparatus operated. In measuring contact pressure, care must be exercised not to close adjacent stud gaps and thus pick up additional load which would give a false measurement of contact pressure.

(b) **Spring Tension:** Spring tension is the force exerted by an individual spring against a spring, stop, stud, card, armature, or similar device when the spring is in its normal position. Unless otherwise stated, the tension specified for a spring applies to that spring only, and the effect of other springs communicated to the spring in question by means of studs, cards, or similar devices must be removed when measuring tension. The point

at which spring tension shall be measured is specified in the individual sections.

**2.08 Tensional and Dimensional Requirements Involving Use of Gauges:** Unless otherwise specified, these requirements should be met regardless of the method of test or adjustment employed. Facilities for meeting these requirements are provided in the form of standard gauges. However, if it is found by experience that such requirements can be met satisfactorily by feel or by eye, these methods may be employed, but it is suggested that checking with gauges be done often enough to insure that the test and readjust requirements are met. When requirements are close, it is advisable to use gauges.

**Note:** The thickness gauges specified for checking apparatus adjustments are manufactured to minimum and maximum limits and, therefore, are subject to variations from their nominal values. Any adjustment may be considered to have been met if it is found to be satisfactory when measured with any specified gauge.

**2.09 Method of Using Thickness Gauges:** When using thickness (feeler) gauges to determine whether a gap or clearance is within the specified dimensional limits, loosely hold the gauge so that it may or may not enter the gap of its own weight, or guide the gauge through the gap without forcing. The minimum value is met if the gauge enters freely or with a slight rub. The maximum value is met if the gauge does not enter the gap or if it enters with at least a slight rub.

**2.10 Dimensional Requirements — "Gauge by Eye":** These are requirements which do not require precise adjustments in order to obtain proper operation. However, when a *minimum* or a *maximum value* is specified to be gauged by eye, this value shall be considered as a limiting value and must not be exceeded. In the case of sections and drawings issued after October 31, 1937, the following shall apply. If the value given is a nominal value (a single value), it is understood that unless otherwise specified

a deviation either way from that value is permissible as follows.

SPECIFIED NOMINAL VALUE	ALLOWABLE DEVIATION
0.005" to 0.010"	1/2 of specified limit
0.011" to 0.030"	1/3 of specified limit
0.031" to 0.250"	1/4 of specified limit
1/32" to 3/64"	1/64"
1/16" to 1/8"	1/32"
9/64" to 1"	1/16"
Above 1"	1/16" per inch or fraction thereof

In case of doubt, the values should be checked with gauges. Where the term "perceptible" is used, this requirement should be interpreted, unless otherwise specified, as an observable *minimum* with a *maximum* of approximately 0.005". In gauging by eye, it is recommended that gauges or parts of known dimensions be used as references as often as necessary to insure that the specified "gauge by eye" values, as interpreted above, are not exceeded.

**2.11 Tightness of Nuts and Screws:** All nuts and screws which have been loosened during adjustment shall be tightened. When checking for loose nuts and screws, apply force in the direction which tends to tighten them.

**Electrical**

**2.12 Effect of Cover on Direct Current Flow Requirements:** Unless otherwise specified in the individual section or in (a) or (b), the electrical test and readjust requirements for relays, including flashing and timing requirements specified on the circuit requirement tables, may be applied with the cover either on or off since the cover has only a slight effect on the adjustment. However, if checked with the cover on, the relay shall not be considered as failing to meet the requirement unless it also fails with the cover off.

(a) For 236-type relays, the cover shall be off unless otherwise specified.

(b) For C-, N-, S-, and 118-type relays, the cover shall be on but the cap may be either on or off.

(c) Where it is desirable to test a relay with the cover on and the relay is affected by the cover, two sets of requirements are specified, the one for the relay with the cover on, and the other for the relay with the cover off.

**2.13 Soak:** Unless otherwise specified, where the circuit requirement table specifies a soak, this soak shall be applied for at least one second before checking the associated test or readjust requirement specified on the circuit requirement table. The requirement shall be checked within 2 or 3 seconds after disconnecting the soak condition. When a soak is specified, it applies only to the associated test or readjust requirement on the table, and should be applied directly before each check of the requirement.

**Note:** In checking or adjusting a relay, it shall be considered in satisfactory adjustment if the electrical requirements are met following a single application or repeated applications of a specified soak condition.

**2.14 Release Current Flow Application:** Unless otherwise specified on the circuit requirement tables or in the individual sections, the circuit through the release key of the test set shall be closed when setting up and applying the soak, operate, nonoperate, or hold current requirements of electromagnetic apparatus for which a release current flow value is specified.

**2.15 Sequence of Applying Electrical Requirements**

(a) Unless otherwise specified, electrical requirements shall be applied in the order shown on the circuit requirement tables.

(b) Working circuits should be taken out of service in accordance with approved procedures before any checks or readjustments are made.