AUG 10 1987

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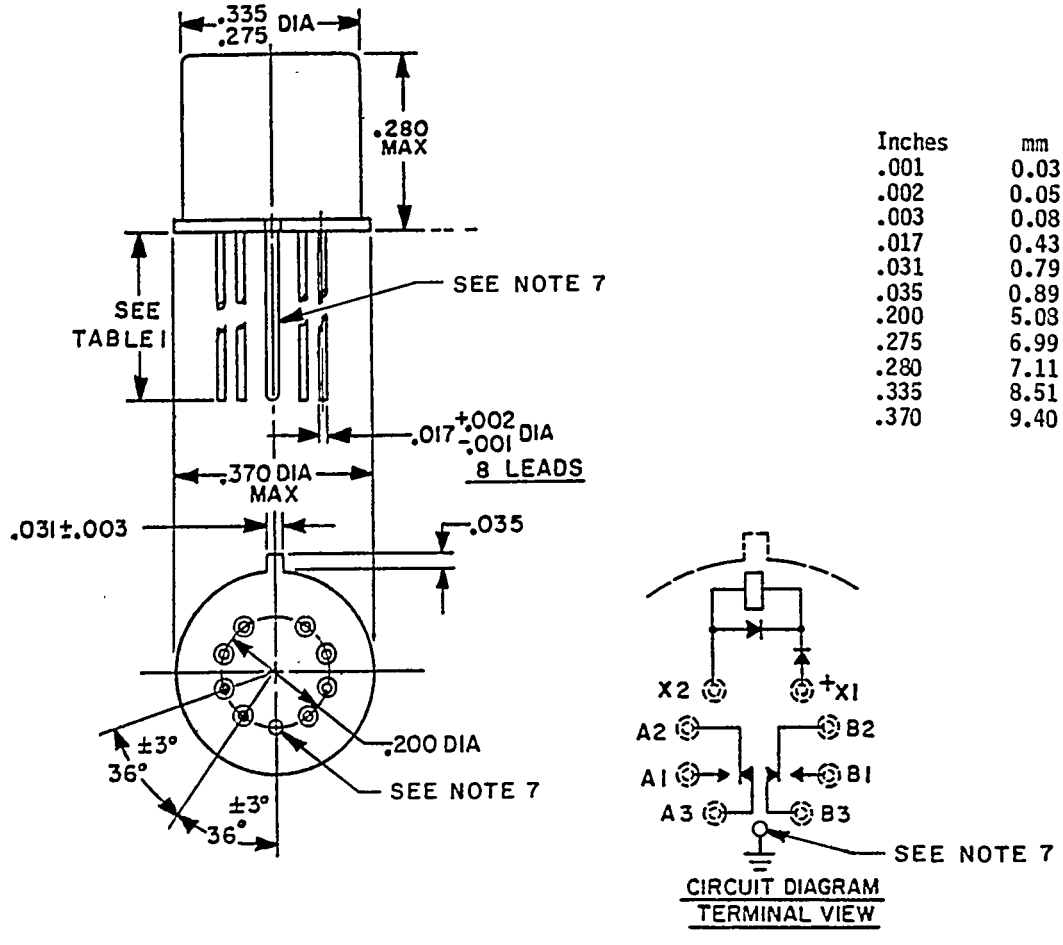
MILITARY SPECIFICATION SHEET

RELAYS, ELECTROMAGNETIC, ESTABLISHED RELIABILITY, DPDT, LOW LEVEL TO 1.0 AMPERE WITH INTERNAL DIODES FOR COIL TRANSIENT SUPPRESSION AND POLARITY REVERSAL PROTECTION

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the relays described herein shall consist of this specification and the latest issue of MIL-R-39016.

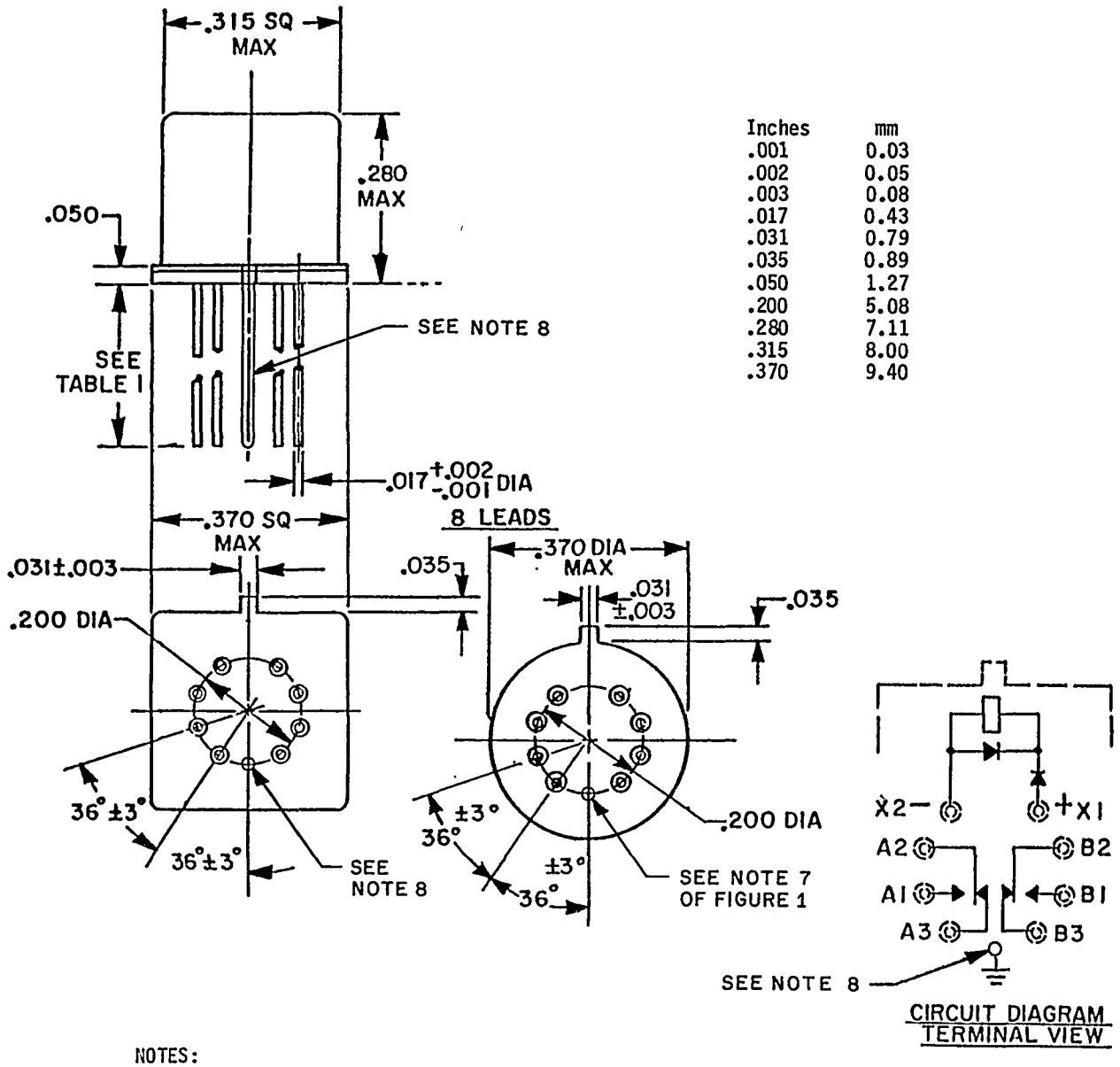


Inches	mm
.001	0.03
.002	0.05
.003	0.08
.017	0.43
.031	0.79
.035	0.89
.200	5.08
.275	6.99
.280	7.11
.335	8.51
.370	9.40

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is ±.010 (0.25 mm).
4. Relays shall have a plus (+) sign place on the circuit diagram as shown.
5. Coil symbol optional in accordance with MIL-STD-1285.
6. Circuit diagram shown on part is the terminal view.
7. The grounding pin shown is a non insulated case ground applicable to -079 through -084 only.

Ⓗ FIGURE 1. Dimensions and configuration (round).

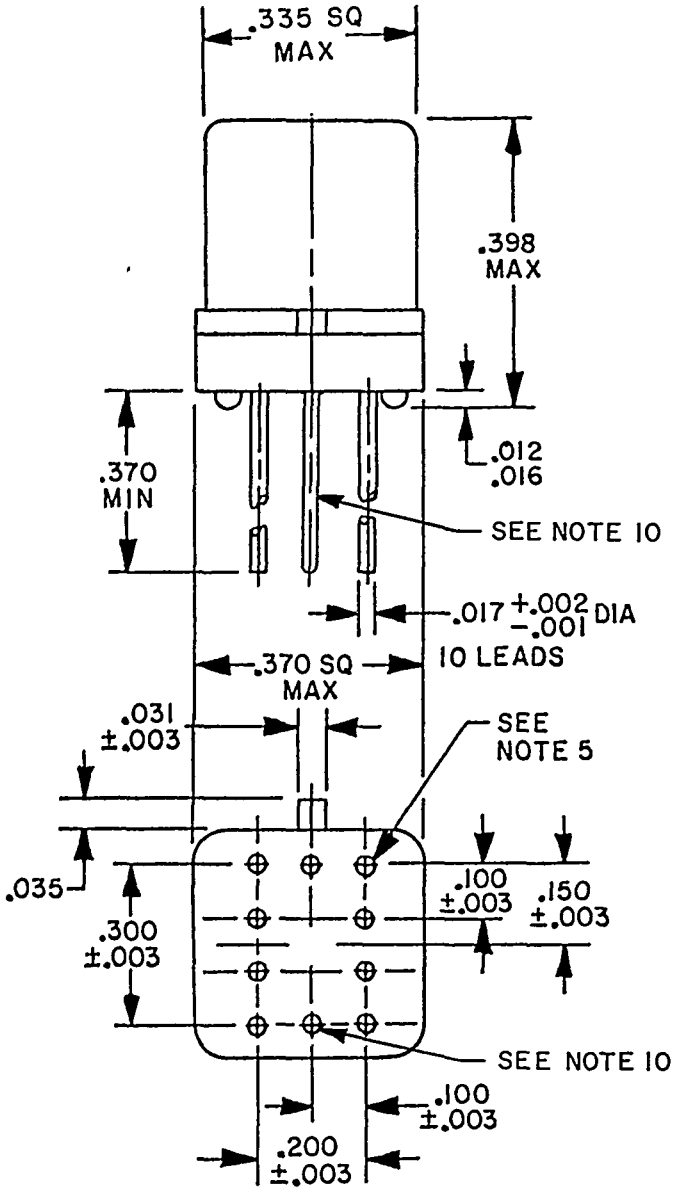
Ⓗ denotes changes



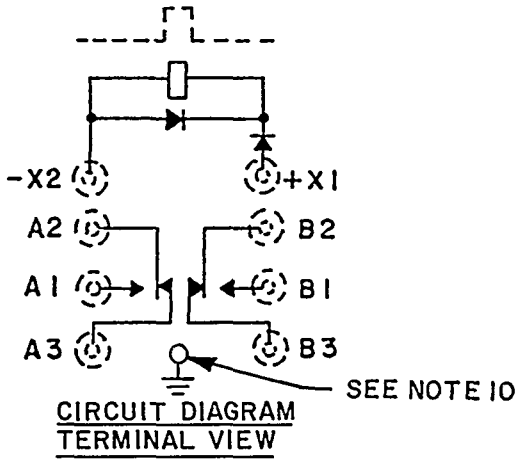
Inches	mm
.001	0.03
.002	0.05
.003	0.08
.017	0.43
.031	0.79
.035	0.89
.050	1.27
.200	5.08
.280	7.11
.315	8.00
.370	9.40

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is ±.010 (0.25 mm).
4. Relays shall have a plus (+) sign placed on the circuit diagram as shown.
5. Coil symbol optional in accordance with MIL-STD-1285.
6. Circuit diagram shown on part is the terminal view.
7. Shape optional within envelope dimension.
8. The grounding pin shown is a non insulated case ground applicable to -085 through -090 only.

(H) FIGURE 2. Dimensions and configuration (square or round).

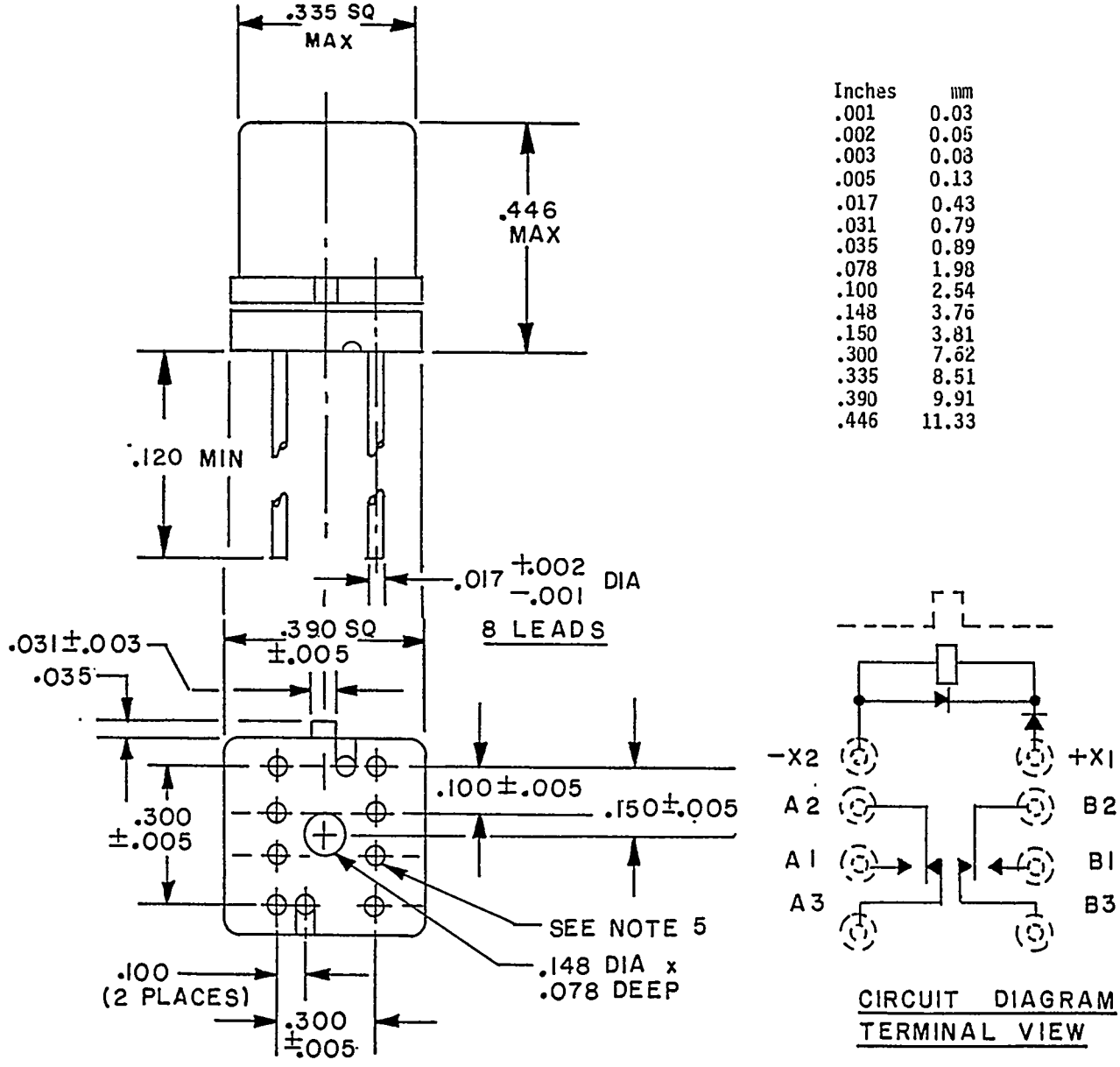


Inches	mm
.001	0.03
.002	0.05
.003	0.08
.012	0.30
.016	0.41
.017	0.43
.031	0.79
.035	0.89
.100	2.54
.150	3.81
.200	5.08
.300	7.62
.335	8.51
.370	9.40
.398	10.11



NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is ±.010 (0.25 mm).
4. Spreader pads shall be certified to MIL-M-38527, M38527/5-003 or M38527/5-013.
5. Dimensions and tolerances shown for the bottom view of the spreader pad are for the center to center locations of the holes in the spreader pad.
6. Shape optional within the envelope dimension.
7. Relays shall have a plus (+) sign place on the circuit diagram as shown.
8. Coil symbol optional in accordance with MIL-STD-1285.
9. Circuit diagram shown on part is the terminal view.
10. The grounding pin shown is a non insulated case ground applicable to -091 through -096 only.

(H) FIGURE 3. Dimensions and configuration relay with spreader pad (.100 x .200 terminal spacing) attached.



Inches	mm
.001	0.03
.002	0.05
.003	0.08
.005	0.13
.017	0.43
.031	0.79
.035	0.89
.078	1.98
.100	2.54
.148	3.76
.150	3.81
.300	7.62
.335	8.51
.390	9.91
.446	11.33

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is ±.010 (0.25 mm).
4. Spreader pads shall be certified to MIL-M-38527, M383527/5-014.
5. Dimensions and tolerances shown for the bottom view of the spreader pad are for the center to center locations of the holes in the spreader pad.
6. Shape optional within the envelope dimension.
7. Coil symbol optional in accordance with MIL-STD-1285.
8. Relays shall have a plus (+) sign place on the circuit diagram as shown.
9. Circuit diagram shown on part is the terminal view.

(H) FIGURE 4. Dimensions and configuration relay with spreader pad (.100 x .300 terminal spacing) attached (square or round).

REQUIREMENTS:

CONTACT DATA:

Load ratings:

High level (relay case grounded):

Resistive:

1.0 ampere at 28 V dc.

500 milliamperes at 115 V ac 400 Hz case not grounded.

250 milliamperes at 115 V ac 60 Hz case not grounded.

100 milliamperes at 115 V ac 60 and 400 Hz case grounded.

Inductive load: 0.2 ampere at 28 V dc with 0.32 henry inductance.

Lamp: 0.10 ampere at 28 V dc.

Low level: 10 to 50 µA at 10 to 50 mV dc or peak ac.

Intermediate current: Applicable.

Contact resistance or voltage drop:

(H) Initial: 0.10 ohm maximum (0.125 ohm maximum with figure 3 spreader pad attached and 0.150 ohm maximum with figure 4 spreader pad attached).

High level:

During life: Not more than 5 percent of open circuit voltage.

After life: 0.20 ohm maximum (0.225 ohm maximum with figure 3 spreader pad attached and 0.250 ohm maximum with figure 4 spreader pad attached).

Low level:

During life: 33 ohms maximum.

After life: 0.15 ohm maximum (0.175 ohm maximum with figure 3 spreader pad attached and 0.200 ohm maximum with figure 4 spreader pad attached).

Intermediate current:

During: 1 ohm maximum.

After: 0.20 ohm maximum (0.225 ohm maximum with figure 3 spreader pad attached and 0.250 ohm maximum with figure 4 spreader pad attached).

Contact bounce: 1.5 milliseconds maximum (applicable to failure rate level "L").

Contact stabilization time: 2.0 milliseconds maximum (applicable to failure rate levels "M", "P", and "R").

Overload (high level only): Two times rated current.

COIL DATA: See table I.

Operate time: 2.0 ms maximum over temperature range with rated coil voltage.

Release time: 4.0 ms maximum over temperature range from rated coil voltage.

ELECTRICAL DATA:

Insulation resistance: 1/ 10,000 megohms minimum at 500 V dc, except the resistance between coil and case at high temperature shall be 1,000 megohms minimum.

Dielectric withstanding voltage: 1/

	Sea level V rms (60 Hz)	Altitude V rms (60 Hz)
Between case, frame, or enclosure and all contacts both in the energized and deenergized positions	500	125 All terminals to case
Between case, frame, or enclosure and coil	500	
Between all contacts and coil	500	
Between open contacts in the energized and deenergized positions	500	
Between contact poles	500	
Between coils of dual coil relays	---	

DIODE CHARACTERISTICS:

(H) Coil transient suppression: Applicable.

Diode breakdown and block integrity (delete coil resistance and substitute this test in all inspection tables of MIL-R-39016):

With applicable voltage applied to the relay coil circuit in the reverse direction, monitor leakage current with dc microammeter, oscilloscope, or qualifying activity approved test equipment. Leakage current shall not exceed the specified value.

Maximum negative transient: 1.0 volt.

Breakdown voltage: 100 V dc at 10 microamperes (μA) (This test may be performed in-process or as final assembly).

Maximum leakage current: 1 μA at 50 V dc.

(H) Semiconductor in-process screening: Applicable, visual inspection of semiconductors shall be in accordance with MIL-STD-750, method 2073 or 2074.

ENVIRONMENTAL DATA:

Temperature range: -65°C to +125°C.

(H) Vibration (sinusoidal): MIL-STD-202, method 204. Contact chatter shall not exceed 10 microseconds maximum for closed contacts, and 1 microsecond maximum for open contacts.

(H) Vibration (random): MIL-STD-202, method 214, test condition IG. Contact chatter shall not exceed 10 microseconds maximum for closed contacts, and 1 microsecond maximum for open contacts (applicable to qualification and group C testing only).

Shock (specified pulse): MIL-STD-202, method 213, test condition B (75 g's). Contact chatter shall not exceed 10 microseconds maximum for closed contacts, and 1 microsecond maximum for open contacts.

Magnetic interference: Applicable.

1/ Insulation resistance and dielectric withstanding voltage tests must always precede all other specified electrical measurements. Connect all coil terminals together to avoid damage to diodes.

Resistance to soldering heat: Applicable.

Acceleration: Applicable.

Salt atmosphere (corrosion): In accordance with MIL-STD-750, method 1041.

PHYSICAL DATA:

Terminals:

Terminal strength (MIL-STD-202, method 211):

Pull test: Test condition A, 1 pound pull.

Bend test: Test condition C, 1/2 pound load.

Twist test: As specified in MIL-R-39016.

Solderability: Applicable.

Dimensions and configuration: See figures 1, 2, 3, and 4.

Weight: 2.27 grams (0.08 ounce) maximum, 2.52 grams (0.089 ounce) maximum with spreader pad.

Seal: Hermetic.

Minimum marking: Military part number, J date code, circuit diagram, manufacturer's name or source code.

LIFE TEST REQUIREMENTS:

High level: 100,000 cycles per relay.

Low level: 100,000 cycles plus 900,000 cycles mechanical life.

PART NUMBER: M39016/20- (dash number from table I and suffix letter designating failure rate level).

Ⓗ TABLE I. Dash numbers and characteristics. 1/

Dash numbers 2/							Coil voltage (V dc) 5/		At 25°C						Over temperature range		
Lead length 1.500 min 3/	Lead length .187 +.040 -.010	Lead length .500 min	Spreader pads 4/	Lead length .500 min with ground	Spreader pads with ground 4/	Fig.	Rated	Max	Coil resistance (ref. only) Ohms	Coil circuit current 6/ (mA) Max	Coil circuit current 6/ (mA) Min	Specified pickup value (voltage) (V dc)	Specified hold value (voltage) (V dc)	Specified drop-out value (voltage) (V dc)	Specified pickup value (voltage) (V dc)	Specified hold value (voltage) (V dc)	Specified drop-out value (voltage) (V dc)
007	037	049	---	079	---	1	5.0	5.8	39	128.2	93.2	3.2	2.3	0.6	4.0	2.8	0.6
008	038	050	---	080	---	1	6.0	8.0	78	78.3	58.3	4.0	2.8	0.7	5.0	3.4	0.7
009	039	051	---	081	---	1	9.0	12.0	220	42.9	33.0	6.3	4.2	0.9	7.8	5.3	0.8
010	040	052	---	082	---	1	12.0	16.0	390	32.8	25.6	8.0	5.2	1.1	10.0	6.5	0.9
011	041	053	---	083	---	1	18.0	24.0	880	22.1	17.5	11.5	7.3	1.4	14.5	10.0	1.1
012	042	054	---	084	---	1	26.5	32.0	1,560	18.5	14.8	15.2	9.5	1.8	19.0	13.0	1.4
019	043	055	---	085	---	2	5.0	5.8	39	128.2	93.2	3.2	2.3	0.6	4.0	2.8	0.6
020	044	056	---	086	---	2	6.0	8.0	78	78.3	58.3	4.0	2.8	0.7	5.0	3.4	0.7
021	045	057	---	087	---	2	9.0	12.0	220	42.9	33.0	6.3	4.2	0.9	7.8	5.3	0.8
022	046	058	---	088	---	2	12.0	16.0	390	32.8	25.6	8.0	5.2	1.1	10.0	6.5	0.9
023	047	059	---	089	---	2	18.0	24.0	880	22.1	17.5	11.5	7.3	1.4	14.5	10.0	1.1
024	048	060	---	090	---	2	26.5	32.0	1,560	18.5	14.8	15.2	9.5	1.8	19.0	13.0	1.4
---	---	---	061	---	091	3	5.0	5.8	39	128.2	93.2	3.2	2.3	0.6	4.0	2.8	0.6
---	---	---	062	---	092	3	6.0	8.0	78	78.3	58.3	4.0	2.8	0.7	5.0	3.4	0.7
---	---	---	063	---	093	3	9.0	12.0	220	42.9	33.0	6.3	4.2	0.9	7.8	5.3	0.8
---	---	---	064	---	094	3	12.0	16.0	390	32.8	25.6	8.0	5.2	1.1	10.0	6.5	0.9
---	---	---	065	---	095	3	18.0	24.0	880	22.1	17.5	11.5	7.3	1.4	14.5	10.0	1.1
---	---	---	066	---	096	3	26.5	32.0	1,560	18.5	14.8	15.2	9.5	1.8	19.0	13.0	1.4
---	---	---	073	---		4	5.0	5.8	39	128.2	93.2	3.2	2.3	0.6	4.0	2.8	0.6
---	---	---	074	---	---	4	6.0	8.0	78	78.3	58.3	4.0	2.8	0.7	5.0	3.4	0.7
---	---	---	075	---	---	4	9.0	12.0	220	42.9	33.0	6.3	4.2	0.9	7.8	5.3	0.8
---	---	---	076	---	---	4	12.0	16.0	390	32.8	25.6	8.0	5.2	1.1	10.0	6.5	0.9
---	---	---	077	---	---	4	18.0	24.0	880	22.1	17.5	.5	7.3	1.4	14.5	10.0	1.1
---	---	---	078	---	---	4	26.5	32.0	1,560	18.5	14.8	15.2	9.5	1.8	19.0	13.0	1.4

1/ Each relay possesses high level and low level capabilities. However, relays previously tested or used above 10 mA resistive at 6 V dc maximum or peak ac open circuits not recommended for subsequent use in low level applications.
2/ The suffix letter L, M, P, or R to designate the applicable failure rate level shall be added to the applicable listed dash number. Failure rate level (percent per 10,000 cycles): L, 3.0; M, 1.0; P, 0.1; R, 0.01. Example, 007L - - - - - 066R.
3/ 1.500 leads are inactive for new design.
4/ Relays supplied with spreader pads (-061 through -066 and -091 through -096) shall have the pad rigidly attached.
5/ CAUTION: The use of any coil voltage less than the rated coil voltage will compromise the operation of the relay.
6/ Coil resistance not directly measurable at relay terminals. When rated voltage is applied to the coil terminals, the coil circuit current must be within the limits shown. Measure at 25°C at rated voltage within 5 seconds, maximum.

QUALIFICATION INSPECTION:

Qualification inspection and sample size: See table II.

(H) TABLE II. Qualification inspection and sample size. 1/

Single submission	Group submission	
18 units plus 1 open unit for level L at C = 0 2/	M39016/20-054 or M39016/20-060	18 units plus 1 open unit for level L at C = 0 2/
33 units plus 1 open unit for level M at C = 0 2/		33 units plus 1 open unit for level M at C = 0 2/
Qualification inspection as applicable		Qualification inspection as applicable
	M39016/20-049 M39016/20-050 M39016/20-051 M39016/20-052 M39016/20-053	2 units each part number qualification inspection table, group II
	M39016/20-084 or M39016/20-055 M39016/20-056 M39016/20-057 M39016/20-058 M39016/20-059	1 unit terminal strength and solderability
	M39016/20-090	1 unit terminal strength and solderability

1/ Figure 1 only: For retention of qualification or extension of qualification to lower failure rate levels, all life test data accumulated on MIL-R-39016/21 may be used in addition to MIL-R-39016/20 data. Prior to performance of retention of qualification, the relay manufacturer shall preselect the sampling plan.

2/ The number of units required for qualification testing shall be increased as required in group V, table II, MIL-R-39016, if the relay manufacutrer elects to test the number of units permitting one or more failures. Prior to performance of qualification inspection, the relay manufacturer shall preselect the sampling plan.

Initial qualification of relays supplied with spreader pads (-061 through -066, -073 through -078 and -091 through -096) shall be tested as specified below:

Perform the following tests as specified in the qualification inspection table of MIL-R-39016, in the order shown below:

Before installation of pad: Screening, visual and mechanical examination (internal), thermal shock, resistance to solvents, vibration (sinusoidal), vibration (random), shock (specified pulse), acceleration, terminal strength, magnetic interference (when specified), capacitance (when specified), coil life (applicable to continuous duty relays only), resistance to soldering heat, salt spray (corrosion), overload (applicable to high level relays only), life, terminal strength, and intermediate current.

After installation of pad, perform the following tests as specified in the qualification inspection table of MIL-R-39016, in the order shown below:

Insulation resistance, dielectric withstanding voltage, static contact resistance, specified pickup, hold, and dropout values (voltages), coil resistance, operate and release time, contact dynamic characteristics, coil transient suppression (when specified), solderability, seal, visual and mechanical inspection (external).

Qualification inspection (reduced testing for previously qualified relays) for relays supplied with spreader pads (-061 through -066, -073 through -078, and -091 through -096), two units from figure 3 and two units from figure 4 of the 26.5 volt rated coil voltage (-066 and -078) shall be tested as specified below:

Before installation of pad, perform the following tests as specified in the qualification inspection table of MIL-R-39016 in the order shown below:

For failure rate level L only: Screening.

For failure rate levels M, P, and R: Vibration (sinusoidal) test duration shall be 10 minutes, vibration (random), particle impact noise detection (P.I.N.D., when specified), screening.

After installation of pad, perform the following tests as specified in the qualification inspection table of MIL-R-39016 in the order shown below:

Insulation resistance, dielectric withstanding voltage, static contact resistance, specified pickup, hold, and dropout values (voltages), coil resistance, operate and release time, contact dynamic characteristics, coil transient suppression (when specified), solderability, seal, visual and mechanical inspection (external).

Group A testing for relays supplied with spreader pads (-061 through -066, -073 through -078, and -091 through -096) shall be tested as specified below:

(H) Before installation of pad, perform subgroup 2 of group A tests.

(H) After installation of pad, perform subgroups 3 and 4 of group A tests.

Qualification inspection (reduced testing) and sample size: See table III.

Figure 1 only: If the relays produced for MIL-R-39016/20 are similar in construction and design except for the coils to the relays produced for MIL-R-39016/21, then reduced testing for qualification of MIL-R-39016/20 relays may be performed concurrent with or subsequent to successful qualification of MIL-R-39016/21 relays.

(H) TABLE III. Qualification inspection (reduced testing).

Examination or test
2 units each coil voltage Group II of qualification inspection table (1 unsealed sample unit) Internal examination

SUPERSESSION DATA:

Supersession data: See table IV.

TABLE IV. Supersession data. 1/

Superseded part no. M39016/20-	New part no. M39016/20-	Superseded part no. M39016/20-	New part no. M39016/20-	Superseded part no. M39016/20-	New part no. M39016/20-
001	007	025	037	067	061
002	008	026	038	068	062
003	009	027	039	069	063
004	010	028	040	070	064
005	011	029	041	071	065
006	012	030	042	072	066
013	019	031	043		
014	020	032	044		
015	021	033	045		
016	022	034	046		
017	023	035	047		
018	024	036	048		

1/ Dash numbers -001 through -006, -013 through -018, and -025 through -036 are inactive for new design and are for support of existing equipment designs only.

Cross reference for Government logistical support: See table V.

Ⓗ TABLE V. Cross reference for Government logistical support.

Superseded part number M39016/20-	New part number M39016/20-	Support with part number M39016/20-	New part number M39016/20-	Support with part number M39016/20-	New part number M39016/20-	Support with part number M39016/20-
001	007	007	049	049	085	085
002	008	008	050	050	086	086
003	009	009	051	051	087	087
004	010	010	052	052	088	088
005	011	011	053	053	089	089
006	012	012	054	054	090	090
013	019	007	055	049	091	091
014	020	008	056	050	092	092
015	021	009	057	051	093	093
016	022	010	058	052	094	094
017	023	011	059	053	095	095
018	024	012	060	054	096	096
025	037	049	061	061		
026	038	050	062	062		
027	039	051	063	063		
028	040	052	064	064		
029	041	053	065	065		
030	042	054	066	066		
031	043	049	073	073		
032	044	050	074	074		
033	045	051	075	075		
034	046	052	076	076		
035	047	053	077	077		
036	048	054	077	078		
067	061	061	078	078		
068	062	062	079	079		
069	063	063	080	080		
070	064	064	081	081		
071	065	065	082	082		
072	066	066	083	083		
			084	084		

Custodians:
Army - ER
Navy - EC
Air Force - 85

Review activities:
Army - AR
Navy - AS, OS,
Air Force - 17, 99
DLA - ES

User activities:
Navy - MC, SH
Air Force - 11, 19

Preparing activity:
Navy - EC

Agent:
DLA - ES

(Project 5945-0757-14)