

ENGINEERING REFERENCE DATA

**STEP BY STEP
SYSTEM RELAYS**

221, 222, 223, 224 AND 225 TYPES

247 AND 248 TYPES

251 AND 252 TYPES

BELL TELEPHONE LABORATORIES

INTRODUCTION

This is one of a series of Engineering Reference Data Bulletins containing information on apparatus designed by the Bell Telephone Laboratories, Inc., for other than military applications, and manufactured by the Western Electric Company or by other suppliers in accordance with specifications prepared by the Laboratories. It is intended primarily for use by engineers of the Laboratories, and contains information on apparatus which may be rated AT&TCo Standard, A&M Only, Component Part, or Special; codes classified ML; or codes designated for nonassociate use. Codes rated Manufacture Discontinued are not included.

Items designated as PREFERRED are those recommended for use wherever practicable. Items not so designated are NONPREFERRED and should not be specified in new applications unless there is no other way of economically accomplishing the desired results. The NONPREFERRED items include (a) the older designs which may have been superseded but are still required for maintenance purposes, (b) designs more expensive to manufacture than others which may perform the same functions, and (c) items in such small demand that they are more costly to furnish.

It is planned to bring this bulletin up to date periodically; however, the information contained herein may not be complete and ratings of the items are not shown. The final selection of apparatus should, therefore, be made on the basis of the usual sources of information such as the Western Electric Apparatus Card Catalog, the manufacturing specifications, and price data. For information regarding the output of apparatus refer to the Western Electric Report A-822.1.

The bulletin may include some codes of apparatus for which catalog cards will not be found in the Western Electric Apparatus Card Catalog. Such codes are in general rated "Component Part." This rating is applied to apparatus where it is believed that the associated telephone companies will have no need for apparatus card catalog information and orders for the apparatus from the field are not expected.

When apparatus which is not listed on a white card in the Western Electric Apparatus Card Catalog is selected for use in new applications, the Standards Engineer, Department 5241, Bell Telephone Laboratories, Inc., 463 West Street, New York, should be notified of the new use and probable demand so that consideration can be given to rerating the apparatus. When such new applications are made within the Laboratories, the selection should first be discussed with the department responsible for the design of the apparatus.

X-75514

SECTION I

GENERAL

Relay Types

The relays generally used in the step-by-step switching systems are coded as 221, 222, 223, 224, 225, 247, 248, 251, and 252 types. The 223 and 224 types are equipped with two spring pile-ups per relay; the others have only one spring pile up per relay. The 247 and 248 types are used only to obtain slower release times than can be obtained with the 221 and 222 types. The 251 and 252 types are designed for use as electropolarized relays.

The 221, 223, 247, and 251 relays are mounted on the left side of switch plates and also are mounted on relay racks. The 222, 224, 248, and 252 relays are mounted in the right-hand position of switch plates. The 225 relay is shorter than the other types and is designed as an auxiliary to the longer types to be used when the available amount of space does not permit the use of longer relays. It mounts on the switch below the release magnet in what is known as the "Z" position. Illustrations of these relays are shown in Fig. 1.

Construction

The core of these relays consists of a round rod of magnetic iron. A magnetic iron, L-shaped bracket is attached to the core at the rear, the long arm of the bracket extending to the front end of the relay parallel to the coil. This is the return pole piece and is known as the heelpiece.

The flat magnetic iron armature is mounted directly in front of the core and is pivoted to a bracket or yoke which is attached to the front end of the heelpiece. All these relays except the 223 and 224 types have an armature with one lever arm and one spring pile-up per relay. The 223 and 224 types have an armature with two lever arms and have two spring pile-ups per relay. The position of the armature yoke is adjustable, permitting variations to be made in the heel gap.

The armature is equipped with one adjustable stop pin or residual screw consisting of a brass set-screw passing through the armature. By adjusting this residual screw the operated armature airgap may be varied, thereby controlling the releasing characteristics of the relay. The armatures of the 251 and 252 relays are not equipped with a residual screw.

247 and 248 Relays

For all of these relays except the 247 and 248 types the movement at the contacts is 2.5 times the movement at the armature gap, that is, the ratio of movement at the contacts to movement at the armature is 2.5 to 1.

The 247 and 248 types were designed with a one to one ratio of movement at the armature in order to effectively reduce the pull required at the armature gap. With these relays longer release times will be obtained for any given spring load than can be obtained with the 221 or 222 relays.

251 and 252 Relays

The 251 and 252 relays are 3-pole electropolarized relays. These relays are equipped with two separate windings, a front winding for operating the relay and a rear winding for furnishing the polarizing flux. The latter is connected across the full central office voltage supply. An iron front pole piece with two arms connects with another pole piece attached to the center of the core between the two windings.

The operation of this relay is as follows: In its normal unoperated position, the armature is resting against the iron back stop screw on the front pole piece. It is held in this position by polarizing flux instead of being attracted to the core because the polarizing flux splits two ways: (1) through the core, armature airgap, armature, and heelpiece, and (2) through the center pole piece, arms of front pole piece, iron back stop screw, armature, and heelpiece. Since the reluctance of the second path is considerably less than that of the first path due to the absence of an airgap, the major portion of the polarizing flux will flow through the second path and therefore hold the armature in that position.

When the operating winding is energized in the same direction as the polarizing flux, the armature will be attracted to the core, aided by the polarizing flux through the core, provided the

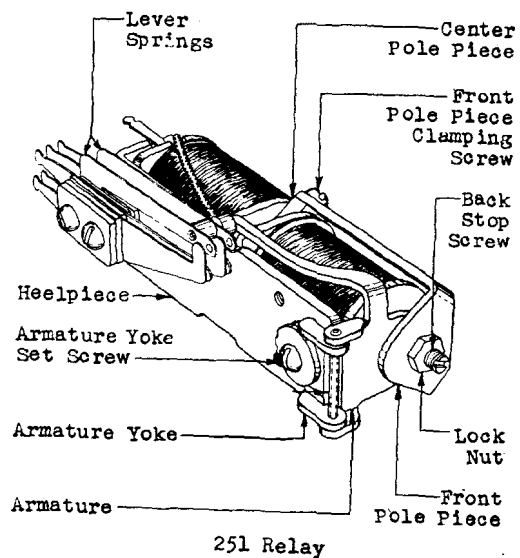
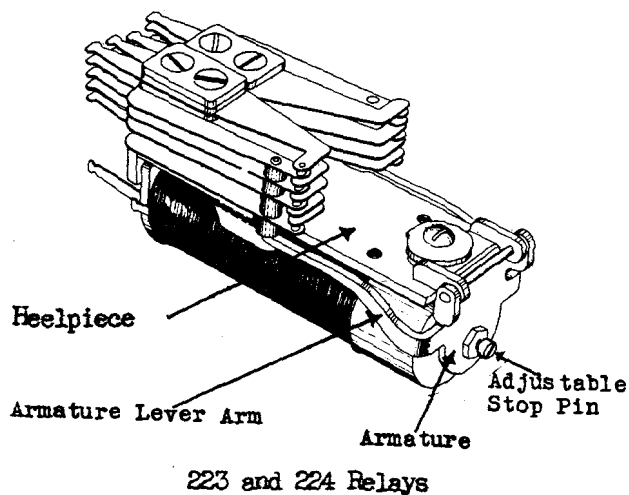
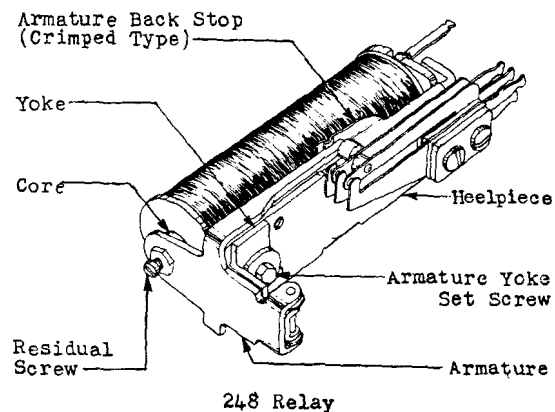
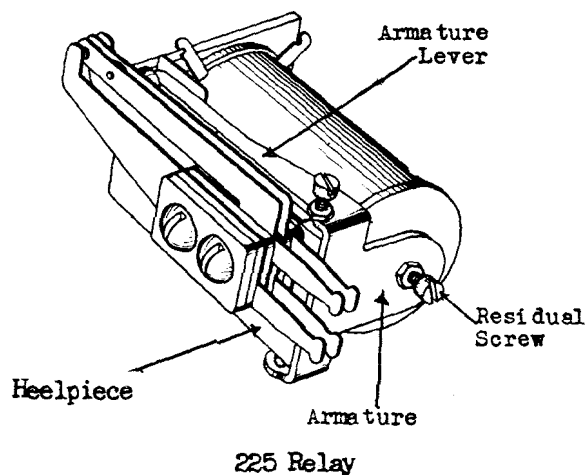
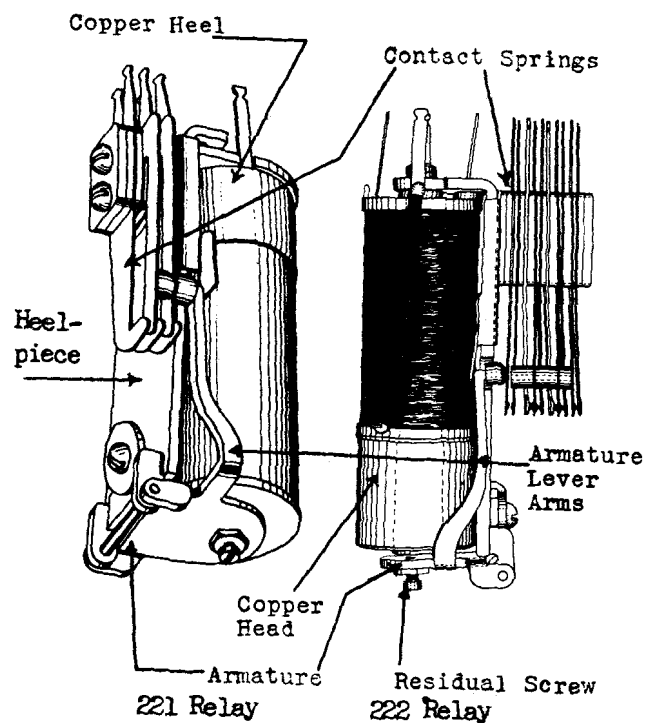


Fig. 1-1 — Step-by-Step Relays

operating flux is sufficient to overcome the effect of the polarizing flux through the front pole piece and the tension of the operating springs. At the instant the armature breaks the magnetic contact with its back stop screw, the relative strength of the polarizing flux through the two paths changes and finally reverses.

When the operating current is applied in the reverse direction, the armature will not move from its unoperated position unless the applied operating current is increased sufficiently to overcome entirely the effect of the polarizing flux through both paths. Normally such high currents are never applied.

Mounting Space

The horizontal mounting space required by these relays varies from 1-21/32 inches to 2-5/8 inches according to the number of contact springs. The maximum vertical dimension of the relays with single spring pile-ups is 1-11/32 inches and with two pile-ups per relay is 1-15/32 inches.

Windings

These relays are wound with single or multiple windings over the iron core or in conjunction with copper sleeves or copper slugs. Most of these relays were designed for spool winding but are now using filled coils. The spool number shows the arrangement of the windings and the dimensions of copper sleeves or slugs where provided. The spool arrangements appear in SPOOL NUMBERS.

Where relays are used to furnish talking battery to the subscriber, they should use windings designed to provide transmission balance. Parallel windings (spool 17) or sandwich windings (spool 21) are equally satisfactory. Spool 21 is wound with enamel-insulated wire, whereas the parallel windings are more costly because they are wound with enamel-nylon-insulated wire. The transmission balance obtained with tandem windings (spool 4) is not as satisfactory due to the different magnetic efficiency of the front and rear windings.

Contacts

The contact springs are of the cantilever type and are mounted on the rear of the heelpiece with the contact end just in front of the stud on the armature lever arms. The springs are actuated by the armature lever, being flexed sufficiently to make and break contacts when the armature moves toward the core.

Contact sequences are obtained by adjusting and positioning the springs.

The number of springs used on these relays when mounted on step-by-step switches is limited by the space available. The maximum number of springs for relays mounted in the left position (221, 223, 247, and 251) on the switch plate is generally 10 per pile-up. The maximum number of springs for the right-hand position relays (222, 224, 248, and 252 types) is generally 14 per pile-up.

Adjustments

The relays are adjusted by changing the tension of the various springs and by varying the armature airgap, contact separation, and spring follow. The unoperated airgap is regulated by bending the armature lever and the operated airgap by means of the adjustable residual screw. The contact separation and spring follow are regulated by positioning the springs.

The gauging values are given in SPRING COMBINATIONS. Nonoperate current flow requirements are always specified for these step-by-step relays.

Current flow adjustments or gauging adjustments other than now specified for any code can be used if within the capability of the relay.

When applying gauging requirements to these relays, a gauge is inserted between the armature and the core, and the relay is energized on a soak current to insure that the armature pulls solidly against the gauge. When the circuit is operated there is a residual flux left in the core which reduces with time. To insure that the current flow requirements are always applied with a known magnetic condition of the core, the current flow requirements should be preceded by a soak requirement.

Time-delay Relays

To provide slower than normal operate or release time, short-circuited windings are provided in the form of slugs or sleeves or both slugs and sleeves, as indicated in SPOOL NUMBERS.

A given volume of copper is most efficient in delaying the release of a relay when used in the form of a sleeve. This is due to the much lower effective resistance of a sleeve compared to that of a slug.

A relay with a front or armature end slug is generally slightly slower releasing than a relay with the same slug at the rear or heel end.

The operating time of a relay with a heel end slug is similar to that of a relay which does not have copper sleeves or slugs. This is due to the fact that the relay operates on a leakage flux which does not penetrate the slug until after a definite lapse of time. Heel end slugs are used for many slow releasing relays because the slug has but a slight influence on the operating time.

A relay with an armature end slug is generally slightly slower operating than a relay with the same volume of copper in the form of a sleeve.

Maximum time delay, either operating or releasing, is obtained when the maximum permissible winding space is allocated to the delay winding.

The releasing time of a relay with either an armature end or heel end slug and the operating time of a relay with an armature end slug is approximately proportional to the length of the slug. The operating and releasing times of relays with different copper sleeves vary as the logarithms of the ratio of their outside to inside diameters.

A copper sleeve is more efficient than a copper slug at the rear end of the core for relays required to operate and hold on pulses such as the B and C position relays of the step-by-step system.

Heating

The maximum mean winding temperature for normal operation should not exceed 225F for all types of insulation.

The maximum mean winding temperature for black enamel insulation should not exceed 250F for trouble heating periods of indefinite duration. Where trouble conditions would not occur, or recur, for a cumulative total of 48 hours during the 40-year life of the relay, the mean winding temperatures may be allowed to reach 325F for enamel insulation and 360F for silk, nylon, or heavy formex insulation. Where relays are operated for longer than 48 hours at this temperature, there is a tendency for the insulation to break down and further increase the wattage.

Fig. 2, provides curves from which the final temperature can be determined for various step-by-step relay spools mounted on a standard selector switch plate under its cover with one relay energized.

The data available are only applicable to relays wound with copper wire. In case the relay is wound with copper wire in combination with resistance wire, or where service conditions arise in which other than a constant voltage is used across the winding, consult the relay requirements group.

Directions for Use

Specification X-75514 contains complete relay code information on all coded 221, 222, 223, 224, 225, 247, 248, 251, and 252 relays that are rated Standard on the date of this issue.

The specification is arranged to facilitate selection of relays to meet particular circuit requirements. The relay code information, that is, code number, spring combination, contact metal, residual, winding, and adjustment information is listed in Tables I to VII, inclusive, according to the number of contact springs on each code. For example, relays having five make contacts are listed under 10 CONTACT SPRINGS; relays having two break-make contacts are listed under 6 CONTACT SPRINGS.

To locate the detailed code information for a particular coded relay, lists of codes in numerical order are provided preceding Table I. These show the table number and the number of contact springs where this information can be found.

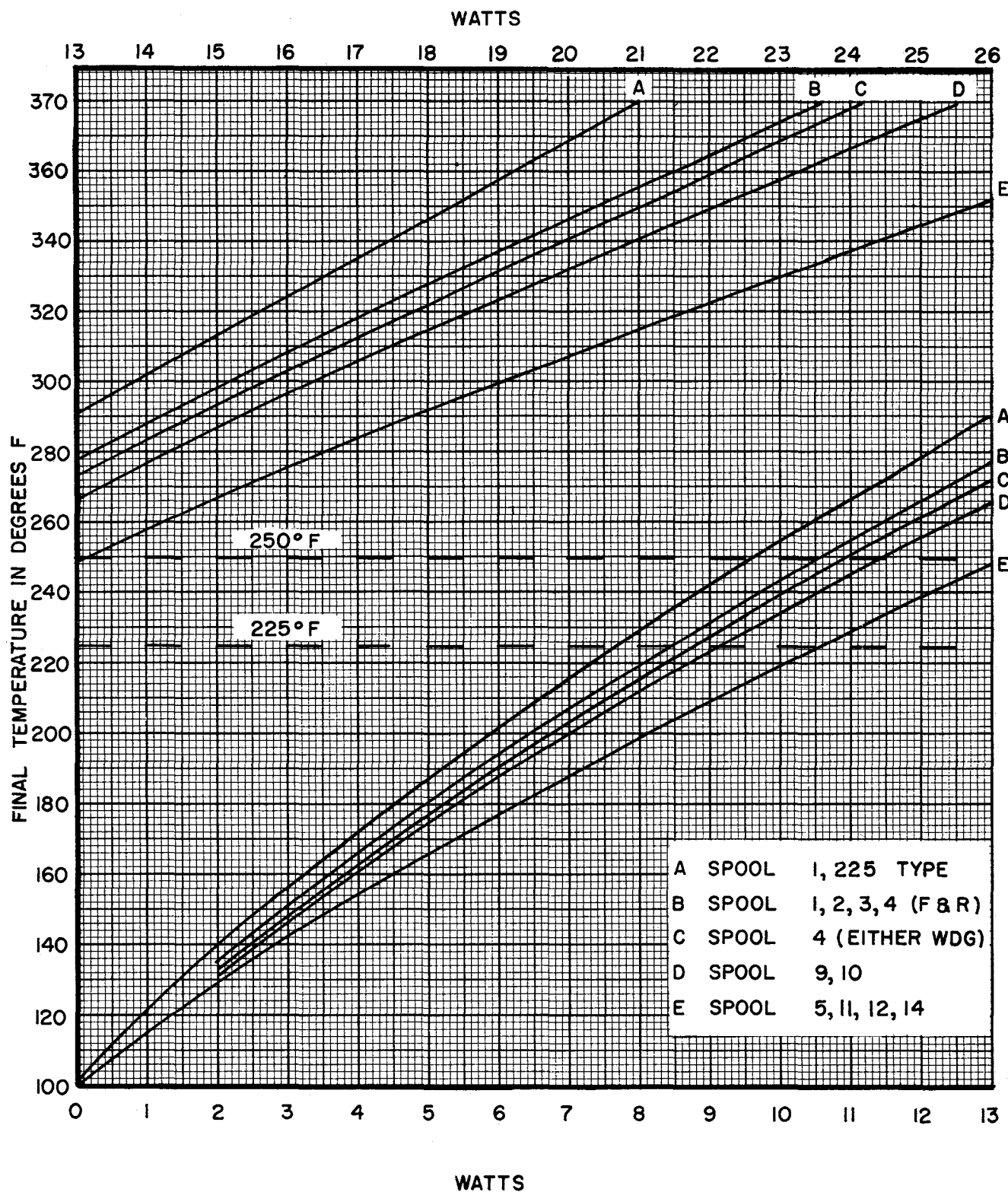


Fig. 1-2 — Step-by-Step Relays — Heating Curves — Constant Voltage Condition

Selection of Relays

For convenience in selecting relays the code information is listed in seven tables:

- TABLE I Single-wound general purpose relays
- TABLE II Double-wound general purpose relays
- TABLE III Single-wound slow-acting relays
- TABLE IV Double-wound slow-acting relays
- TABLE V Slow-acting 247 and 248 relays
- TABLE VI 225 (short core) relays
- TABLE VII 251 and 252 (electropolarized) relays

In selecting relays, extra contact springs can be justified economically depending on the annual demand for the particular relay application. In using the data outlined below, the demand considered should be a recurring annual demand rather than an initial demand.

<i>Annual Demand for Relays</i>	<i>Permissible Extra Springs</i>
2500 to 5000	1
1250 to 2500	2
900 to 1250	3
700 to 900	4
500 to 700	5
300 to 500	7
Less than 300	Up to 10

Preferred Codes

In selecting relays for new applications, it is desirable to use the codes which have reasonably high demands. These relays are distinguished by the letter (P) preceding the code number in the code information tables. For example, the 221A code will be found listed in TABLE II as (P)221A.

Procedure

Count the number of makes (M), breaks (B), transfers (BM), etc., required for use in the circuit; then count the total number of springs. Look in the proper table beginning with the exact number of springs and then with extra springs until a suitable relay is found.

Adjustments

The current flow requirements in the tables are readjust requirements. The test requirements to be shown in the circuit requirements tables should be 5 per cent easier than the readjust, that is, operate and hold test requirements are 105 per cent of the readjust, and nonoperate and release should be 95 per cent of the readjust.

The test and readjust values should be readable on the 35C test set. It has three scales with the nearest readable values as shown below:

<i>For Currents Between</i>	<i>Readable Tolerance</i>
0 and 15 ma	±0.1 ma
15 and 75 ma	±0.5 ma
75 and 750 ma	±5.0 ma

All current flow adjustments should be preceded by a soak. Specify full soak (FS) for all relays where the resulting current flow is less than 700 milliamperes. If the full soak would exceed this value, specify the soak current shown in the tables.

The mechanical adjustments are covered in Bell System Practice A460.040.

Symbols

For double-wound relays the symbols in the circuit requirement table mean:

P	==	primary winding
S	==	secondary winding
T	==	tertiary winding
Q	==	quaternary winding
P/S	==	primary and secondary windings series aiding
P/T	==	primary and tertiary windings series aiding
P//S	==	primary and secondary windings in parallel
P//T	==	primary and tertiary windings in parallel
S/T	==	secondary and tertiary windings series aiding
S//T	==	secondary and tertiary windings in parallel
S/Q	==	secondary and quaternary windings series aiding
P1/P2	==	parallel windings
S(N.I.)	==	noninductive secondary winding
T(N.I.)	==	noninductive tertiary winding
F	==	front winding
R	==	rear winding
FS	==	full soak

Resistance Tolerance

Unless otherwise stated the resistance varies ± 5 per cent.

Timing Requirements

Timing requirements in milliseconds are specified for slow-release relays which hold from the contacts of pulsing relays of selector, connector, and some repeater circuits. The relays are generally the B and C relays of selectors, B, C, and E relays of connectors, and the B and C relays of outgoing repeaters.

Specify hold readjust, release readjust, and release test times in seconds, and a pulsing test set requirement for the test hold value. Specify nonoperate test and nonoperate readjust current flow requirements.

For additional information on timing requirements refer to Bell System Practice A493.051.

SECTION II

CODE NUMBERS

Code	Table	Page	Code	Table	Page	Code	Table	Page	Code	Table	Page
221A	II	IV-2	221BA	M.D.		221DA	M.D.		221FA	I	III-3
221B	III	V-1	221BB	II	IV-4	221DB	M.D.		221FB	II	IV-6
221C	M.D.		221BC	I	III-1	221DC	M.D.		221FC	I	III-5
221D	III	V-3	221BD	III	V-1	221DD	M.D.		221FD	III	V-5
221E	III	V-1	221BE	M.D.		221DE	III	V-5	221FE	IV	VI-1
221F	M.D.		221BF	II	IV-4	221DF	I	III-1	221FF	IV	VI-2
221G	III	V-5	221BG	M.D.		221DG	II	IV-4	221FG	I	III-3
221H	III	V-5	221BH	I	III-1	221DH	I	III-4	221FH	II	IV-3
221J	III	V-2	221BJ	III	V-5	221DJ	II	IV-5	221FJ	M.D.	
221K	III	V-2	221BK	II	IV-7	221DK	II	IV-7	221FK	M.D.	
221L	III	V-2	221BL	III	V-2	221DL	III	V-3	221FL	III	V-6
221M	M.D.		221BM	II	IV-1	221DM	M.D.		221FM	IV	VI-2
221N	M.D.		221BN	IV	IV-2	221DN	IV	VI-3	221FN	M.D.	
221P	II	IV-4	221BP	M.D.		221DP	II	IV-9	221FP	III	V-8
221R	II	IV-4	221BR	II	IV-5	221DR	II	IV-4	221FR	I	III-4
221S	M.D.		221BS	M.D.		221DS	II	IV-6	221FS	II	IV-5
221T	I	III-3	221BT	III	V-4	221DT	II	IV-6	221FT	III	V-4
221U	I	III-3	221BU	I	III-2	221DU	II	IV-5	221FU	M.D.	
221W	I	III-4	221BW	M.D.		221DW	II	IV-2	221FW	III	V-1
221Y	I	III-1	221BY	I	III-1	221DY	I	III-3	221FY	III	V-2
221AA	I	III-3	221CA	I	III-1	221EA	III	V-2	221GA	II	IV-3
221AB	I	III-3	221CB	I	III-3	221EB	II	IV-5	221GB	IV	VI-1
221AC	I	III-4	221CC	III	V-3	221EC	I	III-1	221GC	II	IV-1
221AD	I	III-1	221CD	III	V-1	221ED	III	V-4	221GD	I	III-1
221AE	III	V-7	221CE	III	V-2	221EE	I	III-5	221GE	M.D.	
221AF	I	III-2	221CF	III	V-2	221EF	III	V-4	221GF	I	III-5
221AG	I	III-2	221CG	III	V-2	221EG	M.D.		221GG	M.D.	
221AH	I	III-1	221CH	III	V-5	221EH	M.D.		221GH	I	III-5
221AJ	M.D.		221CJ	III	V-5	221EJ	I	III-4	221GJ	I	III-3
221AK	M.D.		221CK	III	V-3	221EK	II	IV-4	221GK	II	IV-9
221AL	I	III-2	221CL	III	V-1	221EL	II	IV-9	221GL	I	III-2
221AM	II	IV-1	221CM	II	IV-8	221EM	I	III-5	221GM	III	V-4
221AN	III	V-3	221CN	I	III-1	221EN	I	III-4	221GN	I	III-2
221AP	III	V-4	221CP	II	IV-1	221EP	M.D.		221GP	III	V-8
221AR	III	V-6	221CR	IV	VI-2	221ER	M.D.		221GR	III	V-8
221AS	III	V-5	221CS	III	V-5	221ES	III	V-2	221GS	I	III-4
221AT	III	V-3	221CT	III	V-4	221ET	II	IV-1	221GT	III	V-8
221AU	II	IV-1	221CU	M.D.		221EU	II	IV-4	221GU	III	V-2
221AW	I	III-1	221CW	III	V-1	221EW	I	III-3	221GW	I	III-1
221AY	III	V-2	221CY	III	V-7	221EY	M.D.		221GY	III	V-4

X-75514

221 RELAYS

Code	Table	Page	Code	Table	Page	Code	Table	Page	Code	Table	Page
221HA	I	III-3	221KA	III	V-8	221MA	I	III-2	221PA	III	V-2
221HB	I	III-3	221KB	III	V-5	221MB	I	III-3	221PB	II	IV-9
221HC	III	V-2	221KC	III	V-5	221MC	II	IV-3	221PC	III	V-6
221HD	II	IV-5	221KD	III	V-6	221MD	III	V-3	221PD	II	IV-5
221HE	III	V-5	221KE	III	V-7	221ME	II	IV-2	221PE	II	IV-1
221HF	III	V-8	221KF	III	V-6	221MF	II	IV-1	221PF	I	III-3
221HG	II	IV-7	221KG	IV	VI-1	221MG	IV	VI-1	221PG	II	IV-4
221HH	I	III-3	221KH	II	IV-8	221MH	II	IV-5	221PH	I	III-2
221HJ	III	V-4				221MJ	M.D.		221PJ	I	III-1
221HK	I	III-4				221MK	II	IV-1			
221HL	III	V-2	221KL	III	V-7	221ML	I	III-2			
221HM	I	III-2	221KM	III	V-8	221MM	II	IV-1			
221HN	III	V-6	221KN	III	V-7	221MN	I	III-1			
221HP	M.D.		221KP	III	V-2	221MP	III	V-6			
221HR	IV	VI-2	221KR	II	IV-7	221MR	II	IV-8			
221HS	I	III-2	221KS	III	V-7	221MS	II	IV-9			
221HT	II	IV-3	221KT	I	III-5	221MT	I	III-2			
221HU	IV	VI-2	221KU	II	IV-6	221MU	I	III-2			
221HW	II	IV-1	221KW	III	V-9	221MW	I	III-4			
221HY	IV	VI-3	221KY	III	V-6	221MY	I	III-2			
221JA	II	IV-4	221LA	II	IV-7	221NA	II	IV-8	221FAA	II	IV-2
221JB	M.D.		221LB	IV	VI-4	221NB	III	V-8	221FAB	II	IV-9
221JC	II	IV-7	221LC	III	V-5	221NC	III	V-9	221FAC	II	IV-6
221JD	III	V-5	221LD	III	V-1	221ND	II	IV-2	221FAD	II	IV-5
221JE	III	V-4	221LE	III	V-5	221NE	II	IV-4	221FAE	II	IV-6
221JF	I	III-3	221LF	I	III-2	221NF	II	IV-5	221FAF	II	IV-4
221JG	III	V-7	221LG	M.D.		221NG	II	IV-12	221FAG	I	III-1
221JH	II	IV-5	221LH	M.D.		221NH	M.D.		221FAH	II	IV-5
221JJ	II	IV-1	221LJ	III	V-9	221NJ	II	IV-6	221FAJ	II	IV-3
221JK	III	V-7	221LK	I	III-5	221NK	II	IV-6	221FAK	II	IV-5
221JL	II	IV-4	221LL	I	III-5	221NL	II	IV-3	221FAL	I	III-2
221JM	II	IV-4	221LM	I	III-6	221NM	M.D.		221FAM	II	IV-6
221JN	II	IV-8	221LN	I	III-5	221NN	II	IV-3			
221JP	I	III-2	221LP	III	V-6	221NP	I	III-2			
221JR	I	III-2	221LR	I	III-4	221NR	III	V-6			
221JS	M.D.		221LS	III	V-6	221NS	III	V-4			
221JT	II	IV-1	221LT	III	V-7	221NT	II	IV-9			
221JU	III	V-5	221LU	III	V-1	221NU	II	IV-9			
221JW	I	III-4	221LW	I	III-1	221NW	IV	VI-3			
221JY	III	V-8	221LY	IV	VI-1	221NY	IV	VI-2			

222 RELAYS

Code	Table	Page	Code	Table	Page	Code	Table	Page	Code	Table	Page
222A	III	V-3	222BA	III	V-9	222DA	I	III-5	222FA	I	III-7
222B	I	III-5	222BB	III	V-1	222DB	M.D.		222FB	III	V-10
222C	III	V-6	222BC	M.D.		222DC	III	V-4	222FC	II	IV-12
222D	III	V-1	222BD	M.D.		222DD	I	III-1	222FD	I	III-4
222E	M.D.		222BE	II	IV-3	222DE	I	III-2	222FE	IV	VI-3
222F	M.D.		222BF	II	IV-1	222DF	I	III-2	222FF	III	V-9
222G	M.D.		222BG	M.D.		222DG	IV	VI-4	222FG	III	V-3
222H	IV	VI-4	222BH	I	III-6	222DH	II	IV-12	222FH	IV	VI-3
222J	IV	VI-3	222BJ	III	V-10	222DJ	IV	VI-4	222FJ	I	III-6
222K	M.D.		222BK	III	V-2	222DK	I	III-3	222FK	M.D.	
222L	IV	VI-3	222BL	I	III-3	222DL	I	III-1	222FL	I	III-6
222M	M.D.		222BM	I	III-1	222DM	I	III-5	222FM	III	V-9
222N	M.D.		222BN	III	V-1	222DN	I	III-5	222FN	IV	VI-3
222P	M.D.		222BP	II	IV-7	222DP	IV	VI-4	222FP	III	V-7
222R	IV	VI-2	222BR	III	V-6	222DR	M.D.		222FR	IV	VI-4
222S	IV	VI-1	222BS	III	V-8	222DS	IV	VI-2	222FS	III	V-9
222T	IV	VI-4	222BT	II	IV-4	222DT	IV	VI-2	222FT	II	IV-12
222U	M.D.		222BU	III	V-2	222DU	M.D.		222FU	IV	VI-3
222W	II	IV-10	222BW	I	III-1	222DW	II	IV-12	222FW	IV	VI-3
222Y	II	IV-11	222BY	III	V-10	222DY	M.D.		222FY	III	V-9
222AA	II	IV-11	222CA	M.D.		222EA	M.D.		222GA	I	III-6
222AB	M.D.		222CB	I	III-3	222EB	M.D.		222GB	I	III-2
222AC	I	III-3	222CC	M.D.		222EC	M.D.		222GC	II	IV-8
222AD	I	III-5	222CD	IV	VI-1	222ED	II	IV-10	222GD	I	III-6
222AE	M.D.		222CE	III	V-4	222EE	I	III-5	222GE	III	V-9
222AF	I	III-5	222CF	III	V-3	222EF	I	III-4	222GF	I	III-7
222AG	I	III-4	222CG	IV	VI-2	222EG	I	III-3	222GG	III	V-8
222AH	I	III-3	222CH	I	III-1	222EH	M.D.		222GH	I	III-7
222AJ	I	III-5	222CJ	M.D.		222EJ	I	III-4	222GJ	II	IV-12
222AK	I	III-3	222CK	III	V-1	222EK	M.D.		222GK	I	III-1
222AL	I	III-5	222CL	II	IV-4	222EL	M.D.		222GL	II	IV-11
222AM	I	III-5	222CM	II	IV-12	222EM	II	IV-10	222GM	II	IV-12
222AN	I	III-4	222CN	II	IV-12	222EN	I	III-7	222GN	I	III-2
222AP	I	III-1	222CP	II	IV-11	222EP	IV	VI-4	222GP	IV	VI-4
222AR	M.D.		222CR	M.D.		222ER	IV	VI-4	222GR	I	III-2
222AS	III	V-5	222CS	M.D.		222ES	IV	VI-3	222GS	III	V-4
222AT	III	V-5	222CT	I	III-4	222ET	I	III-6	222GT	II	IV-10
222AU	III	V-7	222CU	I	III-5	222EU	I	III-6	222GU	III	V-7
222AW	III	V-9	222CW	III	V-1	222EW	II	IV-13	222GW	II	IV-13
222AY	III	V-6	222CY	M.D.		222EY	II	IV-11	222GY	IV	VI-5

X-75514

222 RELAYS

Code	Table	Page	Code	Table	Page	Code	Table	Page	Code	Table	Page
222HA	II	IV-11	222KA	II	IV-13	222PA	II	IV-3			
222HB	M.D.		222KB	I	III-7	222PB	II	IV-3			
222HC	III	V-10	222KC	I	III-7						
222HD	II	IV-13	222KD	III	V-10						
222HE	II	IV-1	222KE	III	V-9						
222HF	II	IV-10	222KF	II	IV-13						
222HG	I	III-7	222KG	I	III-7						
222HH	I	III-6	222KH	I	III-8						
222HJ	I	III-7	222KJ	III	V-10						
222HK	III	V-1	222KK	II	IV-11						
222HL	I	III-6	222KL	II	IV-2						
222HM	IV	VI-3	222KM	II	IV-10						
222HN	III	V-4	222KN	II	IV-7						
222HP	III	V-7	222KP	II	IV-11						
222HR	III	V-9	222KR	II	IV-11						
222HS	III	V-7	222KS	II	IV-13						
222HT	I	III-1	222KT	I	III-7						
222HU	III	V-3	222KU	II	IV-7						
222HW	IV	VI-1	222KW	II	IV-8						
222HY	I	III-6	222KY	III	V-9						
222JA	I	III-5	222LA	M.D.							
222JB	II	IV-12	222LB	I	III-3						
222JC	I	III-7	222LC	II	IV-12						
222JD	I	III-6	222LD	IV	VI-4						
222JE	II	IV-12	222LE	I	III-7						
222JF	I	III-5	222LF	II	IV-8						
222JG	III	V-10	222LG	III	V-1						
222JH	III	V-6	222LH	II	IV-9						
222JJ	IV	VI-1	222LJ	II	IV-8						
222JK	I	III-6	222LK	IV	VI-4						
222JL	IV	VI-2	222LL	II	IV-11						
222JM	I	III-7	222LM	II	IV-13						
222JN	III	V-1	222LN	II	IV-13						
222JP	I	III-2	222LP	I	III-3						
222JR	M.D.		222LR	III	V-3						
222JS	II	IV-4	222LS	II	IV-9						
222JT	I	III-4	222LT	I	III-7						
222JU	I	III-5	222LU	II	IV-12						
222JW	II	IV-7	222LW	IV	VI-2						
222JY	I	III-2	222LY	II	IV-8						

CODE NUMBERS

223 RELAYS

Code	Table	Page	Code	Table	Page	Code	Table	Page	Code	Table	Page
223A	I	III-7	223BA	III	V-9	223DA	II	IV-15			
223B	I	III-8	223BB	III	V-11	223DB	II	IV-16			
223C	III	V-10	223BC	M.D.		223DC	I	III-12			
223D	II	IV-15	223BD	M.D.		223DD	I	III-11			
223E	II	IV-13	223BE	II	IV-15	223DE	M.D.				
223F	I	III-13	223BF	M.D.		223DF	I	III-3			
223G	II	IV-14	223BG	I	III-7						
223H	I	III-9	223BH	I	III-5						
223J	I	III-6	223BJ	I	III-11						
223K	III	V-9	223BK	I	III-10						
223L	II	IV-13	223BL	II	IV-15						
223M	I	III-10	223BM	III	V-4						
223N	I	III-8	223BN	I	III-13						
223P	I	III-10	223BP	M.D.							
223R	III	V-9	223BR	M.D.							
223S	II	IV-11	223BS	I	III-11						
223T	I	III-9	223BT	I	III-6						
223U	M.D.		223BU	I	III-13						
223W	I	III-6	223BW	II	IV-13						
223Y	I	III-7	223BY	I	III-10						
223AA	III	V-11	223CA	II	IV-12						
223AB	II	IV-14	223CB	I	III-9						
223AC	II	IV-13	223CC	II	IV-16						
223AD	II	IV-16	223CD	IV	VI-5						
223AE	I	III-10	223CE	II	IV-14						
223AF	I	III-9	223CF	III	V-11						
223AG	I	III-9	223CG	I	III-9						
223AH	I	III-6	223CH	II	IV-14						
223AJ	II	IV-9	223CJ	M.D.							
223AK	I	III-8	223CK	I	III-10						
223AL	I	III-9	223CL	M.D.							
223AM	I	III-10	223CM	II	IV-14						
223AN	M.D.		223CN	I	III-6						
223AP	I	III-10	223CP	I	III-12						
223AR	I	III-12	223CR	II	IV-13						
223AS	I	III-8	223CS	M.D.							
223AT	M.D.		223CT	II	IV-15						
223AU	I	III-3	223CU	I	III-10						
223AW	M.D.		223CW	I	III-10						
223AY	M.D.		223CY	II	IV-15						

X-75514

CODE NUMBERS

224 AND 225 RELAYS

Code	Table	Page	Code	Table	Page	Code	Table	Page	Code	Table	Page
224A	I	III-7	224BA	IV	VI-8	225A	VI	VII-3			
224B	I	III-7	224BB	II	IV-14	225B	VI	VII-3			
224C	I	III-7	224BC	I	III-11	225C	VI	VII-3			
224D	IV	VI-5	224BD	I	III-11	225D	VI	VII-4			
224E	IV	VI-6	224BE	I	III-12	225E	VI	VII-3			
224F	IV	VI-7	224BF	II	IV-17	225F	VI	VII-3			
224G	IV	VI-8	224BG	II	IV-16	225G	VI	VII-4			
224H	IV	VI-7	224BH	I	III-12	225H	VI	VII-3			
224J	IV	VI-5	224BJ	I	III-8	225J	VI	VII-3			
224K	I	III-8	224BK	I	III-12	225K	VI	VII-4			
224L	I	III-8	224BL	I	III-8	225L	VI	VII-4			
224M	I	III-9	224BM	M.D.		225M	VI	VII-3			
224N	M.D.		224BN	II	IV-15	225N	M.D.				
224P	M.D.		224BP	II	IV-12	225P	VI	VII-4			
224R	II	IV-16	224BR	IV	VI-6	225R	VI	VII-3			
224S	M.D.		224BS	IV	VI-8	225S	VI	VII-3			
224T	II	IV-15	224BT	IV	VI-6	225T	VI	VII-3			
224U	M.D.		224BU	II	IV-14	225U	VI	VII-4			
224W	M.D.		224BW	II	IV-14	225W	VI	VII-4			
224Y	IV	VI-6	224BY	II	IV-16	225Y	VI	VII-4			
224AA	IV	VI-7	224CA	II	IV-17	225AA	VI	VII-4			
224AB	II	IV-17	224CB	I	III-8	225AB	VI	VII-3			
224AC	M.D.		224CC	II	IV-17	225AC	VI	VII-3			
224AD	II	IV-17	224CD	I	III-10						
224AE	III	V-10	224CE	II	IV-18						
224AF	II	IV-16	224CF	IV	VI-7						
224AG	II	IV-18	224CG	I	III-8						
224AH	M.D.										
224AJ	I	III-11	224CJ	IV	VI-5						
224AK	M.D.										
224AL	II	IV-18									
224AM	I	III-7									
224AN	II	IV-17									
224AP	I	III-8									
224AR	II	IV-15									
224AS	I	III-3									
224AT	I	III-12									
224AU	IV	VI-8									
224AW	II	IV-14									
224AY	IV	VI-7									

247, 248, 251, AND 252 RELAYS

Code	Table	Page	Code	Table	Page	Code	Table	Page	Code	Table	Page
247A	V	VII-1	251A	VII	VII-5						
247B	V	VII-2	251B	VII	VII-5						
247C	V	VII-2	251C	VII	VII-5						
247D	V	VII-1	251D	VII	VII-5						
247E	V	VII-1	251E	VII	VII-5						
247F	V	VII-1									
247G	V	VII-1									
247H	V	VII-2									
247J	V	VII-1									
247K	M.D.										
247L	M.D.										
247M	M.D.										
247N	V	VII-1									
247P	M.D.										
248A	V	VII-1	252A	VII	VII-5						
248B	V	VII-2	252B	VII	VII-5						
248C	V	VII-1	252C	M.D.							
248D	V	VII-1									
248E	V	VII-1									
248F	V	VII-2									
248G	V	VII-2									
248H	V	VII-2									
248J	V	VII-1									
248K	V	VII-2									
248L	V	VII-2									
248M	V	VII-2									

X-75514

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

2 CONTACT SPRINGS

1	—	—	—	—	46	221BC	1	1900	10.7	11	4-8	100	26.5	23.5	—	—	2.2, 2.3
1	—	—	—	—	46	222BM	1	1900	10.7	11	4-8	—	50.	44.5	—	—	2.3
1	—	—	—	—	45	221AD	1	2215	15	13	S-4	—	46.	26.	—	—	
1	—	—	—	—	45	222AP	1	2215	15	13	S-4	—	46.	26.	—	—	
1	—	—	—	—	128	221MN	1	5550	100	11	6-8	65	13.9	11.5	—	3.6	2.3
1	—	—	—	—	48	221AH	1	8300	200	11	3-7	—	10.	9.	—	—	2.3
1	—	—	—	—	128	221CN	1	8300	200	11	S-4	—	9.6	9.2	—	—	2.3
1	—	—	—	—	46	221BH	1	13700	650	11	S-4	—	2.5	2.	—	—	2.3
1	—	—	—	—	12	221GD	1	13700	650	13	0	—	7.3	6.2	—	—	
1	—	—	—	—	45	221Y	1	14000	1300	13	S-4	—	7.3	6.8	—	—	
1	—	—	—	—	45	222CH	1	14000	1300	13	S-4	—	7.3	6.8	—	—	
1	—	—	—	—	46A	222BW	1	53000	11300	13	S-4	—	1.	.9	—	—	2.1
1	—	—	—	—	45	221PJ	1	33560	40000	13	S-4	—	2.2	2.0	—	—	
—	1	—	—	—	138	221DF	1	6650	150	12	7-11	—	23.	20.	—	—	
—	1	—	—	—	144	221EC	1	7450	215	6	S-5	—	8.1	7.2	—	—	
—	1	—	—	—	138A	221GW	1	14500	700	8	5-7	43	—	—	4.1	3.9	
—	1	—	—	—	138A	222DL	1	14500	700	8	5-7	43	—	—	4.1	3.9	
—	1	—	—	—	138	222DD	1	26100	2500	12	S-4	—	4.4	4.	—	—	
—	1	—	—	—	342	(P)222HT	1	43000	21000	6	S-4	—	1.4	1.1	—	—	

NOTES:

- 2.1 Resistance variation $\pm 10\%$.
 2.2 Armature need not touch core on operate.
 2.3 Contact follow min 0.008 in.

3 CONTACT SPRINGS

—	—	1	—	—	11	(P)221LW	1	4850	215	8	7-11	—	36.	34.5	—	—	3.1, 3.2, 3.3, 3.4
—	—	1	—	—	9	221AW	1	10900	400	8	4-8	—	12.	11.5	—	—	3.3, 3.4
—	—	1	—	—	372	221FAG	1	12200	550	8	7-11	—	10.	9.6	—	—	3.2, 3.3, 3.4, 3.5
—	—	1	—	—	125	(P)221BY	1	14000	1300	17	4-8	—	12.	11.	—	—	3.6
—	—	1	—	—	10	221CA	1	14000	1300	12	S-4	—	6.8	6.1	—	—	
—	—	1	—	—	315	(P)222GK	1	14000	1300	12	S-4	—	9.	7.5	—	1.5	

NOTES:

- 3.1 Resistance variation $\pm 10\%$.
 3.2 Armature need not touch core on operate.
 3.3 Contact follow min 0.008 in.
 3.4 Contact separation min 0.003 in.
 3.5 Permalloy core.
 3.6 Contact separation min 0.013 in.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT. ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

4 CONTACT SPRINGS

1	1	—	—	—	89	221NP	1	1900	10.7	12	7-11	—	125.	100.	—	40.	
1	1	—	—	—	197	221JR	1	6650	150	12	7-11	—	27.	20.	—	—	
1	1	—	—	—	197	222GR	1	10000	300	12	S-4	—	11.3	9.7	—	—	
1	1	—	—	—	197	(P)221HM	1	13700	650	12	4-6	—	8.4	6.9	—	3.5	4.1
1	1	—	—	—	197	221GL	1	14000	1300	12	S-4	—	10.	8.	—	—	
1	1	—	—	—	89	222DE	1	14000	1300	12	S-4	—	13.	12.	—	—	
2	—	—	—	—	3A	221BU	1	2215	15	13	S-4	—	45.	28.	—	—	
2	—	—	—	—	3A	221AF	1	8300	200	13	S-4	—	14.8	13.9	—	—	
2	—	—	—	—	3	221HS	1	10900	400	9	S-4	—	9.3	7.1	—	2.1	4.2, 4.3
2	—	—	—	—	77	(P)221AL	1	14500	700	18	0	—	4.	3.	—	—	4.4, 4.5, 4.6, 4.8
													8.5	7.5			4.7
2	—	—	—	—	8	221JP	1	8700	750	13	S-4	—	21.5	18.	—	—	
2	—	—	—	—	8	(P)222GB	1	8700	750	13	S-4	—	21.5	18.	—	—	

NOTES:

- 4.1 Armature need not touch core on operate.
- 4.2 Contact follow min 0.008 in.
- 4.3 Contact separation min 0.003 in.
- 4.4 Contacts 1-2 shall make before springs 2X-3 break.
- 4.5 Contact follow springs 3-4 min 0.008 in.
- 4.6 Contact separation springs 3-4 min 0.003 in.
- 4.7 Contacts 1-2 may make on whole combination N.O.
- 4.8 Requirements for springs 1-2 only.

5 CONTACT SPRINGS

1	—	1	—	—	369	221MA	1	350	.5	12	S-4	—	330.	290.	—	—	5.2, 5.3
1	—	1	—	—	369	(P)221MU	1	1050	4.9	12	S-4	500	140.	115.	—	—	
1	—	1	—	—	5A	221AG	1	8300	200	8	7-11	—	14.8	13.9	—	—	5.3, 5.4, 5.5
1	—	1	—	—	307	(P)221GN	1	7550	200	8	7-11	—	16.5	15.	—	—	5.3, 5.4, 5.5
1	—	1	—	—	307	(P)222JP	1	7540	200	8	9-11	200	23.5	18.5	—	14.7	5.3, 5.4, 5.5
1	—	1	—	—	19	222GN	1	7450	215	18	S-4	—	21.	18.5	—	—	5.6
1	—	1	—	—	7	221LF	1	4000	220	8	S-4	—	32.5	27.5	—	—	5.1, 5.4, 5.5
1	—	1	—	—	377	(P)221FAL	1	8500	275	8	7-11	140	11.8	10.3	—	—	5.1, 5.3, 5.4, 5.5
1	—	1	—	—	5	221MY	1	10900	400	8	2-4	100	12.5	12.	—	—	5.3, 5.4, 5.5
1	—	1	—	—	32	221ML	1	14000	1300	25	S-4	30	8.	4.9	—	—	5.7, 5.10
													18.5	15.			5.8
1	—	1	—	—	32	(P)222JY	1	14000	1300	25	S-4	30	8.	4.9	—	—	5.7, 5.10
													18.5	15.			5.8
1	—	—	1	—	140	(P)222DF	1	11400	500	16	S-4	—	16.5	9.	—	—	
—	1	1	—	—	387	(P)221MT	1	4850	215	9	7-11	190	36.	34.5	—	—	5.1, 5.3, 5.4, 5.5, 5.9
—	1	1	—	—	96	221PH	1	20100	1500	13	S-4	—	7.8	7.1	—	—	

NOTES:

- 5.1 Resistance variation $\pm 10\%$.
- 5.2 Resistance variation $\pm 15\%$.
- 5.3 Armature need not touch core on operate.
- 5.4 Contact follow test min 0.008 in.
- 5.5 Contact separation test min 0.003 in.
- 5.6 Contact separation test min 0.015 in.
- 5.7 Contacts 1-2 shall make before spring 1 strikes the bushing of spring 4.
- 5.8 Contacts 1-2 may make on N.O.
- 5.9 Contacts 1-2 may break on N.O.
- 5.10 Requirements for springs 1-2 only.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON-OPR	HOLD	RLS	
6 CONTACT SPRINGS																	
1	2	—	—	—	103	221EW	1	15625	900	13	7-11	—	13.	11.	—	—	
1	2	—	—	—	103	221AB	1	14000	1300	13	S-4	—	11.5	10.7	—	—	
2	1	—	—	—	81	221FA	1	8300	200	12	7-11	—	25.	21.	—	—	
2	1	—	—	—	181	221FG	1	14000	1300	12	S-4	—	9.7	7.8	—	—	
2	1	—	—	—	442	223DF	1	48900	7850	17	S-4	—	4.	2.	—	—	6.1
—	—	1	1	—	20	(P)221U	1	14000	1300	15	S-4	—	10.7	9.6	—	—	
—	—	1	1	—	20	222AC	1	14000	1300	15	S-4	—	12.5	11.	—	—	
—	—	2	—	—	145	221MB	1	845	1.8	9	S-5	—	100.	85.	—	38.	6.1, 6.2, 6.3, 6.4
—	—	2	—	—	38	221CB	1	14000	1300	13	S-4	—	11.8	10.7	—	—	
—	—	2	—	—	98	(P)222AK	1	14000	1300	13	S-4	—	11.5	10.9	—	—	
—	—	2	—	—	255	224AS	1	14000	1300	12	S-4	—	10.3	9.1	—	—	
—	—	—	2	—	28	222BL	1	14350	800	15	S-4	—	10.1	9.1	—	—	6.5, 6.6
—	—	—	2	—	274	223AU	1	15625	900	16	S-4	—	14.6	6.5	—	—	
—	—	—	2	—	27	221HB	1	14000	1300	16	S-4	—	23.	13.9	—	—	6.7
—	—	—	2	—	124	(P)222CB	1	14000	1300	16	S-4	—	14.7	12.1	—	—	6.6

NOTES:

- 6.1 Resistance variation $\pm 10\%$.
- 6.2 Contacts 1-2 may break on N.O.
- 6.3 Contact separation test min 0.003 in.
- 6.4 Contact follow test min 0.008 in.
- 6.5 Contact pressure springs 2-3 and 5-6 test min 15 grams.
- 6.6 Contact pressure springs 2-3 and 5-6 test min 35 grams.
- 6.7 Contact pressure springs 2-3 and 5-6 test min 60 grams.

7 CONTACT SPRINGS

1	1	—	1	—	199	221GJ	1	26100	2500	15	S-4	—	7.1	5.6	—	—	
1	1	—	1	—	34	221HH	1	22500	2000	25	S-4	—	6.6	5.3	—	—	7.2, 7.4, 7.5, 7.6
1	1	1	—	—	15	221T	1	14000	1300	13	S-4	—	10.5	8.9	—	—	7.3
2	—	1	—	—	17	(P)221HA	1	14500	700	12	4-8	—	12.8	12.1	—	—	7.1
2	—	1	—	—	17	(P)222EG	1	14500	700	12	4-8	—	10.	7.5	—	—	7.1
2	—	1	—	—	14	221DY	1	14000	1300	12	S-4	—	12.1	10.7	—	—	
2	—	1	—	—	14	(P)222LB	1	14000	1300	12	S-4	—	12.1	10.7	—	—	
2	—	—	1	—	142	221JF	1	14500	700	16	4-8	—	12.	7.5	—	—	
2	—	—	1	—	142	222DK	1	14500	700	16	4-8	—	12.	7.5	—	—	
2	—	—	1	—	93A	(P)221AA	1	14000	1300	15	S-4	—	11.5	10.7	—	—	
2	—	—	1	—	93	222AH	1	14000	1300	15	S-4	—	11.5	10.7	—	—	
2	—	—	—	1MM	1006	221PF	1	14000	1300	17	S-4	—	11.8	8.5	—	—	
—	2	1	—	—	36	222LP	1	17100	1000	14	S-4	—	9.2	8.4	—	—	

NOTES:

- 7.1 Armature need not touch core on operate.
- 7.2 Contacts 1-3 shall make before spring 1 strikes bushing on spring 5.
- 7.3 Contacts 1-3 may make and 2-3 may break on whole combination N.O.
- 7.4 Contacts 2-3 shall break before 4-5 break.
- 7.5 Contact pressure springs 2-3 test min 15 grams.
- 7.6 Requirements for springs 1-3 only.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

8 CONTACT SPRINGS

1	1	—	—	1MBM	132	222CT	1	14000	1300	26	S-4	—	10.2	8.6	—	—	8.1, 8.4
1	—	1	1	—	187	221FR	1	14000	1300	15	S-4	—	14.7	12.5	—	—	
1	—	2	—	—	168	221LR	1	13700	650	13	4-8	—	11.5	7.9	—	—	8.5
1	—	2	—	—	83	221EN	1	14500	700	22	S-4	—	14.2	12.	—	—	8.1, 8.2
1	—	2	—	—	168	221EJ	1	14000	1300	13	S-4	—	11.1	8.5	—	—	
1	—	2	—	—	86A	222AG	1	14000	1300	13	S-4	—	11.5	10.9	—	—	
1	—	—	2	—	146	221DH	1	14000	1300	16	S-4	—	17.	14.	—	—	8.3
4	—	—	—	—	76	221JW	1	11400	500	13	S-4	—	15.5	11.2	—	—	
—	1	—	2	—	33	222EJ	1	14000	1300	15	S-4	—	16.5	14.8	—	—	8.6

NOTES:

- 8.1 Contacts 1-2 may make on N.O.
- 8.2 Contacts 1-2 shall make before contacts 3-4 break.
- 8.3 Contacts 1-2 shall make before contacts 4-5 and 7-8 break.
- 8.4 Contact pressure springs 1-2 (armature operated) test min 10 grams.
- 8.5 Armature need not touch core on operate.
- 8.6 Contact pressure springs 4-5 and 7-8 test min 35 grams.

9 CONTACT SPRINGS

1	—	1	—	1BMB	121	221AC	1	14000	1300	27	S-4	—	7.3	6.8	—	—	9.1, 9.3, 9.9
													13.9	12.1			9.2
2	1	1	—	—	31	(P)221W	1	14000	1300	13	S-4	—	16.	13.7	—	—	
2	1	1	—	—	389	221MW	1	14000	1300	13	S-4	—	25.5	22.	—	—	
2	1	1	—	—	31	222FD	1	14000	1300	13	S-4	—	14.3	11.	—	—	
2	1	—	1	—	63	222EF	1	14000	1300	21	S-4	—	16.	13.5	—	—	9.4, 9.5, 9.6
3	—	—	1	—	305	(P)221GS	1	26100	2500	16	S-4	—	8.5	7.1	—	—	
3	—	—	1	—	313	221HK	1	14000	1300	20	S-4	—	13.6	8.9	—	—	9.7
—	—	2	1	—	380	(P)222JT	1	13700	650	16	S-4	65	15.3	7.3	—	—	
—	—	3	—	—	120	222AN	1	14000	1300	14	S-4	—	14.	13.	—	—	9.8

NOTES:

- 9.1 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 9.2 Contacts 1-2 may make on N.O.
- 9.3 Contact pressure springs 8-9 test min 15 grams.
- 9.4 Contacts 1-3 shall make before contacts 4-5 break.
- 9.5 Contacts 1-3 may make on N.O.
- 9.6 Contacts 4-5 may break before contacts 2-3 break.
- 9.7 Contacts 1-2 shall make before contacts 3-4, 5-6, and 7-9 make.
- 9.8 Contacts 1-2 and 4-5 may break on N.O.
- 9.9 Requirements for springs 1-2 only.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

10 CONTACT SPRINGS

1	1	1	1	—	345	(P)221KT	1	13700	650	16	S-4	—	16.5	10.6	—	—	
1	1	2	—	—	58	221GH	1	14000	1300	14	S-4	—	18.	13.9	—	—	10.2
1	1	—	2	—	306	221LK	1	14000	1300	15	S-4	—	20.	15.	—	—	10.1
2	—	1	1	—	169	(P)221EM	1	14000	1300	15	S-4	—	14.7	12.	—	—	
2	3	—	—	—	355	222JF	1	3000	54	28	S-4	—	0.070	0.060	—	—	10.3
													0.125	0.100	—	—	10.4
2	—	2	—	—	360	221LL	1	10900	400	13	S-4	—	16.	8.3	—	—	
2	—	2	—	—	163	(P)221EE	1	14000	1300	13	S-4	—	14.	11.5	—	—	
3	2	—	—	—	136	221GF	1	14000	1300	13	S-4	—	15.	12.8	—	—	
3	2	—	—	—	136	222DA	1	14000	1300	13	S-4	—	16.	14.	—	—	
4	1	—	—	—	308	221LN	1	10900	400	12	S-4	—	17.5	11.5	—	—	
—	2	2	—	—	61	222AF	1	14000	1300	15	S-4	—	18.	16.5	—	—	10.2
—	3	—	—	1MBM	156	222DN	1	14000	1300	23	S-4	—	18.	16.	—	—	10.2

NOTES:

- 10.1 Contact pressure springs 6-7 and 9-10 test min 35 grams.
- 10.2 Contacts 1-2 and 3-4 may break on N.O.
- 10.3 Requirements for springs 1-2 only.
- 10.4 Contacts 1-2 may break on N.O.

11 CONTACT SPRINGS

1	—	2	1	—	381	(P)222JU	1	11400	500	29	S-4	85	12.5	9.4	—	—	11.1, 11.2
													23.	19.	—	—	11.5
1	—	1	2	—	26	222AD	1	14000	1300	15	S-4	—	18.5	16.5	—	—	11.3
1	—	3	—	—	95	222AJ	1	14000	1300	14	S-4	—	14.	13.	—	—	11.4
2	2	—	1	—	92	(P)222JA	1	13725	2000	29	S-4	—	9.5	5.5	—	—	11.1, 11.2
													18.5	15.5	—	—	11.5
2	2	—	1	—	92	221FC	1	13725	2000	29	S-4	—	8.1	6.5	—	—	11.1, 11.2
													17.	14.2	—	—	11.5
3	1	1	—	—	109	(P)222AM	1	14000	1300	13	S-4	—	17.	15.	—	—	
3	1	1	—	—	285	223BH	1	28350	3300	25	S-4	—	4.4	3.4	—	—	11.2, 11.6
													8.3	7.	—	—	11.5
3	1	1	—	—	109	(P)222EE	1	28350	3300	13	S-4	—	8.5	7.	—	—	
—	1	3	—	—	30	(P)222B	1	14000	1300	15	S-4	—	24.5	22.	—	—	11.7
—	4	1	—	—	153	222DM	1	14000	1300	16	S-4	—	18.	15.	—	—	11.7
—	—	—	1	2MBM	99	222AL	1	14000	1300	23	S-4	—	23.	20.	—	—	11.8
—	—	1	—	2BMB	42	(P)222CU	1	14000	1300	17	S-4	—	14.	12.	—	—	11.4, 11.9

NOTES:

- 11.1 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 11.2 Requirements for springs 1-2 only.
- 11.3 Contact pressure springs 7-8 and 10-11 test min 35 grams.
- 11.4 Contacts 1-2 and 4-5 may break on N.O.
- 11.5 Contacts 1T-2T may make on N.O.
- 11.6 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
- 11.7 Contacts 1-2 and 3-4 may make on N.O.
- 11.8 Contact pressure springs 2-3, 5-6, and 9-10 test min 35 grams.
- 11.9 Contact pressure springs 6-7 and 10-11 test min 35 grams.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
12 CONTACT SPRINGS																	
1	1	—	—	2BMB	370	(P)222JK	1	10900	400	16	S-4	—	24.5	13.8	—	—	12.1
1	2	2	—	—	112	222GD	1	14000	1300	27	S-4	—	8.6	5.7	—	—	12.2, 12.17
													23.	15.5			12.3
1	2	2	—	—	335	222HL	1	14000	1300	15	S-4	—	18.	16.	—	—	12.4
2	1	1	1	—	56	222GA	1	14000	1300	26	S-4	—	13.5	11.6	—	—	12.5, 12.18
													23.5	19.5			12.6
2	1	—	2	—	195	222FJ	1	14000	1300	15	S-4	—	21.5	16.5	—	—	
2	1	2	—	—	176	221LM	1	14000	1300	14	S-4	—	13.	10.	—	—	12.4
2	1	2	—	—	176	(P)222EU	1	14000	1300	14	S-4	—	17.	14.4	—	—	12.4
2	1	2	—	—	157	222FL	1	14000	1300	27	S-4	—	7.9	7.3	—	—	12.2, 12.18
													23.	19.			12.3
3	3	—	—	—	418	223CN	1	17100	1200	24	S-4	35	9.4	7.9	—	—	12.7, 12.19
												35	17.	14.2			12.20
3	—	—	2	—	269	223AH	1	14000	1300	27	S-4	—	13.1	7.2	—	—	12.8, 12.9, 12.16
													22.5	18.			12.10
4	—	—	—	1BMB	400	223BT	1	14000	1300	19	S-4	—	17.5	9.9	—	—	12.11
5	1	—	—	—	180	222ET	1	14000	1300	12	S-4	—	20.5	15.5	—	—	
—	1	1	1	1MBM	349	222JD	1	14000	1300	22	S-4	—	21.	12.4	—	—	
—	2	—	—	2BMB	252	223W	1	26100	2500	16	S-4	—	11.3	9.	—	—	12.12
—	—	4	—	—	343	222HY	1	10000	300	15	S-4	—	21.	15.	—	—	12.13
—	—	4	—	—	332	(P)222HH	1	14000	1300	15	S-4	30	21.5	18.	—	—	12.13
—	—	4	—	—	228	223J	1	14000	1300	13	S-4	—	13.6	11.3	—	—	12.14
—	—	4	—	—	60	(P)222BH	1	26100	2500	18	S-4	—	9.	6.5	—	—	12.15

NOTES:

- 12.1 Contacts 1-2 and 5-6 may break on N.O.
- 12.2 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 12.3 Contacts 1-2 may make and contacts 3-4 and 5-6 may break on N.O.
- 12.4 Contacts 1-2 and 3-4 may break on N.O.
- 12.5 Contacts 1-2 shall break and 2-3 shall make before spring 2 strikes bushing on spring 5.
- 12.6 Contacts 1-2 may break and 2-3 may make on whole combination N.O.
- 12.7 Contacts 1T-2T shall break and 3T-4T shall make before spring 3T strikes the bushing on springs 6T and before the armature stud strikes 2B.
- 12.8 Contacts 1T-2T shall make before 1T strikes bushing on 3T.
- 12.9 Contacts 1B-2B shall make before 1B strikes bushing on 3B.
- 12.10 Contacts 1T-2T and 1B-2B may make on N.O. for whole combination.
- 12.11 Contact 1B-2B shall make before 3B-4B and 5B-6B make.
- 12.12 Contact pressure springs 5T-6T and 5B-6B test min 35 grams.
- 12.13 Contacts 1-2 and 4-5 may break on N.O.
- 12.14 As permitted by sequence any two break contacts may break on N.O.
- 12.15 Contact separation 2-3 and 5-6 min 0.013 in.
- 12.16 Requirements for springs 1T-2T and 1B-2B only.
- 12.17 Requirements for springs 1-2 only.
- 12.18 Requirements for springs 1-2-3 only.
- 12.19 Requirements for springs 1T-2T and 3T-4T only.
- 12.20 Contacts 1T-2T and 3T-4T may make on N.O.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

13 CONTACT SPRINGS

1	1	3	—	—	172	(P)222EN	1	14000	1300	15	S-4	—	24.	20.	—	—	13.1
1	1	3	—	—	188	222FA	1	28350	3300	15	S-4	—	8.3	6.9	—	—	13.1
2	—	2	1	—	254	223Y	1	10900	400	27	4-8	—	12.	8.2	—	—	13.2, 13.6
3	2	1	—	—	314	(P)222KG	1	7700	300	27	S-4	140	31.	22.5	—	—	13.3
3	2	1	—	—	314	222GH	1	14000	1300	27	S-4	140	17.5	13.2	—	—	13.4, 13.6
—	1	1	—	—	69	(P)222GF	1	14000	1300	18	S-4	—	9.8	7.2	—	—	13.5
—	3	—	1	—	905	222LT	1	14000	1300	21	S-4	—	19.5	15.5	—	—	13.5
—	1	1	—	2BMB	69	(P)222GF	1	14000	1300	18	S-4	—	23.5	18.	—	—	13.1
—	3	—	1	1MBM	905	222LT	1	14000	1300	21	S-4	—	22.5	16.5	—	—	13.1

NOTES:

- 13.1 Contacts 1-2 and 3-4 may break on N.O.
- 13.2 Contacts 1T-2T shall make before spring 1T strikes the bushing on spring 4T and before armature stud strikes spring 2B.
- 13.3 Contacts 1T-2T may make on N.O.
- 13.4 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 13.5 Contacts 1-2 may make and contacts 3-4 and 5-6 may break on the whole combination N.O.
- 13.6 Requirements for springs 1T-2T only.

14 CONTACT SPRINGS

1	—	1	1	—	707	222LE	1	14000	1300	17	S-4	FS	19.0	14.6	—	—	—
1	—	4	—	—	385	(P)222KC	1	14000	1300	15	S-4	—	25.5	22.	—	—	14.5
2	2	1	1	—	201	(P)223BG	1	14000	1300	17	S-4	—	25.5	22.	—	—	14.4, 14.5
2	2	1	1	—	201	224A	1	14000	1300	17	S-4	—	22.	20.	—	—	14.5, 14.6
2	2	2	—	—	334	(P)222HJ	1	14000	1300	27	S-4	—	9.5	7.7	—	—	14.1, 14.7
—	—	—	—	—	—	—	—	—	—	—	—	—	19.5	17.	—	—	14.8
3	1	—	2	—	397	222KT	1	11400	500	18	0	80	23.	20.	—	—	14.9
3	1	2	—	—	202	224B	1	14000	1300	13	S-4	—	17.	16.	—	—	14.5
—	1	3	1	—	203	224C	1	14000	1300	15	S-4	—	24.5	22.	—	—	14.3, 14.5
—	1	4	—	—	376	(P)222JM	1	14000	1300	15	S-4	—	25.5	22.	—	—	14.5
—	1	4	—	—	331	222HG	1	28350	3300	16	S-4	—	8.3	5.5	—	—	14.5
—	1	3	1	—	246	(P)224AM	1	16000	1300	15	S-4	—	24.5	19.5	—	—	14.2, 14.3, 14.5
—	4	2	—	—	350	(P)222JC	1	28350	3300	17	S-4	—	11.	8.2	—	—	14.5
—	—	2	—	—	200	(P)223A	1	14000	1300	16	S-4	—	14.	12.	—	—	14.5
—	—	2	—	—	383	(P)222KB	1	14000	1300	16	S-4	50	20.	12.	—	—	14.5

NOTES:

- 14.1 Requirements for springs 1-2 only.
- 14.2 Contacts 2T-3T shall make before contacts 5T-6T break.
- 14.3 Contact pressure 5T-6T min 35 grams.
- 14.4 Contact pressure springs 6B-7B test min 35 grams.
- 14.5 As permitted by sequence any two break contacts may break on N.O.
- 14.6 Contact pressure 6T-7T test min 35 grams.
- 14.7 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 14.8 Contacts 1-2 may make and contacts 3-4 and 5-6 may break on N.O.
- 14.9 Contacts 7-8 shall make before 9-11 and 12-14 make.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT. ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

15 CONTACT SPRINGS

2	1	3	—	—	210	224K	1	14000	1300	14	S-4	—	24.5	18.	—	—	15.1
—	3	3	—	—	249	224AP	1	14000	1300	14	4-8	—	25.	17.	—	—	15.1
—	—	5	—	—	432	(P)224CB	1	16000	1300	14	S-4	—	25.5	22.	—	—	15.1

NOTES:

15.1 As permitted by sequence any two break contacts may break on N.O.

16 CONTACT SPRINGS

1	1	3	1	—	414	(P)224BL	1	16000	1300	16	S-4	—	24.5	19.5	—	—	16.1, 16.2, 16.3
1	1	3	1	—	207	223B	1	22500	2000	27	S-4	—	5.1	4.8	—	—	16.1, 16.4, 16.5, 16.8, 16.9
1	—	4	—	—	390	222KH	1	10000	300	15	S-4	140	23.	19.5	—	—	16.7
2	—	2	2	—	439	224CG	1	15300	1300	15	S-4	FS	19.5	16.	—	—	16.1
2	—	4	—	—	273	223AS	1	14500	700	13	S-4	—	20.	17.	—	—	16.1
2	—	4	—	—	242	223N	1	26100	2500	25	S-4	—	5.9	4.8	—	—	16.6, 16.11
4	4	—	—	—	266	223AK	1	28350	3300	13	S-4	—	12.5	10.	—	—	16.12
4	1	2	—	—	213	(P)224L	1	14000	1300	13	S-4	—	11.	9.8	—	—	16.1
—	2	3	1	—	403	(P)224BJ	1	16000	1300	15	S-4	—	17.	16.	—	—	16.1
—	—	—	—	—	—	—	—	—	—	—	—	—	24.5	19.5	—	—	16.1, 16.10

NOTES:

- 16.1 As permitted by sequence any two break contacts may break on N.O.
- 16.2 Contact pressure springs 7T-8T test min 35 grams.
- 16.3 Contacts 4T-5T shall make before 7T-8T break.
- 16.4 Requirements for springs 1T-3T only.
- 16.5 Contacts 1T-3T shall make before 1T strikes bushing on 5T and before the armature stud strikes 2B.
- 16.6 Requirements for springs 1B-2B only.
- 16.7 Contacts 1T-3T may make and 2T-3T may break on N.O. for whole combination.
- 16.8 Contacts 2T-3T shall break before contacts 4T-5T and 1B-2B break.
- 16.9 Contact pressure springs 2T-3T test min 15 grams.
- 16.10 Contact pressure springs 5B-6B min 35 grams.
- 16.11 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B and before armature stud strikes spring 2T.
- 16.12 As permitted by sequence any two break contacts may break and contacts 1B-2B may make on N.O.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT. ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

17 CONTACT SPRINGS

1	3	1	2	—	251	223T	1	16000	1300	29	S-4	—	9. 24.	7. 18.	—	—	17.1, 17.3, 17.4 17.2
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NOTES:

- 17.1 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B and before armature stud strikes spring 2T.
 17.2 As permitted by sequence any two break contacts may break and contacts 1B-2B may make on N.O. for whole combination.
 17.3 Contact pressure springs 7T-8T and 8B-9B min 35 grams.
 17.4 Requirements for 1B-2B only.

18 CONTACT SPRINGS

1	1	2	—	2BMB	268	(P)223AG	1	28350	3300	27	S-4	—	4.5 11.1	2.5 8.8	—	—	18.1, 18.3, 18.6 18.2
4	2	2	—	—	221	223AL	1	28350	3300	25	S-4	—	4.3 11.	3.4 9.6	—	—	18.4, 18.7 18.5

NOTES:

- 18.1 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
 18.2 As permitted by sequence any two break contacts may break and contacts 1T-2T may make on N.O.
 18.3 Contact pressure springs 5T-6T and 3B-4B test min 35 grams.
 18.4 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B and before armature stud strikes 2T.
 18.5 As permitted by sequence any two break contacts may break and contacts 1B-2B may make on N.O.
 18.6 Requirements for springs 1T-2T only.
 18.7 Requirements for springs 1B-2B only.

19 CONTACT SPRINGS

1	1	4	1	—	265	223AF	1	22500	2000	27	S-4	—	7.8 14.5	3.2 13.	—	—	19.1, 19.3, 19.4, 19.11 19.2
3	2	3	—	—	409	(P)223CG	1	13700	650	25	0	—	11.7 21.5	7.6 18.	—	—	19.6, 19.12 19.5
3	2	3	—	—	229	223H	1	14000	1300	27	S-4	—	9.3 19.	7.3 12.	—	—	19.7, 19.13 19.8
4	1	3	—	—	405	223CB	1	13700	650	25	0	—	11.7 22.	7.6 18.5	—	—	19.6, 19.12 19.9
5	—	3	—	—	214	(P)224M	1	14000	1300	13	S-4	—	17.	16.	—	—	19.10

NOTES:

- 19.1 Contacts 1T-3T shall make before spring 1T strikes bushing on 5T and before armature stud strikes spring 2B.
 19.2 As permitted by sequence any two break contacts may break and contacts 1T-3T may make and 2T-3T may break on N.O. for whole combination.
 19.3 Contacts 2T-3T shall break before contacts 4T-5T and 1B-2B break.
 19.4 Contact pressure springs 2T-3T test min 15 grams.
 19.5 Contacts 1T-2T, 3T-4T, and 1B-2B may make and two break contacts may break when the 18 N.O. is applied.
 19.6 Contacts 1T-2T and 3T-4T shall make before spring 3T strikes bushing on spring 6T and contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B.
 19.7 Contacts 1B-2B shall make before spring 1B strikes bushing on 4B and before armature stud strikes 2T.
 19.8 As permitted by sequence any two break contacts may break and 1B-2B may make on secondary N.O.
 19.9 As permitted by sequence any two break contacts may break and contacts 1T-2T, 3T-4T, and 1B-2B may make on N.O.
 19.10 As permitted by sequence any two break contacts may break on N.O.
 19.11 Requirements for springs 1T-3T only.
 19.12 Requirements for springs 1T-2T, 3T-4T, and 1B-2B only.
 19.13 Requirements for springs 1B-2B only.

X-75514

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
20 CONTACT SPRINGS																	
1	2	2	—	2BMB	241	223P	1	26100	2500	17	S-4	—	13.8	9.	—	—	20.1, 20.2
2	2	4	—	—	411	(P)223CK	1	13700	650	25	0	—	9.4	6.2	—	—	20.3, 20.4, 20.23
													19.5	16.5			20.5
2	2	4	—	—	434	(P)224CD	1	16000	1300	15	S-4	—	24.5	19.5	—	—	20.1
2	2	4	—	—	271	223AP	1	26100	2500	27	S-4	—	5.3	3.9	—	—	20.6, 20.24
													12.8	11.5			20.7
2	3	2	—	1BMB	287	223BK	1	22500	2000	29	S-4	—	6.9	4.8	—	—	20.8, 20.10, 20.11, 20.25
													15.	12.2			20.9
3	4	—	2	—	428	223CU	1	14000	1300	28	S-4	30	9.5	7.5	—	—	20.12, 20.14, 20.15, 20.16
													25.5	21.5			20.13
3	1	3	1	—	238	(P)223M	1	14000	1300	16	S-4	—	21.5	16.5	—	—	20.1
3	1	4	—	—	263	(P)223AE	1	14000	1300	17	S-4	—	21.5	18.	—	—	20.17, 20.18
4	3	—	2	—	430	223CW	1	14000	1300	28	S-4	30	9.5	7.5	—	—	20.12, 20.14, 20.15, 20.16
													25.5	21.5			20.19
4	—	4	—	—	402	223BY	1	14000	1300	13	S-4	—	19.	15.	—	—	20.1
5	2	2	—	—	219	223AM	1	14000	1300	27	S-4	—	10.	7.3	—	—	20.20, 20.21
													25.	22.			20.22

NOTES:

- 20.1 As permitted by sequence any two break contacts may break on N.O.
- 20.2 Contact pressure springs 9T-10T and 7B-8B test min 35 grams.
- 20.3 Contacts 1T-2T shall make before spring 1T strikes the bushing on spring 4T.
- 20.4 Contacts 1B-2B shall make before spring 1B strikes the bushing on spring 4B.
- 20.5 Contacts 1T-2T and 1B-2B may make and two break contacts may break on the whole combination N.O.
- 20.6 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
- 20.7 As permitted by sequence any two break contacts may break and contacts 1T-2T may make on N.O.
- 20.8 Contacts 1B-2B and 3B-4B shall make before spring 3B strikes bushing on spring 6B and before armature stud strikes spring 2T.
- 20.9 As permitted by sequence any two break contacts may break and contacts 1B-2B and 3B-4B may make on N.O.
- 20.10 Contacts 2T-3T shall make before contacts 9T-10T break.
- 20.11 Contact pressure springs 9T-10T test min 35 grams.
- 20.12 Contacts 1T-3T shall make before 1T strikes the bushing on 5T and before the armature stud strikes spring 2B.
- 20.13 Any two break contacts may break and contacts 1T-3T may make and 2T-3T may break on N.O.
- 20.14 Contacts 2T-3T shall break before contacts 4T-5T and 1B-2B break.
- 20.15 Contact pressure springs 2T-3T and 9T-10T test min 15 grams.
- 20.16 Requirements for springs 1T-3T only.
- 20.17 Contacts 1T-2T and 1B-2B may break on N.O.
- 20.18 Contact separation springs 2T-3T test min 0.013 in.
- 20.19 Contacts 1T-3T may make, contacts 2T-3T may break, and two break contacts may break on N.O.
- 20.20 Requirements for springs 1B-2B only.
- 20.21 Contacts 1B-2B shall make before spring 1B strikes bushing of 4B and before armature stud strikes spring 2T.
- 20.22 As permitted by sequence any two break contacts may break and contacts 1B-2B may make on N.O.
- 20.23 Requirements for 1T-2T and 1B-2B only.
- 20.24 Requirements for 1T-2T only.
- 20.25 Requirements for 1B-2B and 3B-4B only.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

21 CONTACT SPRINGS

2	1	4	1	—	281	(P)224BC	1	22500	2000	25	S-4	—	7.8	3.2	—	—	21.1, 21.3, 21.4, 21.6
—	2	1	2	2BMB	282	224BD	1	16000	1300	17	S-4	—	15.	13.5	—	—	21.2
													24.	14.7	—	—	21.1, 21.5

NOTES:

- 21.1 As permitted by sequence any two break contacts may break on the whole combination N.O.
- 21.2 Contacts 1T-3T may make and 2T-3T may break on N.O.
- 21.3 Contacts 1T-3T shall make before spring 1T strikes the bushing on spring 5T and before the armature stud strikes spring 2B.
- 21.4 Contact pressure springs 2T-3T test min 15 grams.
- 21.5 Contact pressure springs 3T-4T, 11T-12T, 3B-4B, and 8B-9B test min 35 grams.
- 21.6 Requirements for springs 1T-3T only.

22 CONTACT SPRINGS

3	1	2	—	2BMB	286	(P)223BJ	1	22500	2000	27	S-4	—	9.5	5.4	—	—	22.1, 22.3, 22.6
3	2	4	—	—	437	223DD	1	13700	650	25	0	FS	17.	13.8	—	—	22.2
													9.5	6.2	—	—	22.4, 22.7
													22.0	16.5	—	—	22.5

NOTES:

- 22.1 Contacts 1T-2T, 3T-4T, and 5T-6T shall make before spring 5T strikes bushing on spring 8T and before armature stud strikes 2B.
- 22.2 As permitted by sequence any two break contacts may break and contacts 1T-2T, 3T-4T, and 5T-6T may make on N.O.
- 22.3 Contact pressure springs 9T-10T and 3B-4B test min 25 grams.
- 22.4 Contacts 1T-2T and 1B-2B shall make before springs 1T and 1B strike the bushing on springs 4T and 4B.
- 22.5 Contacts 1T-2T and 1B-2B may make and two break contacts may break on N.O.
- 22.6 Requirements for springs 1T-2T, 3T-4T, and 5T-6T only.
- 22.7 Requirements for springs 1T-2T and 1B-2B only.

23 CONTACT SPRINGS

4	6	1	—	—	243	224AJ	1	15625	900	27	S-4	—	15.5	12	—	—	23.1, 23.2, 23.6
5	2	1	2	—	298	223BS	18	9000	800	15	S-4	50	34.5	27.5	—	—	23.3
													35.	20.	—	—	23.4, 23.5

NOTES:

- 23.1 Contacts 1T-2T shall make before spring 1T strikes bushing of spring 4T.
- 23.2 Contacts 1B-2B and 3B-4B shall make before spring 3B strikes bushing of spring 6B.
- 23.3 As permitted by sequence any two break contacts may break and contacts 1T-2T, 1B-2B, and 3B-4B may make on N.O.
- 23.4 As permitted by sequence two break contacts may break on N.O.
- 23.5 Contact pressure 10T-11T and 11B-12B test min 15 grams.
- 23.6 Requirements for springs 1T-2T, 1B-2B, and 3B-4B.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

24 CONTACT SPRINGS

1	4	2	—	2BMB	420	223CP	1	26100	2500	18	S-4	—	14.5	11.2	—	—	24.1, 24.2
3	3	4	—	—	272	(P)223AR	1	14000	1300	27	S-4	—	11.	7.2	—	—	24.1, 24.3, 24.5, 24.11
													27.	22.			24.4
5	1	4	—	—	412	223DC	1	13750	1300	14	S-4	FS	23.	16.	—	—	24.1
5	1	4	—	—	412	(P)224BK	1	14000	1300	14	S-4	—	22.5	15.5	—	—	24.1
8	2	—	—	1BMB	257	(P)224AT	1	15625	900	29	S-4	—	14.	10.5	—	—	24.6, 24.7, 24.8
													32.	26.			24.9
—	—	8	—	—	290	224BH	1	15625	900	21	S-4	—	43.	34.	—	—	24.1, 24.10

NOTES:

- 24.1 As permitted by sequence any two break contacts may break on N.O.
- 24.2 Contact pressure springs 11T-12T and 9B-10B test min 35 grams.
- 24.3 Contacts 1T-2T shall make before spring 1T strikes the bushing on spring 4T and before the armature stud strikes spring 2B.
- 24.4 Contacts 1T-2T may make on N.O.
- 24.5 Contacts 4T-5T may make before 11T-12T break.
- 24.6 Requirements for springs 1T-2T and 1B-2B only.
- 24.7 Contacts 1T-2T shall make before spring 1T strikes the bushing on spring 4T.
- 24.8 Contacts 1B-2B shall make before spring 1B strikes the bushing on spring 4B.
- 24.9 As permitted by sequence any two break contacts may break and contacts 1T-2T and 1B-2B may make on N.O.
- 24.10 Contact separation test min 0.015 in.
- 24.11 Requirements for springs 1T-2T only.

26 CONTACT SPRINGS

3	4	4	—	—	283	224BE	1	16000	1300	15	S-4	—	20.	14.5	—	—	26.1
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NOTES:

- 26.1 As permitted by sequence any two break contacts may break on N.O.

RELAY DATA — CODE INFORMATION

TABLE I — SINGLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

30 CONTACT SPRINGS

—	—	10	—	—	223	223F	1	13700	650	16	0	—	21.	10.	—	—	30.1
—	—	10	—	—	292	(P)223BN	1	14000	1300	16	S-4	—	18.5	10.6	—	—	30.1

NOTES:

30.1 As permitted by sequence any two break contacts may break on N.O.

32 CONTACT SPRINGS

—	1	10	—	—	299	223BU	1	10900	400	17	S-4	—	26.	13.7	—	—	32.1
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NOTES:

32.1 As permitted by sequence any two break contacts may break on N.O.

X-75514

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
2 CONTACT SPRINGS																	
1	—	—	—	—	128	221MM	3	P 1600 S 22290	13.7 10000	11	S-4	P S	500 —	43.5 4.2	37.5 3.2	— —	2.1, 2.2
1	—	—	—	—	128	(P)221JT	3	P 3750 S 2024	50 760	11	7-11	P/S	—	16.5	13.8	— 3.8	2.1, 2.2
1	—	—	—	—	128	(P)222HE	3	P 3750 S 2024	50 760	11	7-11	P/S	—	16.5	13.8	— 3.8	2.1, 2.2
1	—	—	—	—	46A	221AM	3	P 2350 S 2275	60 1900	13	S-4	P P/S	— —	34. 18.5	31.5 —	— —	—
1	—	—	—	—	49	221ET	3	P 2350 S 2350	60 1900	13	S-4	P P/S	— —	46. 25.	40. —	— —	2.3
1	—	—	—	—	45	222BF	3	P 2350 S 2275	60 1900	13	S-4	P P/S	— —	43. 23.5	40. —	— —	—
1	—	—	—	—	356	(P)221CP	3	P 4825 S 2025	100 380	13	4-6	P S	95 110	19.5 43.	— 39.	15. —	2.1, 2.3
1	—	—	—	—	45	221PE	3	P 3060 S 20250	100 2700	13	S-4	P S	— —	35. 5.9	31. —	— —	—
1	—	—	—	—	45	221BM	3	P 6600 S 12000	250 4000	13	S-4	P S	— —	14.2 8.6	12.3 —	— —	—
1	—	—	—	—	45B	221HW	3	P 5750 S 2900	380 250	11	4-8	P S	— —	20. 36.	— 31.5	— 11.2	2.2
1	—	—	—	—	45	221AU	4	F 10000 R 5600	750 250	13	S-4	R F	— —	18. 9.5	16.5 —	— —	—
1	—	—	—	—	45	221JJ	3	P 10350 S 3150	1000 2000	13	S-4	P P/S	— —	9.9 7.7	8.8 —	— —	2.1
1	—	—	—	—	45	221MF	4	F 11000 R 11000	1000 1000	13	4-8	F R	40. —	11.5 13.5	10.2 —	— —	—
1	—	—	—	—	45	221MK	4	F 12950 R 5600	4000 250	13	S-4	R F	— —	14.2 9.2	12.3 —	— —	—
—	1	—	—	—	192	221GC	4	F 5450 R 5450	200 200	8	S-4	F/R	—	8.8	7.	— —	—

NOTES:

- 2.1 Resistance variation $\pm 10\%$.
- 2.2 Contact follow test min 0.008 in.
- 2.3 Armature need not touch core on operate.

X-75514

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

3 CONTACT SPRINGS

—	—	1	—	—	374	221ME	3	P 3650 S 2320	95 900	17	S-4	P P/S	— —	47. 29.5	39.5 —	— —	3.1
—	—	1	—	—	11	(P)221ND	21	P/T P 2200 S 5150 T 2950	185 70 185 115	8	7-11	P/S	100	14.8	14.4	—	3.1, 3.2, 3.3, 3.4
—	—	1	—	—	11	(P)221A	4	F 5450 R 5450	200 200	8	7-11	F/R	—	14.8	14.4	—	3.2, 3.3, 3.4
—	—	1	—	—	11	221FAA	17	P1 4450 P2 4450	200 200	8	7-11	P1/P2	—	15.	14.	—	3.1, 3.2, 3.3, 3.4
—	—	1	—	—	125	(P)222KL	3	P/T P 13800 S 9100 T (N.I.)	790 1300 1300 2000	17	S-4	P S	50 30	28. 28.	24. —	— —	—
—	—	—	1	—	24	221DW	2	P//S P 11370 S (N.I.)	375 500 1500	15	0	P//S	—	14.7	11.2	—	3.5

NOTES:

- 3.1 Resistance variation $\pm 10\%$.
- 3.2 Armature need not touch core on operate.
- 3.3 Make contact follow test min 0.008 in.
- 3.4 Contact separation test min 0.003 in.
- 3.5 Contact pressure springs 2-3 test min 15 grams.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMP.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

4 CONTACT SPRINGS

1	1	—	—	—	89	222PA	15					This is an iron washer relay—not for general use. See 251 and 252 types.					
2	—	—	—	—	3	221MC	3	P 750 S 8000	2.6 475	9	S-4	P — P/S —	65. 10.5	45.5 —	— —	— —	4.1, 4.2, 4.3, 4.4
2	—	—	—	—	3	221HT	2	P//S P 1940 S (N.I.)	15 15.1 2000	9	S-4	P//S—	49.5	29.	—	—	4.2, 4.3
2	—	—	—	—	3A	222BE	3	P 2350 S 2650	60 1900	13	S-4	P/S — P —	29. 53.	— 43.	— —	— —	
2	—	—	—	—	700 (P)	221NL	2	P//S P 2710 S (N.I.)	181 210 1300	16	7-9	P//S—	100.	90.	—	—	4.4, 4.5
2	—	—	—	—	375	221FAJ	21	P/T P 2050 S 4850 T 2800	210 82 210 128	9	4-8	P/S —	8.9	6.6	—	—	4.2, 4.3, 4.4
2	—	—	—	—	3A	221GA	3	P 15100 S 5500	1450 400	13	0	S — P —	19.5 7.9	14.4 —	— —	— —	
2	—	—	—	—	8	222PB	15					This is an iron washer relay—not for general use. See 251 and 252 types.					
2	—	—	—	—	3A	221FH	3	P 19500 S 9500	2000 1500	13	S-4	P —	8.5 19.5	7.1 —	— —	— —	
2	—	—	—	—	158	221NN	15					This is an iron washer relay—not for general use. See 251 and 252 types.					

NOTES:

- 4.1 Armature need not touch core on the primary operate.
- 4.2 Contact separation test min 0.003 in.
- 4.3 Contact follow test min 0.008 in.
- 4.4 Resistance variation $\pm 10\%$.
- 4.5 Armature need not touch core on operate.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

5 CONTACT SPRINGS

1	—	1	—	—	369	221PG	3	P 584 S 13300	2 1475	12	S-4	P — S —	180. 8.7	160. —	—	—	
1	—	1	—	—	307	(P)221FAF	21	P/T P 2050 S 4850 T 2800	210 82 210 106	8	7-11	P/S/T —	11.9	10.7	—	—	5.1, 5.3, 5.4, 5.6
1	—	1	—	—	5A	(P)221NE	21	P/T P 2200 S 5150 T 2950	185 70 185 115	8	7-11	P/S 100	14.8	14.4	—	—	5.1, 5.3, 5.4, 5.6
1	—	1	—	—	5A	(P)221P	4	F 5450 R 5450	200 200	8	7-11	F/R —	14.8	14.4	—	—	5.3, 5.4, 5.6
1	—	1	—	—	6	(P)221R	4	F 5450 R 5450	200 200	8	7-11	F/R —	14.8	14.4	—	—	5.3, 5.4, 5.6
1	—	1	—	—	4	221EK	2	P//S P 11370 S (N.I.)	375 500 1500	12	S-2	P//S —	115.	11.2	—	—	5.2
1	—	1	—	—	5A	(P)221BB	4	F 7700 R 7700	450 450	8	7-11	F/R —	8.	7.6	—	—	5.3, 5.4, 5.6
1	—	1	—	—	7	(P)221EU	4	F 7700 R 7700	450 450	8	7-11	F/R —	6.7	6.3	—	—	5.3, 5.4, 5.6
1	—	1	—	—	326	221JL	3	P 5720 S 2192	465 600	25	S-4	S — P/S —	59. 34.	35. 30.5	—	—	5.5, 5.7 5.8
1	—	1	—	—	32	221JA	3	P 10000 S 4355	500 1400	25	S-4	S — P/S —	24. 19.	18.5 16.	—	—	5.5, 5.7 5.8
1	—	—	1	—	140	221DG	3	P 2350 2275	60 1900	16	S-4	P — P/S —	54. 30.	47. —	—	—	
1	—	—	1	—	105	221JM	3	P 3650 S 2200	100 900	18	S-4	P — P/S —	51. 33.5	42. —	—	—	5.9
1	—	—	1	—	105	222BT	3	P 3650 S 2200	100 900	18	S-4	P — P/S —	40. 26.	37. —	—	—	5.9
1	—	—	1	—	102	(P)221BF	2	P//S P 2710 S (N.I.)	181 210 1300	18	S-4	P//S —	120.	85.	—	—	5.10
1	—	—	1	—	140	222JS	3	P 4960 S 11300	400 1300	16	S-4	P 100 S —	37.5 18.5	20. —	—	—	
—	1	1	—	—	96	222CL	4	F 3630 R 13100	100 1500	13	S-4	F — R —	35. 12.6	32. —	—	—	
—	1	1	—	—	96	221DR	2	P//S P 11370 S (N.I.)	375 500 1500	13	S-2	P//S —	115.	11.2	—	—	5.2

NOTES:

- 5.1 Resistance variation $\pm 10\%$.
- 5.2 Release time min 62, max 140 milliseconds.
- 5.3 Armature need not touch core on operate.
- 5.4 Contact separation test min 0.003 in.
- 5.5 Requirements for springs 1-2 only.
- 5.6 Contact follow test min 0.008 in.
- 5.7 Contacts 1-2 shall make before spring 1 strikes bushing on spring 4.
- 5.8 Contacts 1-2 may make on P/S N.O.
- 5.9 Contact pressure springs 4-5 test min 15 grams.
- 5.10 Contact pressure springs 4-5 test min 35 grams.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
6 CONTACT SPRINGS																	
1	2	—	—	—	103	221FS	4 F 5450 R 5450	200 200	13	7-11	F/R F	— —	24.5 49	20.5	—	—	
1	—	—	—	1BMB	18 (P)221DU	2 P//S P 11370 S (N.I.)	375 500 1500	13	S-2	P//S	—	115.	11.2	—	—	6.3, 6.4	
3	—	—	—	—	82	221BR	3 P 325 S 4500	.75 150	13	S-4	P S	— —	300. 25.	210.	—	—	
3	—	—	—	—	82 (P)221DJ	22 S//T P 772 S 7750 T (N.I.)	658 2.4 1170 1500	13	0	P S//T	— —	120. 25.	110.	—	—		
3	—	—	—	—	304	221PD	3 P 1280 S 6100	6.3 1000	13	S-4	P S	— —	75. 16.5	65.	—	—	6.2
3	—	—	—	—	82	221NF	3 P 1600 S 9900	10 2000	13	S-4	P S	500 20	45.5 8.1	38.5	—	—	
3	—	—	—	—	304	221HD	4 F 1760 R 1760	20 20	13	4-8	F/R	—	45.5	33.	—	—	
3	—	—	—	—	82	221MH	3 P 5700 S 17700	250 2500	13	S-4	P S	170 17	18.5 6.6	13.8	—	—	
—	—	2	—	—	145	221FAH	23 S/Q P 710 S 2160 T 4300 Q 2160	160 50 75 160 85	9	7-11	S/T	—	15.5	14.3	—	—	6.1, 6.2, 6.5, 6.6, 6.7
—	—	2	—	—	145	221FAD	21 P/T P 2050 S 4850 T 2800	210 82 210 128	9	7-11	P/S/T	—	13.4	12.4	—	—	6.1, 6.2, 6.5, 6.6, 6.7
—	—	2	—	—	145 (P)221EB	4 F 5450 R 5450	200 200	9	7-11	F/R	—	14.8	14.4	—	—	6.2, 6.5, 6.6, 6.7	
—	—	2	—	—	145 (P)221FAK	21 P/T P 2125 S 4220 T 2125	200 98 200 102	9	7-11	P/S	—	13.6	12.4	—	—	6.1, 6.2, 6.5, 6.6, 6.7	
—	—	2	—	—	145	221JH	4 F 7700 R 7700	450 450	9	7-11	F/R	—	7.8	7.3	—	—	6.2, 6.5, 6.6, 6.7

NOTES:

- 6.1 Resistance variation $\pm 10\%$.
- 6.2 Armature need not touch core on operate.
- 6.3 Release time min 62, max 140 milliseconds.
- 6.4 Contact pressure springs 3-4 test min 15 grams.
- 6.5 Contacts 1-2 may break on N.O.
- 6.6 Contact follow test min 0.008 in.
- 6.7 Contact separation test min 0.003 in.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO. TURNS	RES	SOAK			OPR	NON- OPR	HOLD	RLS		
7 CONTACT SPRINGS																	
1	1	1	—	—	347	221NK	4	<i>F</i> 5300 <i>R</i> 5300	200 200	29	15-4	<i>R</i> <i>F</i>	— —	30.5 57.	27. 40.	— —	7.2, 7.4 7.3
1	1	1	—	—	347	221KU	3	<i>P</i> 7125 <i>S</i> 20000	600 2700	29	S-4	<i>P</i> <i>S</i>	— —	21.5 13.	10.6 11.	— —	7.2, 7.4 7.3
2	—	1	—	—	366	(P)221FAE	23	<i>S/Q</i> <i>P</i> 710 <i>S</i> 2160 <i>T</i> 4300 <i>Q</i> 2160	160 50 75 160 85	8	7-11	<i>S/T</i>	—	14.8	13.9	— —	7.1, 7.6, 7.8, 7.9
2	—	1	—	—	366	221FAM	21	<i>P/T</i> <i>P</i> 2125 <i>S</i> 4220 <i>T</i> 2125	200 98 200 102	8	7-9	<i>P/S</i>	100	14.8	14.4	— —	7.1, 7.6, 7.8, 7.9
2	—	1	—	—	366	221NJ	21	<i>P/T</i> <i>P</i> 2720 <i>S</i> 6400 <i>T</i> 3680	355 135 355 220	8	4-6	<i>P/S</i>	55	7.8	6.9	— —	7.1, 7.6
2	—	1	—	—	37	(P)221FB	3	<i>P</i> 3110 <i>S</i> 19900	1000 2000	25	S-4		— —	32.5 10.4	27.5 8.8	— —	7.2, 7.4 7.3
2	—	1	—	—	366	(P)221FAC	21	<i>P/T</i> <i>P</i> 2050 <i>S</i> 4850 <i>T</i> 2800	210 82 210 128	8	4-8	<i>P/S/T</i>	—	13.4	12.4	— —	7.1, 7.6, 7.8, 7.9
—	2	—	1	—	135	221DS	2	<i>P//S</i> <i>P</i> 11370 <i>S</i> (N.I.)	375 500 1500	14	0	<i>P//S</i>	—	14.7	11.2	— —	7.5
—	—	1	—	1BMB	94	(P)221DT	2	<i>P//S</i> <i>P</i> 11370 <i>S</i> (N.I.)	375 500 1500	14	S-2	<i>P//S</i>	—	115.	11.2	— —	7.7, 7.10

NOTES:

- 7.1 Resistance variation $\pm 10\%$.
- 7.2 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 7.3 Contacts 1-2 may make on the whole combination N.O.
- 7.4 Requirements for springs 1-2 only.
- 7.5 Contact pressure springs 6-7 test min 10 grams.
- 7.6 Armature need not touch core on operate.
- 7.7 Release time min 62, max 140 milliseconds.
- 7.8 Contact separation test min 0.003 in.
- 7.9 Contact follow test min 0.008 in.
- 7.10 Contact pressure springs 6-7 test min 15 grams.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

8 CONTACT SPRINGS

1	1	—	—	1BMB	41	(P)221HG	2	P//S P 11370 S (N.I.)	375 500 1500	14	S-2	P//S —	115.	11.2	—	—	8.2, 8.3
1	—	2	—	—	168	221LA	3	P 7330 S (N.I.)	200 7400	13	4-8	P —	23.5	20.	—	—	8.4
1	—	2	—	—	86	222BP	3	P 10000 S 8000	500 800	13	4-8	P — S —	18.5 21.	— 19.	— —	— —	—
1	—	2	—	—	86A	222KU	3	P 25200 S 8850	4100 1700	13	S-4	P 10 P//S 30	6.5 12.6	4.5	—	—	—
2	2	—	—	—	52	(P)221BK	4	F 5600 R 8300	250 500	13	S-4	F — R —	30. 27.5	28.	—	—	—
4	—	—	—	—	84	(P)221DK	22	S//T P 772 S 7550 T (N.I.)	658 2.4 1170 1500	13	0	P — S//T —	120. 25.	110.	—	—	—
4	—	—	—	—	76	221JC	22	S//T P 13800 S 9100 T (N.I.)	565 1300 1300 1000	13	S-4	P — S//T —	15. 61.	12.4	—	—	—
—	1	—	2	—	33	(P)222KN	21	P/T P 2200 S 5150 T 2950	185 70 185 115	15	S-2	P/S 100	19.5	14.	—	—	8.1, 8.5
—	1	—	2	—	33	222JW	4	F 5450 R 5450	200 200	15	S-2	F/R 100	19.5	14.	—	—	8.5
—	1	1	1	—	344	221KR	2	P//S P 11370 S (N.I.)	375 500 1500	13	S-2	P//S —	115.	11.7	—	—	8.3, 8.6, 8.7

NOTES:

- 8.1 Resistance variation $\pm 10\%$.
- 8.2 Contact pressure springs 5-6 test min 10 grams.
- 8.3 Release time min 62, max 140 milliseconds.
- 8.4 Armature need not touch core on operate.
- 8.5 Contact pressure springs 4-5 and 7-8 test min 35 grams.
- 8.6 Contact separation springs 6-8 test min 0.003 in.
- 8.7 Contact pressure springs 7-8 test min 10 grams.

X-75514

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
9 CONTACT SPRINGS																	
1	2	1	—	—	85	221NA	3 P 7125 S 20000	600 2700	27	S-4	P S	70 15	17.5 12.7	10.1 10.7	— —	— —	9.2, 9.6 9.3
1	—	1	—	1BMB	121	221CM	3 P 584 S 13300	2 1475	27	S-4	P S	— —	165. 19.	135. 16.	— —	— —	9.2, 9.5, 9.6 9.4
2	1	1	—	—	31	222LJ	4 F 5300 R 5300	200 200	13	S-4	F/R	—	18.5	17.	—	—	
2	1	1	—	—	706	222LF	3 P 15300 S 3700	1200 850	25	S-4	S(FS) P/S	— —	39. 16.5	32. 14.4	— —	— —	9.1
3	—	1	—	—	106	221JN	3 P 6640 S 11400	300 1300	25	S-4	P S	— —	18. 20.5	12. 17.5	— —	— —	9.2, 9.6 9.4
3	—	1	—	—	106	222GC	3 P 6640 S 11400	300 1300	25	S-4	P S	— —	18. 20.5	12. 17.5	— —	— —	9.2, 9.6 9.4
3	—	1	—	—	106	222LY	3 P 13800 S 1850	1300 250	25	S-4	S P	170 30	90. 18.	75. 15.5	— —	— —	9.2, 9.6 9.7
3	—	1	—	—	106	222KW	3 P 22450 S 2775	2400 450	25	S-4	S P	90 17	43. 12.6	34.5 10.7	— —	— —	9.1, 9.2, 9.6 9.7.
—	1	1	—	1BMB	386	221MR	2 P//S P 11370 S (N.I.)	375 500 1500	15	S-2	P//S	—	115.	11.2	—	—	9.8, 9.9, 9.10
—	—	2	1	—	339	221KH	2 P//S P 2660 S (N.I.)	181 210 1300	16	4-8	P//S	—	145.	100.	—	—	9.11

NOTES:

- 9.1 Resistance variations $\pm 10\%$.
- 9.2 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 9.3 Contacts 1-2 may make and contacts 3-4 and 5-6 may break on the secondary N.O.
- 9.4 Contacts 1-2 may make on the secondary N.O.
- 9.5 Contact pressure springs 8-9 test min 15 grams.
- 9.6 Requirements for springs 1-2 only.
- 9.7 Contacts 1-2 may make on the primary N.O.
- 9.8 Release time min 62, max 140 milliseconds.
- 9.9 As permitted by sequence, two break contacts may break on N.O.
- 9.10 Contact pressure springs 8-9 test min 10 grams.
- 9.11 Contact pressure springs 8-9 test min 35 grams.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
10 CONTACT SPRINGS																	
1	1	—	2	—	306	221FAB	17	P1 4450 P2 4450	200 200	15	S-4	P1/P2 —	25.	15.	—	—	10.1, 10.5
1	1	2	—	—	184	221NU	3	P 2180 S 11450	30 1300	27	S-4	P — S —	46.5 20.	39. 18.5	—	—	10.7, 10.9
2	1	—	—	1BMB	162	(P)221EL	2	P//S P 11370 S (N.I.)	375 500 1500	14	S-2	P//S115—	—	11.2	—	—	10.2, 10.3
2	—	1	1	—	151	(P)221DP	3	P 6640 S 5009	300 900	16	S-5	S — P —	37. 31.	34.	—	—	10.8
2	—	2	—	—	74	221NT	3	P 2180 S 11450	30 37	25	S-4	P — S —	45. 18.	41. 16.5	—	—	10.9 10.7
2	3	—	—	—	133	221PB	3	P 3800 S 14300	125 1300	27	S-4	P — S —	26. 28.	22. 17.	—	—	10.9 10.7
3	2	—	—	—	119	(P)221MS	2	P//S P 11370 S (N.I.)	375 500 1500	13	S-2	P//S115—	—	11.2	—	—	10.10
4	1	—	—	—	910	222LS	3	P 4420 S 11500	125 1300	27	S-4	P — S —	25. 25.5	21.5 22.5	—	—	10.9, 10.11 10.7
4	1	—	—	—	308	222LH	4	F 5300 R 5300	200 200	12	S-4	F/R —	18.5	17.	—	—	
4	1	—	—	—	267	223AJ	3	P 7125 S 20000	600 2700	25	S-4	P — P/S —	17. 8.1	9.6 7.2	—	—	10.4, 10.6, 10.12
5	—	—	—	—	303	221GK	4	F 5450 R 5450	200 200	13	S-4	F/R —	17.	14.	—	—	

NOTES:

- 10.1 Resistance variation $\pm 10\%$.
- 10.2 Contact pressure springs 5-6 test min 10 grams.
- 10.3 Release min 55, max 125 milliseconds.
- 10.4 Contacts 1T-2T may make on N.O.
- 10.5 Contact pressure springs 6-7 and 9-10 test min 35 grams.
- 10.6 Contacts 1T-2T shall make before spring 1T strikes bushing on 4T and before armature stud strikes spring 1B.
- 10.7 Contacts 1-2 may make on the secondary N.O.
- 10.8 Contacts 4-5 shall make before contacts 2-3 and 6-7 make.
- 10.9 Requirements for springs 1-2 only.
- 10.10 Release min 62, max 140 milliseconds.
- 10.11 Springs 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 10.12 Requirements for springs 1T-2T only.

X-75514

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

II CONTACT SPRINGS

1	—	1	2	—	26	(P)222KM	21	P/T P 2200 S 5150 T 2950	185 70 185 115	15	S-2	P/S	100	19.5	14.	—	—	11.1, 11.2
1	—	1	2	—	26	222W	4	F F 5450 R 5450	200 200	15	S-2	F/R	100	19.5	14.	—	—	11.2
3	1	—	1	—	108	(P)222HF	3	P P 4960 S 17600	400 1800	27	S-4	P S	— —	28. 15.	20.5 12.2	— —	— —	11.3, 11.4 11.5
4	—	1	—	—	22	(P)222GT	24	P//T P 7800 S 14200 T (N.I.)	333 443 2000 1345	25	S-4	P//T S	— —	20.5 18.	18.5 15.5	— —	— —	11.3, 11.4 11.5
—	2	1	—	1MBM	171	(P)222EM	3	P P 11100 S 16100	1000 2300	23	S-4	P S	— —	24.5 19.	20.5 —	— —	— —	11.6
—	—	1	—	2BMB	42	222ED	3	P P 16000 S (N.I.)	1300 300	17	S-4		—	12.5	11.5	—	—	11.6, 11.7

NOTES:

- 11.1 Resistance variation $\pm 10\%$.
- 11.2 Contact pressure springs 7-8 and 10-11 test min 35 grams.
- 11.3 Requirements for springs 1-2 only.
- 11.4 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 11.5 Contacts 1-2 may make on the secondary N.O.
- 11.6 As permitted by sequence, two break contacts may break on N.O.
- 11.7 Contact pressure springs 6-7 and 10-11 test min 35 grams.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

12 CONTACT SPRINGS																	
3	—	1	1	—	392	222KK	3	P 14000 S 8650	1300 800	15	S-4	S P	50 —	31. 21.	25.5 —	— —	—
3	—	2	—	—	117	(P)222CP	21	P//T P 6060 S 15920 T (N.I.)	333 500 2000 1000	27	S-2	P//T S	— —	20.5 14.	18.5 12.	— —	12.3, 12.5, 12.9 12.2
4	2	—	—	—	248	223S	4	F 5450 R 5450	200 200	12	S-4	F/R F	— —	27. 54.5	22.5 —	— —	—
1	1	—	—	2BMB	930	222LL	3	P 18100 S (N.I.)	1300 700	17	S-4	P	—	13.9	12.1	—	12.6
1	—	2	—	1BMB	25	222GL	3	P 4420 S 11500	125 1300	29	S-4	P S	— —	27. 25.	17. 21.	— —	12.3, 12.5 12.4
1	—	—	2	1BMB	118	222AA	4	F 5450 R 5450	200 200	15	S-2	F/R	100	19.5	14.	—	12.7
1	—	—	2	1BMB	118	(P)222KP	21	P/T P 2200 S 5150 T 2950	185 70 185 115	15	S-2	P/S	100	19.5	14.	—	12.7
2	—	—	—	2BMB	91	222EY	3	P 13800 S (N.I.)	1300 300	16	S-4	P	—	19.	15.5	—	—
—	—	2	2	—	44	(P)222KR	21	P/T P 2200 S 5150 T 2950	185 70 185 115	16	S-2	P/S	100	19.5	14.	—	12.1, 12.8
—	—	2	2	—	44	222Y	4	F 5450 R 5450	200 200	16	S-2	F/R	100	19.5	14.	—	12.8
—	—	4	—	—	107	(P)222HA	2	P//S P 12450 S (N.I.)	384 565 1200	17	0	P//S	—	20.5	17.	—	12.6

NOTES:

- 12.1 Resistance variation $\pm 10\%$.
- 12.2 Contacts 1-2 and 4-5 may make and 3-4 may break on N.O.
- 12.3 Requirements for springs 1-2 only.
- 12.4 Contacts 1-2 may make and contacts 3-4 and 6-7 may break on N.O.
- 12.5 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 12.6 As permitted by sequence, two break contacts may break on N.O.
- 12.7 Contact pressure springs 3-4, 8-9, and 11-12 test min 35 grams.
- 12.8 Contact pressure springs 8-9 and 11-12 test min 35 grams.
- 12.9 Contacts 4-5 shall make before contacts 7-8 make.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON-OPR	HOLD	RLS	

13 CONTACT SPRINGS

1	1	1	2	—	62	222DW	4	F 5450 R 5450	200 200	16	S-4	F/R — F —	18.5 37.	14.6	—	—	13.3
1	2	1	—	1MBM	129	(P)222CN	3	P 19500 S 9500	2000 1500	21	S-4	P — S —	14. 32.	11.	—	—	13.4, 13.5, 13.12
2	3	—	1	—	352	222JE	3	P 7125 S 20000	600 2700	29	S-4	P — S —	18.5 13.3	10.6 11.2	—	—	13.2, 13.8 13.9
2	3	—	1	—	394	221NG	3	P 20500 S 2400	1800 525	26	S-2	S 80 P 23	66.5 17.5	55.5 15.5	—	—	13.10, 13.13 13.11
2	—	2	1	—	114	(P)222CM	3	P//T P S T	333 500 2000 1000	27	S-4	P — S —	20.5 15.	18.5 13.	—	—	13.2, 13.8 13.7
2	—	3	—	—	404	223CA	2	P//S P 14350 S (N.I.)	522 800 1500	13	S-2	P//S —	20.5	14.4	—	—	13.12
2	—	3	—	—	316	(P)222GJ	3	P 13800 S (N.I.)	1300 30	14	S-4	P —	22.5	18.	—	—	13.12
4	1	1	—	—	152	(P)222DH	3	P 3750 S 13200	125 1100	25	S-4	P — S —	23.5 22.	21.5 17.	—	—	13.2, 13.8 13.7
4	1	1	—	—	351	(P)222JB	3	P 3750 S 13200	125 1100	25	S-4	P — S —	22. 18.	19.5 15.	—	—	13.2, 13.8 13.7
4	1	1	—	—	152	222LU	3	P 4420 S 11500	125 1300	25	S-4	P — S —	23.5 22.0	21.5 17.0	—	—	13.2 13.7
4	1	1	—	—	417	224BP	3	P 8000 S 11100	375 1300	25	S-4	P 110 S 30	11.9 23.	8.5 19.5	—	—	13.6, 13.14, 13.16
5	—	1	—	—	182	222FC	3	P 5140 S 11100	150 1300	25	S-4	P — S —	28. 23.	20. 19.5	—	—	13.2, 13.8 13.7
5	—	1	—	—	310	222FT	21	P//T P 6780 S 12000 T (N.I.)	273 375 1300 1000	25	S-4	P — S —	24. 27.	15. 19.5	—	—	13.2, 13.7, 13.8
—	—	1	2	1MBM	115	222LC	21	P/T P 2200 S 5150 T 2950	185 70 185 115	21	S-2	P/S 100 S —	19.5 51.	14.	—	7.4	13.1, 13.15
—	—	1	2	1MBM	115	222GM	4	F 5450 R 5450	200 200	21	S-2	F/R 100 F —	19.5 51.	14.	—	7.4	13.15

NOTES:

- 13.1 Resistance variation $\pm 10\%$.
- 13.2 Requirements for springs 1-2 only.
- 13.3 Contact pressure springs 9-10 and 12-13 test min 35 grams.
- 13.4 Contacts 8-9 shall make before contacts 6-7 and 12-13 make.
- 13.5 Contact pressure springs 11-12 test min 15 grams.
- 13.6 Requirements for springs 1B-2B only.
- 13.7 Contacts 1-2 may make on N.O.
- 13.8 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 13.9 Contacts 1-2 may make and contacts 3-4 and 5-6 may break on N.O.
- 13.10 Contacts 1-2 shall break and 3-4, 5-6 shall make before spring 5 strikes the bushing on spring 8.
- 13.11 Contacts 1-2 may break and contacts 3-4, 5-6 may make on N.O.
- 13.12 As permitted by sequence, two break contacts may break on N.O.
- 13.13 Requirements for springs 1-2, 3-4, and 5-6.
- 13.14 Contacts 1B-2B shall make before springs 1T-2T break.
- 13.15 Contact pressure springs 5-6, 8-9, and 11-12 test min 35 grams.
- 13.16 Contacts 1B-2B shall make before spring 1B strikes the bushing on spring 4B.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON-OPR	HOLD	RLS	
14 CONTACT SPRINGS																	
1	—	1	3	—	330 (P)	222HD	3	P 6225 S 9130	340 750	27	4-8	P — S —	19. 46.5	12.8 26.5	—	—	14.2, 14.4, 14.5 14.3
1	—	2	2	—	322 (P)	222KS	21	P/T P 2200 S 5150 T 2950	185 70 185 115	16	S-2	P/S 100	19.5	14.	—	—	14.1, 14.6
1	—	2	2	—	322	222GW	4	F 5450 R 5450	200 200	16	S-2	F/R 100	19.5	14.	—	—	14.6
1	—	4	—	—	261 (P)	223AC	3	P 4960 S 17600	400 1800	18	S-4	P — P — S —	59.5 — 18.5	48. 37. —	—	—	14.7, 14.8
3	1	—	2	—	401	223BW	2	P//S P 14350 S (N.I.)	522 800 1500	27	S-2	P//S — —	14.2 31.	10.7 26.	—	—	14.9, 14.22 14.19
3	4	—	—	—	423 (P)	223CR	3	P 7670 S 5880	250 750	25	S-4	P 160 S 55	19.5 50.5	12.5 43.5	—	—	14.11, 14.20 14.10
4	—	2	—	—	173 (P)	222EW	3	P 5140 S 11100	150 1300	25	S-4	P — S —	34. 26.5	27. 22.5	—	—	14.12, 14.21 14.13
4	3	—	—	—	217	223E	4	F 5450 R 5450	200 200	13	4-8	F/R — R —	25. 56.	17.5 —	—	—	14.7
4	—	2	—	—	388 (P)	222KF	21	P//T P 7800 S 14200 T (N.I.)	333 443 2000 1345	29	S-4	P 120 S 20	20.5 18.	18.5 15.5	—	—	14.2, 14.5, 14.15, 14.16 14.14
6	1	—	—	—	710	222LM	3	P 4420 S 11500	125 1300	27	S-4	P — S —	25. 25.5	21.5 22.5	—	—	14.5
6	1	—	—	—	382	222KA	3	P 14900 S (N.I.)	1000 1000	16	S-4	P 40	17.5	14.9	—	—	14.17
—	2	1	1	1MBM	236	223L	3	P 4960 S 17600	400 1800	21	S-4	P — S —	75. 18.	— 14.5	—	—	14.7
—	1	—	—	1MBM 2BMB	711	222LN	3	P 18100 S	1300 700	18	S-4	P —	13.9	12.1	—	—	14.18

NOTES:

- 14.1 Resistance variation $\pm 10\%$.
- 14.2 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 14.3 Contacts 1-2 may make on N.O.
- 14.4 Contact pressure springs 7-8, 10-11, and 13-14 test min 35 grams.
- 14.5 Requirements for springs 1-2 only.
- 14.6 Contact pressure springs 10-11 and 13-14 test min 35 grams.
- 14.7 As permitted by sequence, any two break contacts may break on N.O.
- 14.8 Contact separation test min 0.013 in.
- 14.9 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 3T and before armature stud strikes spring 2B.
- 14.10 As permitted by sequence, two break contacts may break and contacts 1T-2T and 1B-2B may make on N.O.
- 14.11 Contacts 1T-2T and 1B-2B shall make before spring 1T strikes the bushing on spring 4T and before spring 1B strikes the bushing on spring 4B.
- 14.12 Contacts 1-2 and 3-4 shall make before spring 3 strikes the bushing on spring 6.
- 14.13 Contacts 1-2 and 3-4 may make on N.O.
- 14.14 Contacts 1-2 and 4-5 may make and contacts 3-4 may break on N.O.
- 14.15 Contacts 3-4 shall break before contacts 6-7 break.
- 14.16 Contacts 4-5 shall make before contacts 7-8 make.
- 14.17 Springs 3-4 shall make before any others make.
- 14.18 Contact pressure springs 5-6, 9-10, and 12-13 test min 15 grams.
- 14.19 Contacts 1T-2T may make on N.O.
- 14.20 Requirements for springs 1T-2T and 1B-2B.
- 14.21 Requirements for springs 1-2 and 3-4 only.
- 14.22 Requirements for springs 1T-2T only.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON-OPR	HOLD	RLS	

15 CONTACT SPRINGS

2	1	2	1	—	410	(P)223CH	2	P//S P 14350 S (N.I.)	522 800 1500	27	S-2	P//S P//S	— —	14.2 28.	10.7 22.5	— —	15.1, 15.3 15.2
3	—	1	2	—	259	224AW	3	P 13950 S 3020	770 625	33	S-4	S P/S	— —	55.5 26.	38.5 23.	— —	15.3, 15.10, 15.11, 15.14 15.9
3	—	2	1	—	226	223G	3	P 5140 S 11100	150 1300	27	S-4	P S	— —	34. 26.5	27. 22.5	— —	15.4, 15.5, 15.12 15.6
4	2	1	—	—	415	(P)223CM	3	P 8000 S 11100	375 1300	25	S-4	P S	110 30	11.9 27.	8.5 21.5	— —	15.1, 15.3 15.2
5	1	1	—	—	424	(P)224BU	3	P 8000 S 11100	375 1300	25	S-4	P S	110 30	11.9 26.	8.5 22.	— —	15.7, 15.13 15.8

NOTES:

- 15.1 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
- 15.2 Contacts 1T-2T may make and two break contacts may break on N.O.
- 15.3 Requirements for springs 1T-2T only.
- 15.4 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T.
- 15.5 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B.
- 15.6 Contacts 1T-2T and 1B-2B may make on N.O.
- 15.7 Contacts 1B-2B shall make before spring 1B strikes the bushing on spring 4B and before armature stud strikes spring 2T.
- 15.8 Contacts 1B-2B may make on N.O.
- 15.9 Contacts 1T-2T and 1B-3B may make and springs X-1B may break on N.O.
- 15.10 Contacts 2B-3B shall break before 6T-8T make.
- 15.11 Contact pressure springs 7T-8T and 2B-3B test min 15 grams.
- 15.12 Requirements for 1T-2T and 1B-2B.
- 15.13 Requirements for 1B-2B.
- 15.14 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 1B.

16 CONTACT SPRINGS

2	3	2	—	—	253	224BB	3	P 4420 S 10000	125 900	27	S-4	P S	— —	27.5 37.5	18. 28.5	— —	16.1, 16.8 16.2
2	3	2	—	—	256	223AB	3	P 11100 S 10150	1000 1100	27	S-4	S S P	— — —	12.3 34. 34.5	8.3 26. —	— — —	16.1, 16.8 16.2
2	—	3	1	—	425	(P)224BW	21	P//T P 7800 S 11300 T (N.I.)	333 443 1250 1345	27	S-4	P S	120 —	20.5 26.	18.5 21.5	— —	16.3, 16.7 16.4
4	1	2	—	—	213	223CE	3	P 11100 S 10150	1000 1100	13	S-4	P S	— —	23.5 28.5	20. —	— —	16.5, 16.6

NOTES:

- 16.1 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B and before armature stud strikes spring 2T.
- 16.2 As permitted by sequence, any two break contacts may break and contacts 1B-2B may make on N.O.
- 16.3 Contacts 1T-2T shall make before spring 1T strikes the bushing on spring 4T and before armature stud strikes spring 2B.
- 16.4 Contacts 1T-2T may make and two break contacts may break on N.O.
- 16.5 As permitted by sequence, any two break contacts may break on N.O.
- 16.6 Contact pressure springs 9B-10B test min 15 grams.
- 16.7 Requirements for springs 1T-2T only.
- 16.8 Requirements for springs 1B-2B only.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

17 CONTACT SPRINGS

4	3	1	—	—	416	(P)224BN	3	P 8000 S 11100	375 1300	25	S-4	P S	110 30	11.9 27.	8.5 21.5	— —	17.2, 17.3 17.1
5	2	1	—	—	427	(P)223CT	3	P 8000 S 11100	375 1300	25	S-4	P S	110 —	11.9 27.	8.5 21.5	— —	17.2, 17.3 17.1

NOTES:

- 17.1 Contacts 1T-2T may make and two break contacts may break on N.O.
 17.2 Contacts 1T-2T shall make before spring 1T strikes the bushing on spring 4T and before armature stud strikes spring 2B.
 17.3 Requirements for springs 1T-2T only.

18 CONTACT SPRINGS

3	3	2	—	—	279	(P)223BE	3	P 11000 S 10150	1000 1100	27	S-4	S S P	— — —	12.3 34. 34.5	8.3 26. —	— — —	18.2, 18.3 18.4
3	3	2	—	—	288	223BL	3	P 13800 S 10700	1300 1250	27	S-4	P S	— —	24. 18.	20. 13.	— —	18.5, 18.6, 18.15 18.13
4	2	2	—	—	250	224AR	3	P 4420 S 11500	125 1300	27	S-4	P S	— —	27. 27.5	21.5 19.	— —	18.7, 18.8, 18.9, 18.14 18.6
4	2	2	—	—	221	224T	3	P 4420 S 11500	125 1300	25	S-4	P S	— —	24.5 24.5	16.5 20.	— —	18.2, 18.3 18.4
4	2	—	2	—	220	(P)223DA	3	P 2200 S 5150 T 2950	70 185 115	15	4-8	P/S S	— —	28. 56.5	13. —	— —	18.1, 18.10
4	2	—	2	—	220	223D	4	F 5450 R 5450	200 200	15	4-8	F/R R	— —	28. 70.	11. —	— —	18.10
4	5	—	—	—	431	223CY	2	P//S P 2660 S (N.I.)	181 210 1300	22	S-2	P//S	—	160.	130.	— —	18.11, 18.12

NOTES:

- 18.1 Resistance variation $\pm 10\%$.
 18.2 Requirements for springs 1T-2T only.
 18.3 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
 18.4 As permitted by sequence, any two break contacts may break and contacts 1T-2T may make on N.O.
 18.5 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T.
 18.6 As permitted by sequence, any two break contacts may break and contacts 1T-2T and 1B-2B may make on N.O.
 18.7 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B and before spring 1T strikes bushing on spring 4T.
 18.8 Contacts 1B-2B shall make before contacts 1T-2T make.
 18.9 Contacts 1T-2T shall make before contacts 3B-4B and 3T-4T break.
 18.10 Contact pressure springs 8T-9T and 8B-9B test min 35 grams.
 18.11 Contacts 1T-2T, 3T-4T, and 1B-2B may make and two break contacts may break on N.O.
 18.12 Contacts 1T-2T, 3T-4T, and 1B-2B shall make before any break contacts break.
 18.13 Requirements for springs 1T-2T and 1B-2B.
 18.14 Requirements for springs 1B-2B only.
 18.15 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

19 CONTACT SPRINGS

3	2	2	1	—	262	(P)223AD	3	P 5140 S 9350	150 870	27	S-4	P — S —	34. 38.	27. 32.	—	—	19.1, 19.2, 19.9 19.3
3	5	1	—	—	289	224BG	3	P 10600 S 6250	950 270	25	S-4	S — P —	36. 34.	27.5 29.	—	—	19.4, 19.10 19.5
5	3	1	—	—	426	(P)224BY	3	P 8000 S 11100	375 1300	25	S-4	P 110 S —	11.9 27.	8.5 21.5	—	—	19.6, 19.8 19.7

NOTES:

- 19.1 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T.
 19.2 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B.
 19.3 As permitted by sequence, any two break contacts may break and contacts 1T-2T and 1B-2B may make on N.O.
 19.4 Contacts 1T-2T, 3T-4T, and 5T-6T shall make before spring 5T strikes bushing on spring 8T and before armature stud strikes spring 2B.
 19.5 As permitted by sequence, any two break contacts may break and contacts 1T-2T, 3T-4T, and 5T-6T may make on N.O.
 19.6 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
 19.7 Contacts 1T-2T may make and two break contacts may break on N.O.
 19.8 Requirements for springs 1T-2T only.
 19.9 Requirements for springs 1T-2T and 1B-2B.
 19.10 Requirements for springs 1T-2T, 3T-4T, and 5T-6T.

20 CONTACT SPRINGS

3	1	4	—	—	407	223CC	3	P 3800 S 14100	300 1300	25	S-4	P — S —	32.5 20.	25. 16.5	—	—	20.6, 20.8 20.2
4	3	—	2	—	435	(P)223DB	21	P/T P 2200 S 5150 T 2950	185 70 185 115	16	3-5	P/S FS S —	28. 56.5	13.	—	—	20.3, 20.4, 20.5, 20.7
5	2	2	—	—	219	(P)224R	3	P 4420 S 10000	125 900	27	S-4	P — S —	24. 36.5	18. 24.	—	—	20.1, 20.6 20.2
5	2	2	—	—	230	224AF	3	P 4420 S 10000	125 900	25	S-4	P — S —	25. 35.	17. 23.	—	—	20.1, 20.6 20.2

NOTES:

- 20.1 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
 20.2 As permitted by sequence, any two break contacts may break and contacts 1T-2T may make on N.O.
 20.3 Contact pressure springs 6T-7T and 9T-10T test min 35 grams.
 20.4 Contacts 3T-4T shall make before contacts 7B-8B.
 20.5 Winding resistance $\pm 10\%$.
 20.6 Requirements for springs 1T-2T only.
 20.7 As permitted by sequence, any two break contacts may break on N.O.
 20.8 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

21 CONTACT SPRINGS

3	3	3	—	—	234	224AD	4	<i>F</i> 13300 <i>R</i> 13300	1300 1300	14	S-4	<i>R</i> <i>F</i>	— —	27. 23.	20. —	— —	21.1
4	5	1	—	—	429	224CA	3	<i>P</i> 7300 <i>S</i> 6350	500 270	25	S-4	<i>S</i> <i>P</i>	45 —	35.5 52.5	27. 46.5	— —	21.2, 21.4, 21.7 21.3
7	2	1	—	—	247	224AN	3	<i>P</i> 4420 <i>S</i> 10000	125 900	25	S-4	<i>P</i> <i>S</i>	— —	24. 36.5	16.5 24.	— —	21.8, 21.5 21.6

NOTES:

- 21.1 As permitted by sequence, any two break contacts may break on N.O.
 21.2 Contacts 1T-2T, 3T-4T, 1B-2B, and 3B-4B shall make before spring 3T strikes bushing on spring 6T and before spring 3B strikes bushing on spring 6B.
 21.3 Contacts 1T-2T, 3T-4T, 1B-2B, and 3B-4B may make and two break contacts may break on N.O.
 21.4 Contacts 6T-7T may make before contacts 10T-11T break.
 21.5 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
 21.6 As permitted by sequence, any two break contacts may break and contacts 1T-2T may make on N.O.
 21.7 Requirements for springs 1T-2T, 3T-4T, 1B-2B, and 3B-4B.
 21.8 Requirements for springs 1T-2T only.

22 CONTACT SPRINGS

8	—	2	—	—	433	224CC	21	<i>P</i> // <i>T</i> <i>P</i> 7800 <i>S</i> 11300 <i>T</i> (N.I.)	333 443 1250 1345	25	S-4	<i>P</i> // <i>T</i> <i>S</i>	120— —	20.5 26.5	18.5 20.5	— —	22.1, 22.3 22.2
8	—	2	—	—	284	224BF	3	<i>P</i> 11100 <i>S</i> 11000	1000 980	12	S-4	<i>P</i> <i>S</i>	— —	29. 32.5	24.5 —	— —	—

NOTES:

- 22.1 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
 22.2 Contacts 1T-2T may make on N.O.
 22.3 Requirements for springs 1T-2T only.

24 CONTACT SPRINGS

6	3	2	—	—	233 (P)224AB	3	<i>P</i> 4420 <i>S</i> 10000	125 900	27	S-4	<i>P</i> <i>S</i>	— —	24. 36.5	18. 27.	— —	— —	24.3, 24.1 24.2
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NOTES:

- 24.1 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and armature stud strikes spring 2B.
 24.2 As permitted by sequence, any two break contacts may break and contacts 1T-2T may make on N.O.
 24.3 Requirements for springs 1T-2T only.

RELAY DATA — CODE INFORMATION

TABLE II — DOUBLE-WOUND 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

26 CONTACT SPRINGS

5	2	4	—	—	436 (P)224CE	3	P 4420 S 10000	125 900	27	S-4	P S	— —	25. 36.5	18. 28.5	— —	— —	26.1, 26.3 26.2
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NOTES:

- 26.1 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and armature stud strikes spring 2B.
 26.2 As permitted by sequence, any two break contacts may break and contacts 1T-2T may make on N.O.
 26.3 Requirements for springs 1T-2T only.

27 CONTACT SPRINGS

5	1	3	2	—	245	224AL	2	P//S P 14900 S (N.I.)	500 1000 1000	27	S-4	P//S — P//S —	18.5 57.	13. 45.	— —	— —	27.1, 27.2 27.3
6	—	3	2	—	237	224AG	2	P//S P 14900 S (N.I.)	500 1000 1000	27	S-4 S-4	P//S — P//S —	57. —	45. 13.	— —	— —	27.3, 27.4, 27.5, 27.6, 27.7 27.1

NOTES:

- 27.1 Requirements for springs 1T-2T only.
 27.2 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
 27.3 As permitted by sequence, any two break contacts may break and contacts 1T-2T may make on N.O.
 27.4 Contact pressure springs 9T-10T and 12T-13T test min 35 grams.
 27.5 Contacts 6T-7T shall make before contacts 9T-10T and 12T-13T break.
 27.6 Contacts 1T-2T shall make before contacts 3T-4T and 1B-2B break.
 27.7 Spring 1T may strike the bushing on spring 4T and the armature stud may strike spring 2B before contacts 1T-2T make.

RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

2 CONTACT SPRINGS

1	—	—	—	—	47	222BB	7	4000	200	13	S-4	75	25.	23.5	—	—	
1	—	—	—	—	47	221CW	10	10200	800	13	S-2	50	—	7.3	—	—	2.1
1	—	—	—	—	45	222HK	5	16700	1300	13	S-4	—	7.	6.	—	—	
—	1	—	—	—	78	221BD	9	13500	1300	8	0	—	11.	9.4	—	—	
—	1	—	—	—	78	222BN	9	13500	1300	8	0	—	11.	9.4	—	—	

NOTES:

2.1 Release time min 300, max 500 milliseconds.

3 CONTACT SPRINGS

—	—	1	—	—	10	221E	5	1050	4.37	12	S-4	500	—	90.	—	—	3.1, 3.2
—	—	1	—	—	10	222D	5	1050	4.37	12	S-4	500	—	95.	—	—	3.1, 3.2
—	—	1	—	—	10	(P)221CL	5	1440	8	12	S-4	500	—	69.	—	—	3.3, 3.4, 3.5
—	—	1	—	—	10	(P)222CK	5	1440	8	12	S-4	500	—	69.	—	—	3.3, 3.4, 3.5
—	—	1	—	—	709	222LG	9	22000	3400	12	S-4	—	5.	3.	—	—	3.1
—	—	1	—	—	10	221LD	5	4160	75	12	S-4	—	22.	8.5	—	—	
—	—	1	—	—	10	221FW	10	4670	200	12	0	25	11.4	9.8	—	—	
—	—	1	—	—	10	222CW	10	10200	800	12	0	—	7.9	7.3	—	—	
—	—	—	1	—	901	221B	5	1050	4.37	15	S-4	500	—	95.	—	—	3.2, 3.6
—	—	—	1	—	901	(P)221CD	5	1440	8	15	S-4	500	—	69.	—	—	3.3, 3.4, 3.5, 3.6
—	—	—	1	—	365	221LU	9	13500	1300	16	S-4	—	11.2	—	—	—	3.7
—	—	—	1	—	365	(P)222JN	9	13500	1300	16	S-4	—	13.7	10.	—	—	3.7
—	—	—	1	—	365	(P)222JN	9	13500	1300	16	S-4	30	11.2	—	—	—	3.7
—	—	—	1	—	365	(P)222JN	9	13500	1300	16	S-4	—	13.7	10.	—	—	3.7

NOTES:

- 3.1 Resistance variation $\pm 10\%$.
- 3.2 Release time min 125, max 175 milliseconds.
- 3.3 Release time min 111, max 140 milliseconds.
- 3.4 When timing requirements are not applied: operate 85, N.O. 69.
- 3.5 When timing requirements are applied from test jack: readjust hold 0.100 second, release 0.140 second; test release 0.155 second.
- 3.6 Contact pressure springs 2-3 test min 10 grams.
- 3.7 Contacts 1-3 shall make and contacts 2-3 may break.

RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
4 CONTACT SPRINGS																	
1	1	—	—	—	97	221L	5	1050	4.37	17	S-4	—	115.	95.	—	—	4.2, 4.3, 4.4
1	1	—	—	—	90	221K	5	1050	4.37	12	S-4	500	—	95.	—	—	4.4, 4.5
1	1	—	—	—	97	221CE	5	1440	8	17	S-2	—	85.	69.	—	—	4.2, 4.3
1	1	—	—	—	90	221CF	5	1440	8	12	S-4	500	—	69.	—	—	4.6, 4.7, 4.8
1	1	—	—	—	197	221GU	12	8350	305	12	S-4	—	14.1	10.5	—	—	
1	1	—	—	—	90	221PA	5	8800	335	12	S-4	—	13.8	12.0	—	—	
2	—	—	—	—	2A	221BL	5	680	2	13	S-4	—	115.	100.	—	—	4.1
2	—	—	—	—	2A	222BU	5	680	2	13	S-4	—	115.	100.	—	—	4.1
2	—	—	—	—	2A	221AY	5	1910	14	13	S-4	—	47.	27.	—	—	
2	—	—	—	—	2A	222BK	5	1910	14	13	S-4	—	47.	27.	—	—	
2	—	—	—	—	170	221ES	12	4890	150	13	7-11	—	40.	37.	—	—	
2	—	—	—	—	143	221EA	5	8800	335	13	S-4	—	13.8	12.	—	—	
2	—	—	—	—	143	(P)221HC	10	10200	800	13	0	—	7.9	7.3	—	—	
2	—	—	—	—	8	221KP	7	18000	2300	13	7-11	—	16.5	14.	—	—	
—	2	—	—	—	193	221FY	10	10200	800	9	S-4	—	9.7	7.	—	—	
—	—	—	—	1MBM	43	221J	5	1050	4.37	18	S-4	—	115.	95.	—	—	4.4, 4.7, 4.8, 4.9, 4.10
—	—	—	—	1MBM	43	(P)221CG	5	1440	8	18	S-4	500	—	64.	—	—	4.6, 4.7, 4.8, 4.9, 4.10, 4.12
—	—	—	—	1BMB	111	221HL	5	1440	8	13	S-4	500	—	65.	—	—	4.6, 4.11

NOTES:

- 4.1 Resistance variation $\pm 15\%$.
- 4.2 Contacts 1-2 may make on N.O.
- 4.3 Contacts 1-2 shall make before contacts 3-4 break.
- 4.4 Resistance variation $\pm 10\%$.
- 4.5 Release time min 125, max 175 milliseconds.
- 4.6 Release time min 111, max 140 milliseconds.
- 4.7 When timing requirements are not applied: operate 85, N.O. 60.
- 4.8 When timing requirements are applied from test jack: readjust hold 0.100 second, release 0.140 second; test release 0.155 second.
- 4.9 Contact pressure springs 2-3 test min 10 grams.
- 4.10 Springs 2-3 shall break before springs 3-4 make.
- 4.11 Contact pressure springs 3-4 test min 15 grams.
- 4.12 Armature need not touch core on operate.

RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

5 CONTACT SPRINGS

1	—	1	—	—	4	221D	5	1050	4.37	12	S-4	500	—	95.	—	—	5.1, 5.2
1	—	1	—	—	4	(P)221CK	5	1440	8	12	S-4	500	—	69.	—	—	5.3, 5.4, 5.5
1	—	1	—	—	4	221AN	5	8800	33.5	12	S-2	—	125.	12.	—	—	5.6
1	—	1	—	—	4	221CC	10	10200	800	12	0	—	7.9	7.3	—	—	
1	—	1	—	—	4	(P)222HU	10	10200	800	12	0	—	7.9	7.3	—	—	
1	—	1	—	—	4	222CF	10	11500	1300	12	S-4	—	9.6	8.7	—	—	
1	—	1	—	—	4A	222LR	5	24000	3410	10	S-4	—	4.1	3.6	—	—	
—	1	—	1	—	371	(P)221MD	5	1400	8	13	S-4	500	—	69.	—	—	5.3, 5.4, 5.5, 5.7, 5.8
1	—	—	1	—	147	221DL	10	10200	800	19	0	—	10.	6.5	—	—	5.7, 5.9
1	—	1	—	—	4A	222A	10	10200	800	12	S-2	50	—	7.3	—	—	5.10
—	1	1	—	—	96	221AT	5	8800	335	13	S-4	—	13.8	12.	—	—	
—	1	1	—	—	96	222FG	5	10750	600	13	0	—	12.	9.7	—	—	

NOTES:

- 5.1 Resistance variation $\pm 10\%$.
- 5.2 Min release 125, max 175 milliseconds.
- 5.3 Min release 111, max 140 milliseconds.
- 5.4 When timing requirements are not applied: operate 85, N.O. 69, residual S-4.
- 5.5 When timing requirements are applied from test jack: readjust hold 0.100 second, release 0.140 second; test release 0.155 second.
- 5.6 Min release 111, max 155 milliseconds.
- 5.7 Contact pressure springs 4-5 test min 10 grams.
- 5.8 Contact separation springs 4-5 test min 8 in.
- 5.9 Contacts 1-2 shall make before contacts 3-5 make.
- 5.10 Release time min 300, max 500 milliseconds.

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RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

6 CONTACT SPRINGS

1	—	—	—	1BMB	18	(P)221ED	5	1440	8	13	S-4	500	—	69.	—	—	6.4, 6.5, 6.6, 6.7
1	—	—	—	1BMB	18	221AP	5	8800	335	13	S-2	125	—	10.6	—	—	6.5, 6.8
1	—	—	—	1MBM	139	222DC	5	8800	335	21	S-4	—	14.	10.7	—	—	6.9
3	—	—	—	—	82	221CT	5	680	2	13	S-4	—	200.	150.	—	—	6.1
3	—	—	—	—	82	(P)221BT	5	1670	10	13	S-4	—	38.	34.	—	—	
3	—	—	—	—	304	221GM	12	4890	150	13	10-14	—	40.	37.	—	—	6.2
3	—	—	—	—	79	221GY	10	10200	800	17	0	—	7.9	7.3	—	—	6.3
3	—	—	—	—	82	222CE	10	10200	800	13	0	—	10.7	9.6	—	—	
—	3	—	—	—	318	221JE	12	7100	210	10	7-11	—	35.	25.5	—	—	
—	—	1	1	—	20	222HN	12	22000	3600	15	S-4	—	10.	7.1	—	—	
—	—	2	—	—	126	221NS	5	1050	4.37	13	S-4	—	100.	90.	—	—	
—	—	2	—	—	164	(P)221EF	5	1440	8	13	S-4	500	—	69.	—	—	6.4, 6.6, 6.7
—	—	2	—	—	311	221FT	5	1440	8	13	S-4	—	85.	69.	—	—	6.4, 6.6, 6.7
—	—	2	—	—	126	(P)221HJ	5	8800	335	13	S-4	—	14.7	12.2	—	—	
—	—	2	—	—	291	223BM	5	8800	335	12	S-4	—	14.7	12.2	—	—	
—	—	2	—	—	80	(P)222GS	10	10200	800	13	S-2	50	—	7.3	—	—	6.10

NOTES:

- 6.1 Resistance variation $\pm 15\%$.
- 6.2 Armature need not touch core on operate.
- 6.3 Contacts 1-2 shall make before contacts 3-4 and 5-6 make.
- 6.4 Release time min 111, max 140 milliseconds.
- 6.5 Contact pressure springs 3-4 test min 15 grams.
- 6.6 When timing requirements are not applied: operate 85, N.O. 69, residual S-4.
- 6.7 When timing requirements are applied from test jack: readjust hold 0.100 second, release 0.140 second; test release 0.155 second.
- 6.8 Release time min 111, max 155 milliseconds.
- 6.9 Contact pressure springs 4-5 test min 15 grams.
- 6.10 Release time min 300, max 500 milliseconds.

RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
7 CONTACT SPRINGS																	
1	1	1	—	—	16	221G	5	1050	4.37	13	S-4	—	100.	90.	—	—	
1	1	1	—	—	16	(P)221CJ	5	1440	8	13	S-4	500	—	69.	—	—	7.1, 7.2, 7.3
1	1	—	1	—	50	(P)221HE	5	8800	335	13	S-2	125	—	10.6	—	—	7.4, 7.5
1	1	—	1	—	50	(P)221FD	10	10200	800	13	0	—	7.9	7.3	—	—	7.4
1	1	—	1	—	51	(P)221BJ	5	16700	1300	15	S-4	—	10.7	9.6	—	—	7.6, 7.7
2	—	1	—	—	14	221JD	12	4890	150	12	10-14	—	40.	37.	—	—	7.8
2	—	1	—	—	13	221LC	10	6930	400	12	S-4	—	15.	12.2	—	—	
2	—	1	—	—	13	(P)221KB	10	8800	650	12	S-4	—	12.	9.6	—	—	
2	—	1	—	—	13	221CS	10	10200	800	12	0	—	7.9	7.3	—	—	
2	—	1	—	—	354	(P)221LE	10	10200	800	12	S-2	50	—	7.3	—	—	7.9
2	—	1	—	—	13	222AS	10	10200	800	12	S-2	50	—	7.3	—	—	7.9
2	—	1	—	—	13A	(P)222AT	10	10200	800	12	S-2	50	—	7.3	—	—	7.9
2	—	1	—	—	13	221KC	5	21400	2500	12	S-4	—	5.7	4.8	—	—	
—	2	1	—	—	36	221H	5	1050	4.37	14	S-4	—	115.	90.	—	—	7.10, 7.12
—	2	1	—	—	36	(P)221CH	5	1440	8	14	S-4	500	—	69.	—	—	7.1, 7.2, 7.3, 7.10
—	2	1	—	—	329	(P)221JU	7	18000	2300	12	7-11	—	16.5	14.5	—	—	7.10, 7.11
—	2	—	1	—	135	(P)221DE	5	8800	335	14	S-2	125	—	10.6	—	—	7.4, 7.5
—	—	1	—	1BMB	94	221AS	5	8800	335	14	S-2	125	—	10.6	—	—	7.5, 7.7

NOTES:

- 7.1 Release time min 111, max 140 milliseconds.
- 7.2 When timing requirements are not applied: operate 85, N.O. 69, residual S-4.
- 7.3 When timing requirements are applied from test jack: readjust hold 0.100 second, release 0.140 second; test release 0.155 second.
- 7.4 Contact pressure springs 6-7 test min 10 grams.
- 7.5 Release time min 111, max 155 milliseconds.
- 7.6 Contacts 3-4 shall make before contacts 6-7 break.
- 7.7 Contact pressure springs 6-7 test min 15 grams.
- 7.8 Armature need not touch core on operate.
- 7.9 Release time min 300, max 500 milliseconds.
- 7.10 As permitted by sequence, any two break contacts may break on N.O.
- 7.11 Contacts 2-3 may make before contacts 6-7 break.
- 7.12 Resistance variation $\pm 10\%$.

RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

8 CONTACT SPRINGS

1	1	—	—	1BMB	41	221NR	5	1050	4.37	14	S-4	—	115.	90.	—	—	8.8, 8.13
1	1	—	—	1BMB	41	221PC	5	1390	8	14	S-4	500	—	69.	—	—	8.13
1	—	2	—	—	191	(P)221FL	5	1440	8	13	S-4	500	—	69.	—	—	8.1, 8.2, 8.3
1	—	2	—	—	86	221KY	10	4670	200	13	S-4	—	32.	26.	—	—	
1	—	2	—	—	55	221AR	5	8800	335	23	S-2	—	10.7 12.5	9.5 12.	—	—	8.4, 8.5, 8.7, 8.14 8.6
1	—	2	—	—	191	221MP	5	8800	335	13	S-2	125	—	10.6	—	—	8.4
1	—	2	—	—	191	222JH	10	10200	800	13	S-2	—	10.2	7.3	—	—	8.10
1	—	2	—	—	168	221LP	7	18000	2300	13	S-4	—	12.8	10.	—	—	
2	2	—	—	—	361	221LS	5	8800	335	19	0	—	19.	15.	—	—	8.9
2	2	—	—	—	39	221HN	10	10200	800	13	S-4	—	15.5	12.	—	—	
2	2	—	—	—	100	222C	10	11500	1300	13	S-4	—	9.6	8.7	—	—	
3	1	—	—	—	57	(P)222BR	5	16700	1300	12	S-4	—	9.5	8.5	—	—	
4	—	—	—	—	84	222AY	10	10200	800	13	S-2	—	50.	7.3	—	—	8.10
—	1	2	—	—	336	221KF	5	1440	8	13	S-4	500	—	69.	—	—	8.1, 8.2, 8.3, 8.11
—	1	2	—	—	336	221KD	12	4890	150	13	7-11	—	40.	35.	—	—	8.11, 8.12

NOTES:

- 8.1 Release time min 111, max 140 milliseconds.
- 8.2 When timing requirements are not applied: operate 85, N.O. 69, residual S-4.
- 8.3 When timing requirements are applied from test jack: readjust hold 0.100 second, release 0.140 second; test release 0.155 second.
- 8.4 Release time min 111, max 155 milliseconds.
- 8.5 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 8.6 Contacts 1-2 may make on N.O.
- 8.7 Contact separation springs 4-5 and 7-8 test min 0.003 in.
- 8.8 Resistance variation $\pm 10\%$.
- 8.9 Contact separation test min 0.015 in.
- 8.10 Release time min 300, max 500 milliseconds.
- 8.11 Contacts 1-2 and 4-5 may break on N.O.
- 8.12 Armature need not touch core on operate.
- 8.13 Contact pressure springs 5-6 test min 10 grams.
- 8.14 Requirements for springs 1-2 only.

RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

9 CONTACT SPRINGS

1	—	1	—	1MBM	122	221AE	10	10200	800	25	0	—	13.9	12.8	—	—	9.1, 9.2
1	2	1	—	—	340	222HP	5	8800	335	14	S-2	—	125.	13.6	—	—	9.3, 9.4
1	2	1	—	—	101	(P)222GU	7	18000	2300	14	S-4	—	15.5	12.6	—	—	9.3
2	1	1	—	—	327	221JK	10	10200	800	13	S-4	—	15.5	12.	—	—	
2	1	—	1	—	131	221CY	7	14000	2500	14	S-4	—	15.	13.	—	—	9.5, 9.6
2	1	—	1	—	341	222HS	7	18000	2300	27	S-4	—	8.	5.9	—	—	9.7, 9.8
												—	15.5	13.2	—	—	9.1
2	1	—	1	—	196	222FP	10	10200	800	13	0	—	9.4	6.8	—	—	9.9
2	1	—	1	—	196	(P)221KE	5	16700	1300	13	S-4	—	9.1	6.1	—	—	9.9
3	—	1	—	—	54	221LT	5	8800	335	12	S-4	—	15.5	12.2	—	—	
3	—	1	—	—	54	(P)221KL	10	8800	650	12	S-4	—	12.	9.6	—	—	
3	—	1	—	—	104	221KN	10	10200	800	12	S-2	50	—	7.3	—	—	9.10
3	—	1	—	—	54	222AU	10	10200	800	12	S-2	50	—	7.3	—	—	9.10
3	—	—	1	—	348	221KS	5	21400	2500	17	S-4	—	10.6	5.9	—	—	9.11
—	3	1	—	—	116	221JG	12	4890	150	12	7-11	—	40.	35.	—	—	9.3, 9.12, 9.13

NOTES:

- 9.1 Contacts 1-2 may make on N.O.
- 9.2 Contact pressure (armature operated) springs 1-2 test min 10 grams.
- 9.3 As permitted by sequence, any two break contacts may break on N.O.
- 9.4 Release min 111, max 155 milliseconds.
- 9.5 Contact pressure springs 8-9 test min 15 grams.
- 9.6 Contacts 3-4 shall make before contacts 8-9 break.
- 9.7 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 9.8 Requirements for springs 1-2 only.
- 9.9 Contact pressure springs 8-9 test min 10 grams.
- 9.10 Release time min 300, max 500 milliseconds.
- 9.11 Contacts 1-2 shall make before contacts 3-4 and 5-6 make and before contacts 8-9 break.
- 9.12 Armature need not touch core on operate.
- 9.13 Contacts 2-3 may make before contacts 6-7 and 8-9 break.

X-75514

RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

10 CONTACT SPRINGS

1	1	—	2	—	306	221GP	7	18000	2300	15	S-4	—	16.5	12.5	—	—	
2	—	1	1	—	151	221NB	5	21400	2500	16	S-4	17	10.1	7.1	—	—	10.1
2	—	1	1	—	71	222GG	10	10200	800	13	S-4	—	27.	24.	—	—	10.2
2	—	2	—	—	74	221JY	10	10200	800	25	S-4	—	10.8	6.3	—	—	10.3, 10.9
												—	19.	16.	—	—	10.4
2	—	2	—	—	87	221KM	10	10200	800	13	S-4	—	13.1	9.9	—	—	
3	2	—	—	—	119	(P)222BS	5	16700	1300	13	S-4	—	10.	9.	—	—	
3	2	—	—	—	119	221HF	5	16700	1300	13	S-4	—	10.	9.	—	—	
4	1	—	—	—	308	221GR	7	18000	2300	12	4-8	—	16.5	12.	—	—	
5	—	—	—	—	303	221GT	7	18000	2300	13	S-4	—	15.	12.	—	—	
—	2	2	—	—	333	221KA	5	8800	335	13	S-4	—	15.5	12.	—	—	10.5, 10.6
—	2	2	—	—	185	(P)221FP	10	10200	800	26	0	—	8.4	6.6	—	—	10.7, 10.10
												—	14.2	12.3	—	—	10.8

NOTES:

- 10.1 Contacts 4-5 shall make before contacts 2-3 and 6-7 make.
- 10.2 Contact pressure springs 9-10 test min 15 grams.
- 10.3 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 10.4 Contacts 1-2 may make on N.O.
- 10.5 As permitted by sequence, any two break contacts may break on N.O.
- 10.6 Contacts 2-3 and 5-6 may make before contacts 9-10 break.
- 10.7 Contacts 1-2 shall break and contacts 2-3 shall make before spring 2 strikes the bushing on spring 5.
- 10.8 Contacts 1-2, 4-5, and 6-7 may break and contacts 2-3 may make on N.O.
- 10.9 Requirements for springs 1-2 only.
- 10.10 Requirements for springs 1-2-3 only.

RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

11 CONTACT SPRINGS

1	—	1	2	—	26	(P)222KE	10	10200	800	15	S-2	50	—	10.6	—	—	11.1
1	—	2	1	—	393	221NC	10	4670	200	27	S-4	210	28.	24.	—	—	11.2, 11.4, 11.5, 11.9
												—	43.5	34.	—	—	11.3
1	—	3	—	—	302	222FM	10	10200	800	14	S-4	—	13.8	10.3	—	—	11.6
2	2	1	—	—	75	222GE	5	10750	600	14	S-4	—	16.	13.5	—	—	11.6
3	1	—	1	—	64	222FY	5	16700	1300	25	S-4	—	6.6	5.6	—	—	11.2, 11.7, 11.8, 11.9
												—	11.	9.3	—	—	11.3
4	—	1	—	—	301	221LJ	10	10200	800	12	0	—	9.8	7.3	—	—	
4	—	1	—	—	186	222FF	10	10200	800	12	S-4	—	31.	26.5	—	—	
4	—	1	—	—	301	222FS	10	10200	800	12	0	—	9.8	7.3	—	—	

NOTES:

- 11.1 Release time min 100, max 175 milliseconds.
 11.2 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
 11.3 Contacts 1-2 may make on N.O.
 11.4 Contacts 4-5 and 7-8 shall make before contacts 10-11 break.
 11.5 Contact pressure springs 10-11 test min 15 grams.
 11.6 As permitted by sequence, any two break contacts may break on N.O.
 11.7 Contact separation springs 9-11 test min 3 in.
 11.8 Contact pressure springs 10-11 test min 10 grams.
 11.9 Requirements for springs 1-2 only.

12 CONTACT SPRINGS

1	2	1	1	—	110	(P)222BA	10	10200	800	16	S-4	—	12.1	11.2	—	—	12.1, 12.2
1	2	2	—	—	338	222HR	10	10600	1000	15	S-4	—	14.3	11.2	—	—	12.1
2	1	2	—	—	176	221KW	5	8800	335	14	S-4	—	24.	20.5	—	—	12.1
3	—	2	—	—	240	223R	10	10200	800	25	0	—	11.5	9.	—	—	12.3, 12.4, 12.6
												—	17.5	14.2	—	—	12.5
4	2	—	—	—	399	222KY	5	16700	1300	13	S-4	30	10.	9.	—	—	
6	—	—	—	—	66	222AW	10	10200	800	13	0	—	10.7	9.6	—	—	
6	—	—	—	—	231	223K	12	12350	1200	13	S-4	—	30.	25.	—	—	
—	—	4	—	—	228	223BA	12	9680	440	13	4-8	—	32.5	29.	—	—	12.1

NOTES:

- 12.1 As permitted by sequence, any two breaks may break on N.O.
 12.2 Contact pressure springs 11-12 test min 10 grams.
 12.3 Contacts 1T-2T shall make before spring 1T strikes bushing of spring 4T.
 12.4 Contacts 1B-2B shall make before spring 1B strikes bushing of spring 4B.
 12.5 Contacts 1T-2T and 1B-2B may make on N.O.
 12.6 Requirements for 1T-2T and 1B-2B only.

RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT. ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

13 CONTACT SPRINGS

1	1	1	2	—	62 (P)222BJ	7	18000	2300	16	S-4	—	13.5	10.	—	—	13.1
2	—	1	2	—	35 (P)222BY	7	10200	646	17	0	—	23.	14.	—	—	13.2
											—	17.	—	—	—	13.4
2	—	3	—	—	316 (P)222KD	7	18000	2300	14	S-4	18	13.8	11.6	—	—	13.3
4	1	1	—	—	190 222HC	10	10200	800	13	S-4	—	14.5	10.6	—	—	
4	1	1	—	—	189 (P)222FB	12	13000	900	13	S-4	—	14.	9.2	—	—	
5	—	1	—	—	363 222JG	10	10200	800	12	S-4	—	31.	26.5	—	—	

NOTES:

- 13.1 Contact pressure springs 9-10 and 12-13 test min 35 grams.
 13.2 Contacts 4-5 and 6-7 shall make before contacts 8-9 and 11-13 make.
 13.3 As permitted by sequence, any two break contacts may break on N.O.
 13.4 Contacts 4-5 shall make.

14 CONTACT SPRINGS

—	4	—	2	—	391 222KJ	7	18000	2300	17	S-2	18	15.5	12.	—	—	14.1, 14.2, 14.3
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NOTES:

- 14.1 As permitted by sequence, any two break contacts may break on N.O.
 14.2 Contacts 10-12 shall make before contacts 13-14 break.
 14.3 Contact pressure springs 13-14 test min 15 grams, readjust min 20 grams.

15 CONTACT SPRINGS

2	—	1	—	2MBM 235 224AE	7	11450	900	25	0	—	17.	10.	—	—	15.1, 15.2, 15.3
—	1	3	—	1BMB 205 (P)223C	5	16700	1300	14	S-4	—	12.1	10.	—	—	15.4, 15.5

NOTES:

- 15.1 As permitted by sequence, any two break contacts may break and contacts 1T-2T and 4B-5B may make on N.O.
 15.2 Contacts 1B-2B shall break before contacts 1T-2T and 4B-5B make.
 15.3 Contact pressure springs 1T-2T and 4B-5B (armature operated) test min 10 grams.
 15.4 As permitted by sequence, any two break contacts may break on N.O.
 15.5 Contact pressure springs 6T-7T test min 10 grams.

RELAY DATA — CODE INFORMATION

TABLE III — SINGLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

16 CONTACT SPRINGS

— 2 4 — — 276 223BB 12 7940 285 14 4-8 — 51. 43. — — 16.1

NOTES:

16.1 As permitted by sequence, any two break contacts may break on N.O.

19 CONTACT SPRINGS

3 2 3 — — 215 223AA 10 10200 800 27 S-4 — 17.5 12.6 — — 19.1, 19.2, 19.6
 — 31. 25.5 — — 19.3
 4 1 2 1 — 408 223CF 5 8800 335 15 S-4 — 24. 18. — — 19.4, 19.5

NOTES:

- 19.1 Contacts 1T-2T shall make before spring 1T strikes the bushing on spring 4T.
- 19.2 Contacts 1B-2B shall make before spring 1B strikes the bushing on spring 4B.
- 19.3 As permitted by sequence, any two break contacts may break and contacts 1T-2T and 1B-2B may make on N.O.
- 19.4 As permitted by sequence, any two break contacts may break on N.O.
- 19.5 Contact pressure springs 9B-10B test min 15 grams.
- 19.6 Requirements for springs 1T-2T and 1B-2B only.

X-75514

RELAY DATA — CODE INFORMATION

TABLE IV — DOUBLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

2 CONTACT SPRINGS

1	—	—	—	—	45B(P)221FE	13	P 3970 S 2530	65 400	11	7-11	P — S —	24. 41.5	20.	—	—	—	2.1, 2.2
1	—	—	—	—	47 221GB	14	P 10450 S 5350	1000 500	13	0	P — S —	4.3 9.1	1.7	—	—	—	—

NOTES:

- 2.1 Armature need not touch core on operate.
2.2 Contact follow test min 0.008 in.

3 CONTACT SPRINGS

—	—	—	1	—	368 221LY	8	P 850 S (N.I.)	6.8 100	15	4-6	P — S —	360.	290.	—	—	—	3.1
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NOTES:

- 3.1 Contact pressure springs 2-3 test min 15 grams.

4 CONTACT SPRINGS

1	1	—	—	—	197 221KG	13	P 8550 S 8850	350 1800	12	S-4	P — S —	14.7 16.	12.5	—	—	—	—
1	1	—	—	—	197 221MG	19	P 1450 S (N.I.) T 2750 P//S	11.5 32 1300 8.4	12	S-2	P 500 S —	130.	120.	—	—	—	—

5 CONTACT SPRINGS

—	1	1	—	—	96 222S	8	P 4000 S 8800	200 1300	13	S-4	P — S —	41. 20.5	38.	—	—	—	—
—	1	1	—	—	96 (P)222JJ	14	P 5200 S 7150	200 1100	13	S-2	P — S —	23.5 19.	20.	—	—	—	—

6 CONTACT SPRINGS

1	2	—	—	—	123 222CD	8	P 4000 S 8800	200 1300	25	S-4	P 75. S —	25. 24.	23.5	—	—	—	6.1, 6.3 6.2
2	1	—	—	—	346 222HW	8	P 13600 S 2380	1600 400	25	S-4	P — S —	8. 80.	6.7	—	—	—	6.1, 6.3 6.2

NOTES:

- 6.1 Contacts 1-2 shall make before spring 1 strikes bushing on spring 4.
6.2 Contacts 1-2 may make on N.O.
6.3 Requirements for springs 1-2 only.

X-75514

RELAY DATA — CODE INFORMATION

TABLE IV — DOUBLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

7 CONTACT SPRINGS

1	1	1	—	—	177	221FF	8	P 3300 S 7500	110 1180	25	0	P — S —	38. 27.	31.5 22.5	—	—	7.1, 7.3 7.2
1	1	1	—	—	16	221FM	6	F 7790 R 4380	700 200	13	0	F — R —	12.2 24.5	9. 18.5	—	—	

NOTES:

- 7.1 Contacts 1-2 shall make before spring 1 strikes bushing on spring 4.
 7.2 Contacts 1-2 may make on N.O.
 7.3 Requirements for springs 1-2 only.

9 CONTACT SPRINGS

1	2	1	—	—	70	222LW	8	P 4000 S 8800	200 1300	14	S-4	P — S —	44. 23.5	37.	—	—	9.1
1	2	1	—	—	70	221NY	8	P 4000 S 8800	200 1300	14	S-4	P — S —	42. 21.	38.	—	—	9.1
1	2	1	—	—	85	(P)221HU	8	P 2800 S 7450	110 865	27	S-4	P — S —	52. 37.	38.	—	—	9.2, 9.5 9.3
1	2	1	—	—	70	221HR	14	P 5200 S 5780	200 700	14	S-4	P — S —	32. 31.5	24.5	23.5	—	9.1
1	—	1	—	1BMB	166	222DT	8	P 4000 S 8800	200 1300	29	S-4	P 75 S —	25. 25.	23.5	—	—	9.2, 9.5 9.4
2	1	—	1	—	88	222R	8	P 4000 S 8800	200 1300	18	S-2	P — S —	37. 18.5	27.5	—	—	9.6, 9.7, 9.8, 9.9
2	1	1	—	—	31	221BN	11	P 10600 7200	1000 1000	13	S-4	P — S —	22. 36.	20.	—	—	

NOTES:

- 9.1 Contacts 1-2 and 3-4 may break on N.O.
 9.2 Contacts 1-2 shall make before spring 1 strikes bushing on spring 4.
 9.3 Contacts 1-2 may make and contacts 3-4 and 5-6 may break on N.O.
 9.4 Contacts 1-2 may make on N.O.
 9.5 Requirements for springs 1-2 only.
 9.6 Contacts 1-2 may make on N.O.
 9.7 Contacts 1-2 may make before contacts 3-4 break.
 9.8 Contact pressure springs 8-9 test min 10 grams.
 9.9 Contacts 1-2 shall make before contacts 5-6 make.

10 CONTACT SPRINGS

1	1	1	1	—	130	(P)221CR	8	P 3350 S 7500	110 1180	21	S-4	P — S —	71. 34.	64.	—	—	10.1, 10.2, 10.3, 10.4
1	4	—	—	—	127	222CG	8	P 4000 S 8800	200 1300	27	S-4	S 33 P —	29.5 71.5	27.5	—	—	10.5, 10.6
1	4	—	—	—	373	(P)222JL	8	P 4000 S 8800	200 1300	23	S-4	P 75 S —	25. 26.	23.5	—	—	10.5, 10.12 10.6
1	—	—	—	2BMB	165	(P)222DS	8	P 4000 S 8800	200 1300	29	S-4	P 75 S —	25. 25.	23.5	—	—	10.5, 10.12 10.7

RELAY DATA — CODE INFORMATION

TABLE IV — DOUBLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON-OPR	HOLD	RLS	

10 CONTACT SPRINGS (Contd)

2	—	2	—	—	73	(P)222L	8	P 4000 S 8800	200 1300	25	S-4	S 33 P —	27. 65.5	21.	—	—	10.5, 10.7
2	—	2	—	—	74	(P)222J	8	P 4000 S 8800	200 1300	25	S-4	P 75 S —	25. 27.	23.5	—	—	10.5, 10.12 10.7
2	3	—	—	—	902	221NW	8	P 4000 S 8800	200 1300	14	S-4	P — S —	42. 20.	38.	—	—	10.11
2	—	1	1	—	151	221HY	13	P 8630 S 4000	287 665	16	S-4	S — P —	56.5 29.5	36.	48.	—	10.1, 10.8
4	1	—	—	—	308	222HM	13	P 9000 S 11500	790 1000	12	S-4	P — S —	26. 22.5	22.	—	—	—
4	1	—	—	—	309	222FU	14	P 13100 S 5340	1325 825	25	0	S — S — P —	20.5 36.5 16.5	15.5	—	—	10.5, 10.12 10.7
—	2	2	—	—	150	(P)221DN	8	P 3300 S 7500	110 1180	24	S-4	P — S —	30. 24.5	27.	—	—	10.10, 10.13 10.9

NOTES:

- 10.1 Resistance variation $\pm 10\%$.
- 10.2 Contacts 1-2 may break and contacts 3-4 may make on N.O.
- 10.3 Sequence break 1-2; then make 3-4; then break 5-6.
- 10.4 Contact pressure springs 9-10 test min 15 grams.
- 10.5 Contacts 1-2 shall make before spring 1 strikes bushing on spring 4.
- 10.6 Contacts 1-2 may make and contacts 3-4 and 5-6 may break on N.O.
- 10.7 Contacts 1-2 may make on N.O.
- 10.8 Contacts 4-5 shall make before contacts 2-3 and 6-7 make.
- 10.9 Contacts 1-2, 4-5, and 6-7 may break and contacts 2-3 may make on N.O.
- 10.10 Springs 2-3 shall make before spring 2 strikes bushing on spring 5.
- 10.11 Contacts 1-2 and 3-4 may break on N.O.
- 10.12 Requirements for springs 1-2 only.
- 10.13 Requirements for springs 1-2-3 only.

11 CONTACT SPRINGS

1	1	1	—	1BMB	300	222FN	14	P 10450 S 5350	1000 500	15	0	P — S —	13.2 28.5	10.7	—	—	11.1, 11.2
1	3	1	—	—	194	222FH	11	P 3350 S 12300	140 1300	24	SL	P — S —	66. 22.	43.	—	—	11.3, 11.8 11.4, 11.5
2	—	1	—	1BMB	183	(P)222FE	8	P 4000 S 8800	200 1300	27	S-4	P 75 S —	25. 26.	23.5	—	—	11.2, 11.6, 11.9 11.7
3	1	1	—	—	179	222ES	14	P 13100 S 5340	1325 825	25	0	S — — P —	17. 29. 13.	12.5	—	—	11.6, 11.9 11.7
—	1	3	—	—	312	222FW	14	P 10450 S 5350	1000 500	15	0	P — S —	17. 37.	12.4	—	—	11.1

NOTES:

- 11.1 Contacts 1-2 and 3-4 may break on N.O.
- 11.2 Contact pressure springs 8-9 test min 15 grams.
- 11.3 Contacts 1-2 shall break and contacts 3-4 shall make before spring 3 strikes bushing on spring 6.
- 11.4 Contacts 1-2 and 5-6 may break and contacts 3-4 may make on N.O.
- 11.5 Contacts 6-7 may make before contacts 8-9, 10-11 break.
- 11.6 Contacts 1-2 shall make before spring 1 strikes bushing on spring 4.
- 11.7 Contacts 1-2 may make on N.O.
- 11.8 Requirements for springs 1-2 and 3-4 only.
- 11.9 Requirements for springs 1-2 only.

RELAY DATA — CODE INFORMATION

TABLE IV — DOUBLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
12 CONTACT SPRINGS																	
2	1	2	—	—	113A(P)222T	8	P 4000 S 8800	200 1300	25	S-4	P 75 S —	25. 27.	23.5 21.	—	—	—	12.1, 12.3 12.2
2	1	2	—	—	155 222DP	8	P 4000 S 8800	200 1300	27	S-4	S 33 P —	27. 65.5	21. —	—	—	—	12.1, 12.2
3	—	2	—	—	149 (P)222DG	8	P 4000 S 8800	200 1300	25	S-4	P 75 S —	25. 27.	23.5 21.	—	—	—	12.1, 12.3 12.4
3	—	2	—	—	154 222DJ	8	P 4000 S 8800	200 1300	25	S-4	S 33 P —	27. 65.5	21. —	—	—	—	12.1, 12.4

NOTES:

- 12.1 Contacts 1-2 shall make before spring 1 strikes bushing on spring 4.
- 12.2 Contacts 1-2 may make and contacts 3-4 and 5-6 may break on N.O.
- 12.3 Requirements for springs 1-2 only.
- 12.4 Contacts may make on N.O.

13 CONTACT SPRINGS

1	1	3	—	—	72 (P)	222H	8	P 4000 S 8800	200 1300	27	S-4	P 75 S —	25. 27.	23.5 21.	— —	— —	13.2, 13.10 13.3
1	1	3	—	—	141	222GP	8	P 4000 S 8800	200 1300	27	S-4	S 33 P —	27. 65.5	21. —	— —	— —	13.2, 13.5, 13.6
1	—	1	—	2BMB	701 (P)	222LD	8	P 4000 S 8250	200 950	29	S-4	P — S 43	27. 35.5	25.5 30.	— —	— —	13.1, 13.2, 13.10 13.7
1	2	1	—	1BMB	931	222LK	8	P 4000 S 8800	200 1300	31	S-4	P — S —	27. 29.	25.5 24.5	— —	— —	13.10 13.3
2	1	1	—	1BMB	198	222FR	14	P 10450 S 5350	1000 500	15	0	P 40 S 85	13.4 29.	10. —	— —	— —	13.8, 13.9
2	—	2	1	—	353	221LB	11	P 7500 S 9500	660 1000	16	S-4	P — S —	37. 26.5	— 18.	— —	— —	
2	—	3	—	—	174 (P)	222ER	8	P 4000 S 8800	200 1300	27	S-4	P 75 S —	25. 27.	23.5 21.	— —	— —	13.2, 13.10 13.5
2	—	3	—	—	175	222EP	8	P 4000 S 8800	200 1300	27	S-4	S 33 P —	27. 65.5	21. —	— —	— —	13.2, 13.5

NOTES:

- 13.1 Resistance variation $\pm 10\%$.
- 13.2 Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
- 13.3 Contacts 1-2 may make and contacts 3-4 and 5-6 may break on N.O.
- 13.4 Contacts 4-5 may make before contacts 12-13 break.
- 13.5 Contacts 1-2 may make and contacts 3-4 and 6-7 may break on N.O.
- 13.6 Contacts 4-5 may make before contacts 12-13 break.
- 13.7 Contacts 1-2 may make and contacts 3-4 and 7-8 may break on N.O.
- 13.8 Contacts 1-2 and 3-4 may break on N.O.
- 13.9 Contact pressure springs 8-9 test min 15 grams.
- 13.10 Requirements for springs 1-2 only.

RELAY DATA — CODE INFORMATION

TABLE IV — DOUBLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

14 CONTACT SPRINGS

3	2	—	—	1MBM	324 (P)222GY	16	P 3550 S 12000 T (N.I.)	185 1240 650	31	S-4	P — S —	39. 22.5	22.5 18.5	— —	— —	14.2, 14.3, 14.5 14.1
5	2	—	—	—	204 224J	6	F 9000 R 9000	1000 1000	12	S-4	F — R —	23. 33.	21. —	— —	— —	—
5	2	—	—	—	406 223CD	14	P 10450 S 5350	1000 500	25	S-4	P — P — S —	11. 26.5 57.	8.8 22.5 —	— — —	— — —	14.2, 14.5 14.4

NOTES:

- 14.1 Contacts 1-2 and 3-5 may make and contacts 3-4 and 7-8 may break on N.O.
- 14.2 Springs 1T-2T shall make before spring 1T strikes the bushing on spring 4T.
- 14.3 Contact pressure springs 3-5 test min 15 grams.
- 14.4 Springs 1T-2T may make on N.O.
- 14.5 Requirements for springs 1-2 only.

16 CONTACT SPRINGS

5	3	—	—	—	903 224CJ	11	P 4250 S 10800	125 1300	31	S-4	P — S —	25. 29.	21.5 26.	— —	— —	16.8 16.1
5	3	—	—	—	206 (P)224D	11	P 4250 S 9150	125 1100	31	S-4	P — S — S —	28. 31.5 21.	25. 26. —	— — —	— — —	16.2, 16.4, 16.5, 16.6, 16.8 16.3 16.7

NOTES:

- 16.1 Contacts 1T-2T and 1B-2B may make on N.O.
- 16.2 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B.
- 16.3 Contacts 1T-2T and 1B-2B may make and contacts 3T-4T and 3B-4B may break on N.O.
- 16.4 Contacts 1B-2B shall make before contacts 1T-2T make and contacts 3T-4T break.
- 16.5 Contacts 3T-4T shall break before contacts 3B-4B break.
- 16.6 Contacts 1T-2T shall make before contacts 5B-6B break.
- 16.7 Contacts 3T-4T shall break and contacts 1T-2T may make.
- 16.8 Requirements for springs 1B-2B only.

X-75514

RELAY DATA — CODE INFORMATION

TABLE IV — DOUBLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
17 CONTACT SPRINGS																	
5	2	1	—	—	208 (P)224E	11	P 4250 S 9150	125 1100	31	S-4	P — S — S —	28. 31.5 21.	25. 26. —	— — —	— — —	17.1, 17.18 17.2, 17.3, 17.4, 17.5 17.6	
5	2	1	—	—	419 (P)224BR	11	P 4250 S 9150	125 1100	27	S-4	P — S —	27. 32.	21.5 27.	— —	— —	17.9, 17.10, 17.11, 17.12, 17.18 17.8	
2	2	1	2	—	225 (P)224Y	11	P 3350 S 12300	140 1300	28	0	P — P — S —	49.5 66. 25.5	42. 59.5 21.5	— — —	— — —	17.13, 17.19 17.15, 17.16, 17.17, 17.20 17.14	

NOTES:

- 17.1 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B.
- 17.2 Contacts 1T-2T and 1B-2B may make and contacts 3T-4T and 3B-4B may break on N.O.
- 17.3 Contacts 1B-2B shall make before contacts 1T-2T make and contacts 3T-4T break.
- 17.4 Contacts 3T-4T shall break before contacts 3B-4B break.
- 17.5 Contacts 1T-2T shall make before contacts 5B-6B break.
- 17.6 Contacts 3T-4T shall break and contacts 1T-2T may make and contacts 1B-2B shall make.
- 17.8 Contacts 1B-2B and 1T-2T may make, and as permitted by sequence, two break contacts may break on N.O.
- 17.9 Contacts 1B-2B shall make before spring 1B strikes the bushing on spring 4B and before spring 1T strikes the bushing on spring 4T.
- 17.10 Contacts 1T-2T may make on operate.
- 17.11 Contacts 1B-2B shall make before contacts 1T-2T make.
- 17.12 Contacts 1T-2T shall make before contacts 3T-4T and 3B-4B break.
- 17.13 Contacts 3T-4T shall make before spring 3T strikes bushing on spring 6T and before spring 2B strikes bushing on spring 4B.
- 17.14 Contacts 1T-2T and 1B-2B may break and contacts 3T-4T may make on N.O.
- 17.15 Contacts 1T-2T may break and contacts 3T-4T may make on N.O.
- 17.16 Contacts 1T-2T shall break before contacts 3T-4T make.
- 17.17 Contacts 3T-4T shall make before contacts 1B-2B break.
- 17.18 Requirement for 1B-2B only.
- 17.19 Requirement for 1T-2T and 3T-4T only.
- 17.20 Requirement for 1T-2T, 3T-4T, and 1B-2B only.

18 CONTACT SPRINGS

6	3	—	—	—	421	224BT	11	P 4250 S 9150	125 1100	25	2-4	P — S —	27. 32.	21.5 26.	— —	— —	18.1, 18.3, 18.4, 18.5 18.2
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NOTES:

- 18.1 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B and spring 1T strikes bushing on spring 4T.
- 18.2 Contacts 1T-2T and 1B-2B may make and two break contacts may break on N.O.
- 18.3 Contacts 1B-2B shall make before contacts 1T-2T make.
- 18.4 Contacts 1T-2T shall make before contacts 3T-4T and 3B-4B break.
- 18.5 Requirement for springs 1B-2B only.

RELAY DATA — CODE INFORMATION

TABLE IV — DOUBLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

19 CONTACT SPRINGS

3	2	2	1	—	260	224AY	11	P 4250	125	27	S-4	P —	25.	17.	—	—	19.1, 19.3
								S 6700	640			S —	54.	38.	—	—	19.2

NOTES:

- 19.1 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before armature stud strikes spring 2B.
 19.2 As permitted by sequence, any two break contacts may break and contacts 1T-2T may make on N.O.
 19.3 Requirements for 1T-2T only.

20 CONTACT SPRINGS

3	2	2	—	1BMB 209	224F	11	P 4250	125	27	S-4	P —	25.	21.5	—	—	20.1, 20.3
							S 9150	1100			S —	32.	26.	—	—	20.2
4	1	2	—	1BMB 212	224H	11	P 4250	125	29	S-4	P —	25.	21.5	—	—	20.4, 20.8
							S 9150	1100			S —	29.	22.5	—	—	20.5, 20.6, 20.7

NOTES:

- 20.1 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B and before armature stud strikes 2T.
 20.2 As permitted by sequence, any two break contacts may break and contacts 1B-2B may make on N.O.
 20.3 Requirements for 1B-2B only.
 20.4 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before spring 1B strikes bushing on spring 4B.
 20.5 As permitted by sequence, any two break contacts may break and contacts 1T-2T and 1B-2B may make on N.O.
 20.6 Contacts 1B-2B shall make before contacts 3B-4B and 3T-4T break.
 20.7 Contacts 1T-2T shall make before contacts 1B-2B make.
 20.8 Requirement for 1T-2T only.

21 CONTACT SPRINGS

3	3	2	1	—	227 (P)224AA	11	P 4250	125	29	S-4	P —	25.	21.5	—	—	21.1, 21.3
							S 9150	1100			S —	34.	21.5	—	—	21.2
4	5	1	—	—	438 224CF	11	P 4250	125	27	S-4	P —	25.	21.5	—	—	21.4
							S 10800	1300			S —	29.	26.	—	—	21.5, 21.6, 21.7

NOTES:

- 21.1 Contacts 1B-2B shall make before spring 1B strikes the bushing on spring 4B and before the armature stud strikes spring 2T.
 21.2 As permitted by sequence, any two break contacts may break and contacts 1B-2B may make.
 21.3 Requirement for 1B-2B only.
 21.4 Requirement for 1T-2T only.
 21.5 As permitted by sequence, any two break contacts may break and contacts 1T-2T and 1B-2B may make on N.O.
 21.6 Contacts 1T-2T shall make before spring 1T strikes the bushing on spring 4T and before spring 1B strikes the bushing on spring 4B.
 21.7 Contacts 1T-2T shall make before contacts 1B-2B make.

X-75514

RELAY DATA — CODE INFORMATION

TABLE IV — DOUBLE-WOUND SLOW-ACTING 221, 222, 223, AND 224 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	
22 CONTACT SPRINGS																	
5	1	2	—	1BMB	211	224G	11	P 4250 S 9150	125 1100	29	S-4	P — S — S —	28. 21. 31.5	25. — 26.	— — —	— — —	22.1, 22.5, 22.6, 22.16 22.3, 22.17 22.2, 22.4, 22.7
6	2	2	—	—	258	224AU	11	P 4250 S 6700	125 640	27	S-4	P — S — S —	27. 54.	21.5 45.	— —	— —	22.1, 22.5, 22.9, 22.16 22.8
6	5	—	—	—	264	224BA	11	P 4250 S 6700	125 640	31	S-4	P — S — S —	28. 29. 50.	23.5 — 41.	— — —	— — —	22.10, 22.13, 22.18 22.12, 22.19 22.11, 22.14, 22.15

NOTES:

- 22.1 Contacts 1T-2T shall make before spring 1T strikes bushing on spring 4T and before spring 1B strikes bushing on spring 4B.
 22.2 As permitted by sequence, any two break contacts may break, contacts 1T-2T and 1B-2B may make, and contacts 3T-4T may break on N.O.
 22.3 Contacts 1B-2B may make on operate.
 22.4 Contact pressure springs 11B-12B test min 15 grams.
 22.5 Contacts 1T-2T shall make before contacts 1B-2B make.
 22.6 Contacts 1B-2B shall make before contacts 4T-5T, 7T-8T, 9T-10T, 5B-6B, 7B-8B, and 10B-12B make.
 22.7 Contacts 3T-4T shall break before contacts 6T-7T and 3B-4B break.
 22.8 As permitted by sequence, any two break contacts may break and contacts 1T-2T and 1B-2B may make on N.O.
 22.9 Contacts 1B-2B shall make before contacts 3T-4T and 3B-4B break.
 22.10 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B and 1T strikes bushing on spring 4T.
 22.11 Contacts 1T-2T and 1B-2B may make and contacts 3B-4B may break, and as permitted by sequence, any other two break contacts may break on N.O.
 22.12 Contacts 1T-2T may make on operate.
 22.13 Contacts 1B-2B shall make before contacts 1T-2T make.
 22.14 Contacts 1T-2T shall make before contacts 7T-8T, 9T-10T, 11T-12T, and 9B-10B make and contacts 5T-6T and 7B-8B break.
 22.15 Contacts 3B-4B shall break before contacts 5B-6B and 3T-4T.
 22.16 Requirement for 1T-2T only.
 22.17 Requirement for 1T-2T and 3T-4T only.
 22.18 Requirement for 1B-2B only.
 22.19 Requirement for 1B-2B and 3B-4B only.

23 CONTACT SPRINGS

5	5	1	—	—	422 (P)224BS	11	P 4250 S 6700	125 640	31	3-5	P — S — S —	27. 29. 50.	21.5 — 41.	— — —	— — —	23.1, 23.3, 23.6 23.7, 23.8 23.2, 23.4, 23.5
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NOTES:

- 23.1 Contacts 1B-2B shall make before spring 1B strikes bushing on spring 4B and spring 1T strikes bushing on spring 4T.
 23.2 Contacts 1T-2T and 1B-2B may make and contacts 3B-4B may break, and as permitted by sequence, any other two break contacts may break on N.O.
 23.3 Contacts 1B-2B shall make before contacts 1T-2T make.
 23.4 Contacts 1T-2T shall make before contacts 3T-4T and 5B-6B break.
 23.5 Contacts 3B-4B shall break before contacts 3T-4T and 5B-6B break.
 23.6 Requirement for 1B-2B only.
 23.7 Requirement for 1B-2B and 3B-4B.
 23.8 Contacts 1T-2T may make.

RELAY DATA — CODE INFORMATION

TABLE V — 247 AND 248 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

3 CONTACT SPRINGS

—	—	1	—	—	507	247D	2	8800	335	27	1.5-4	—	10.3	9.2	—	—	
—	—	—	1	—	508	247F	2	8800	335	35	1.5-4	—	15.	8.7	—	—	1

4 CONTACT SPRINGS

2	—	—	—	—	522	248J	1	9000	800	28	1.5-4	50	—	9.	—	—	2
												50	10.	9.	—	—	

5 CONTACT SPRINGS

1	—	1	—	—	500	(P)248A	1	9000	800	27	1.5-4	50	—	9.	—	—	2
—	1	—	1	—	526	(P)247N	2	8800	335	33	1.5-4 FS	—	19.	13.5	—	—	3

6 CONTACT SPRINGS

2	1	—	—	—	518	247G	1	9000	800	27	1.5-4	50	10.2	9.	—	—	
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7 CONTACT SPRINGS

2	—	1	—	—	501	(P)247A	1	9000	800	27	1.5-4	—	10.	9.	—	—	2
2	—	1	—	—	515	(P)248E	1	9000	800	27	1.5-4	50	—	9.	—	—	2
2	—	1	—	—	504	247E	2	8800	335	27	1.5-4	—	13.6	10.8	—	—	
2	—	1	—	—	504	(P)248D	1	9000	800	27	1.5-4	50	—	9.	—	—	2

8 CONTACT SPRINGS

1	—	—	2	—	521	(P)247J	2	8800	335	49	1.5-4	125	—	14.	—	—	4, 5, 6, 7
4	—	—	—	—	503	248C	1	9000	800	28	1.5-4	50	—	9.	—	—	2

NOTES:

1. Contact pressure springs 2-3 test min 15 grams.
2. Release time min 333, max 500 milliseconds.
3. Contact pressure springs 4-5 test min 15 grams.
4. Contacts 2-3 shall break before contacts 4-6 and 7-8 make.
5. Contact pressure springs 2-3 and 5-6 test min 10 grams.
6. Release time min 140, max 275 milliseconds.
7. Has special core for long life.

RELAY DATA — CODE INFORMATION

TABLE V — 247 AND 248 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

9 CONTACT SPRINGS

2	1	1	—	—	1015	248M	1	9000	800	29	1.5-4	50	—	9.	—	—	18, 20
3	—	1	—	—	505	(P)247B	1	9000	800	27	1.5-4	50	—	9.	—	—	18
3	—	1	—	—	502	(P)248B	1	9000	800	27	1.5-4	50	—	9.	—	—	18
3	—	1	—	—	516	(P)248F	1	9000	800	27	1.5-4	50	—	9.	—	—	18
—	—	—	3	—	506	(P)247C	2	8800	335	49	1.5-4	125	—	14.	—	—	8, 9, 19

10 CONTACT SPRINGS

1	1	—	2	—	519	247H	2	8800	335	48	1.5-4	125	—	17.	—	—	15, 17
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11 CONTACT SPRINGS

1	—	1	2	—	523	248K	4	P 11370 S (N.I.) P//S 1500 375	500	48	1.5-4	110	—	18.	—	—	10, 11, 12, 13
1	—	3	—	—	520	(P)248H	3	P 5200 S 7150	200 1100	31	1.5-3	P 100 S 35	28. 22.5	23.	—	—	14
4	—	1	—	—	517	(P)248G	1	9000	800	27	1.5-4	50	—	9.	—	—	18

13 CONTACT SPRINGS

4	1	1	—	—	524	(P)248L	1	9000	800	29	1.5-4	50	—	13.3	—	—	16
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NOTES:

8. Contacts 2-3 shall break before contacts 4-6 and 7-9 make.
9. Contacts 2-3, 5-6, and 8-9 test min 15 grams.
10. Contacts 5-6 shall break before contacts 2-3, 7-9, and 10-11 make.
11. Contacts 10-11 shall make before contacts 2-3 make.
12. Contact pressure springs 5-6 and 8-9 test min 10 grams.
13. Release time min 50, max 70 milliseconds.
14. Contacts 1-2 and 4-5 may break on the primary N.O.
15. Contact pressure springs 4-5 and 7-8 test min 10 grams.
16. Release time min 275, max 450 milliseconds
17. Contacts 4-5 shall break before contacts 6-8 and 9-10 make.
18. Release time min 333, max 500 milliseconds.
19. Release time min 140, max 275 milliseconds.
20. Resistance variation $\pm 10\%$.

RELAY DATA — CODE INFORMATION

TABLE VI — 225 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

2 CONTACT SPRINGS

1	—	—	—	—	45	225E	2	3800	1100	13	S-4	—	28.	24.	—	—	
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4 CONTACT SPRINGS

1	1	—	—	—	89	225B	1	11900	1300	13	S-4	—	10.5	9.5	—	—	
2	—	—	—	—	8	225AB	2	9150	1100	13	4-8	—	28.	24.	—	—	

5 CONTACT SPRINGS

1	—	1	—	—	4	225AC	5	9150	1100	8	S-4	—	15.	13.5	—	—	
1	—	—	1	—	102	225J	4	P 3000 S (N.I.) P//S 180	210 1300 180	18	S-4	—	105.	85.	—	—	1
1	—	—	1	—	140	(P)225S	3	P 4580 S 9000	400 1250	16	S-4	P 100 S 30	36. 20.5	20.5	—	—	
1	—	—	1	—	140	(P)225F	3	P 6900 S (N.I.) 600	450 600	16	S-5	P —	24.	14.	—	—	
1	—	—	1	—	53	225H	1	11900	1300	16	S-4	—	15.5	12.1	—	—	

6 CONTACT SPRINGS

—	—	1	1	—	21	(P)225A	1	11900	1300	13	S-4	—	17.	14.5	—	—	2
—	—	2	—	—	38	225C	1	11900	1300	13	S-4	—	12.1	11.2	—	—	

7 CONTACT SPRINGS

2	—	1	—	—	14	225T	1	11900	1300	12	S-4	—	12.1	9.2	—	—	
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9 CONTACT SPRINGS

2	1	1	—	—	31	(P)225R	2	10100	1500	13	S-4	—	20.5	17.5	—	—	
3	—	—	1	—	305	(P)225M	1	11900	1300	16	S-4	—	17.	9.6	—	—	

NOTES:

- Contact pressure springs 4-5 test min 35 grams.
- Contact pressure springs 5-6 test min 15 grams.

RELAY DATA — CODE INFORMATION

TABLE VI — 225 RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

I O CONTACT SPRINGS

1	1	2	—	—	184	(P)225G	3	P 1900 S 4200	30 665	27	S-4	P S	— —	75. 50.	53. 37.	— —	3, 5, 6
2	—	1	1	—	703	225W	1	11900	1300	27	S-4	—	25 —	8.7 22.	6.4 17.	— —	3, 5, 10 4

II CONTACT SPRINGS

1	1	1	—	1BMB	702	(P)225U	1	4500	500	29	S-4	—	67. —	22.5 59.0	16.5 46.5	— —	3, 5, 10 4
1	1	1	—	1BMB	702	(P)225Y	1	11900	1300	29	S-4	FS	—	13.0 25.0	11.0 21.0	— —	3, 5, 10 4
2	2	1	—	—	65	225K	1	11900	1300	24	S-4	—	—	15. 20.	12. 17.	— —	7, 9 8
4	—	—	1	—	337	(P)225P	1	11900	1300	16	S-4	—	—	18.	12.	—	—
—	1	1	2	—	704	225AA	1	11900	1300	16	S-4	FS	—	19.0	15.5	—	10
—	4	1	—	—	153	(P)225D	1	11900	1300	16	S-4	—	—	22.	16.	—	—
—	—	1	—	2BMB	67	225L	1	11900	1300	28	S-4	—	—	16. 26.5	14. 19.5	— —	7, 9 8

NOTES:

- Contacts 1-2 shall make before spring 1 strikes bushing on spring 4.
- Contacts 1-2 may make on N.O.
- Requirements for springs 1-2 only.
- Contacts 1-2 may make and contacts 3-4 and 5-6 may break on the secondary N.O.
- Contacts 1-2 shall break and contacts 2-3 shall make before spring 2 strikes bushing on spring 5.
- Contacts 1-2 may break and contacts 2-3 may make on N.O. for whole combination.
- Requirements for springs 1-2-3 only.
- Resistance variation $\pm 10\%$.

RELAY DATA — CODE INFORMATION

TABLE VII — 251 AND 252 (ELECTROPOLAR) RELAYS

CONT ARRANGEMENT					SPRING COMB.	CODE NO.	WINDING			ARM. TRVL	RESID	CURRENT FLOW REQUIREMENTS					SEE NOTE
M	B	BM	MB	OTHERS			SPOOL NO.	TURNS	RES			SOAK	OPR	NON- OPR	HOLD	RLS	

4 CONTACT SPRINGS

2	—	—	—	—	8	251C	3	P 6600 365	13	—	F	—	13.	7.5	—	—	1, 8
								F S (N.I.) 1000	—								
								P/S 267	—								
								R 8420 1400	—								

5 CONTACT SPRINGS

—	1	1	—	—	378	(P)251D	1	F 6760 375	—	—	F	—	13.3	10.3	—	—	1, 2, 8
								R 8420 1400	17	—	F	—	—	-74.	—	-13.3	

6 CONTACT SPRINGS

—	—	—	2	—	364	251A	1	F 5700 300	16	—	F	—	17.	12.3	—	—	1, 3, 8
								R 8420 1400	—	—	F	—	—	-80.	—	-17.	

8 CONTACT SPRINGS

—	1	—	2	—	367	251E	1	F 6760 375	18	—	F	—	—	-67.5	—	-13.3	1, 4, 5, 8
								R 8420 1400	—	—	F	—	13.3	10.3	—	—	
—	1	—	2	—	367	(P)252A	1	F 6760 375	18	—	F	—	13.3	10.3	—	—	1, 4, 5, 8
								R 8420 1400	—	—	F	—	—	-67.5	-10	-13.3	

10 CONTACT SPRINGS

1	—	—	—	2BMB	396	251B	2	P 9450 850	29	—	F	—	—	-190.	—	—	1, 6, 7
								F S (N.I.) 300	—	—	F	—	50.5	38.	—	-55.5	
								P/S 222	—								
								R 10250 950	—								

12 CONTACT SPRINGS

1	1	—	—	2BMB	384	252B	2	P 9450 850	28	—	F	—	—	-190.	—	—	1, 6, 7
								F S (N.I.) 300	—	—	F	—	50.5	38.	—	-55.5	
								P/S 222	—								
								R 10250 950	—								

NOTES:

1. All current-flow adjustments made with 48.5- to 50-volt battery connected to rear winding.
2. Contact pressure springs 1-2 and 4-5 test min 15 grams, readjust min 20 grams.
3. Contact pressure springs 2-3 and 5-6 test min 45 grams.
4. Contacts 1-3 and 4-6 may make before contacts 7-8 break.
5. Contact pressure springs 2-3 and 5-6 test min 35 grams. Contacts 7-8 test min 45 grams; readjust min 50 grams.
6. Contacts 1-2 shall make before spring 1 strikes the bushing on spring 4.
7. Contact pressure springs 3-4 and 7-8 test min 15 grams.
8. Resistance variation $\pm 10\%$.

SECTION VIII

SPOOL NUMBERS

Step-by-Step Relays Spool Numbers and Winding Arrangements — Terminal End

221, 222, 223, & 224 TYPE RELAYS			
221 & 223 1 222 & 224	221 & 223 2 222 & 224	221 & 223 3 222 & 224	221 & 223 4 222 & 224
221 & 223 5 222 & 224	221 & 223 6 222 & 224	221 & 223 7 222 & 224	221 & 223 8 222 & 224
221 & 223 9 222 & 224	221 & 223 10 222 & 224	221 & 223 11 222 & 224	221 & 223 12 222 & 224
221 & 223 13 222 & 224	221 & 223 14 222 & 224	221 & 223 15 222 & 224	221 & 223 16 222 & 224
221 & 223 17 222 & 224	221 & 223 18 222 & 224	221 & 223 19 222 & 224	221 & 223 20 222 & 224
221 & 223 21 222 & 224	221 & 223 22 222 & 224	221 & 223 23 222 & 224	221 & 223 24 222 & 224
SAME AS SPOOL 3 EXCEPT PRIMARY AND TERTIARY ARE CONNECTED INTERNALLY AND FORM THE "P" WINDING.		PRIMARY IS SHORTED. "S" AND "Q" ARE CONNECTED IN SERIES INTERNALLY. SCHEMATIC SHOWS "S" AND "Q" AS "P" WINDING AND TERTIARY AS "S" WINDING.	

X-75514

Step-by-Step Relays
Spool Numbers and Winding Arrangements — Terminal End

225 TYPE RELAYS			
1	2	3	4
247 & 248 TYPE RELAYS			
1	2	3	4
251 & 252 TYPE RELAYS			
1	2		