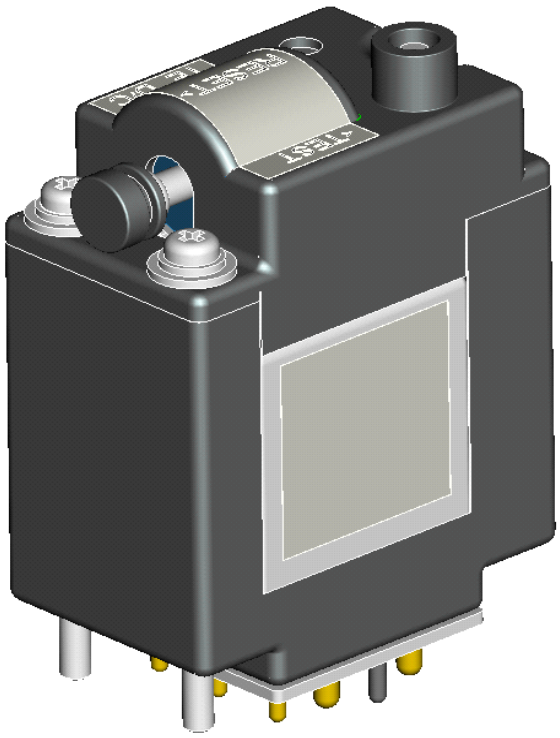
Rev.
E

Ground Fault Interrupter Relay
CAP30 SERIES
115/200VAC, 15 Amps/Pole
SPDT Auxiliary Contacts

- 3 Pole Single-Throw 15A @ 115/200VAC per Pole
- SPDT Auxiliary Contacts 2A @ 115VAC or DC
- Built-in Ground Fault Interrupter circuits
- Built-in push to test function
- Fault trip current at 1.5A±10%
- -40ºC to + 70ºC Operating Range
- Maintenance push to test button temperature range -15ºC to + 70ºC
- 28Vdc and 100Vdc Coil versions available



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TITLE
GROUND FAULT INTERRUPTER SERIES

SD- **CAP30**

CD	CUSTOMER DRAWING	CAGE CODE 18741	SCALE NONE	SHEET 1 of 16

Tyco GFI General Description

System Overview

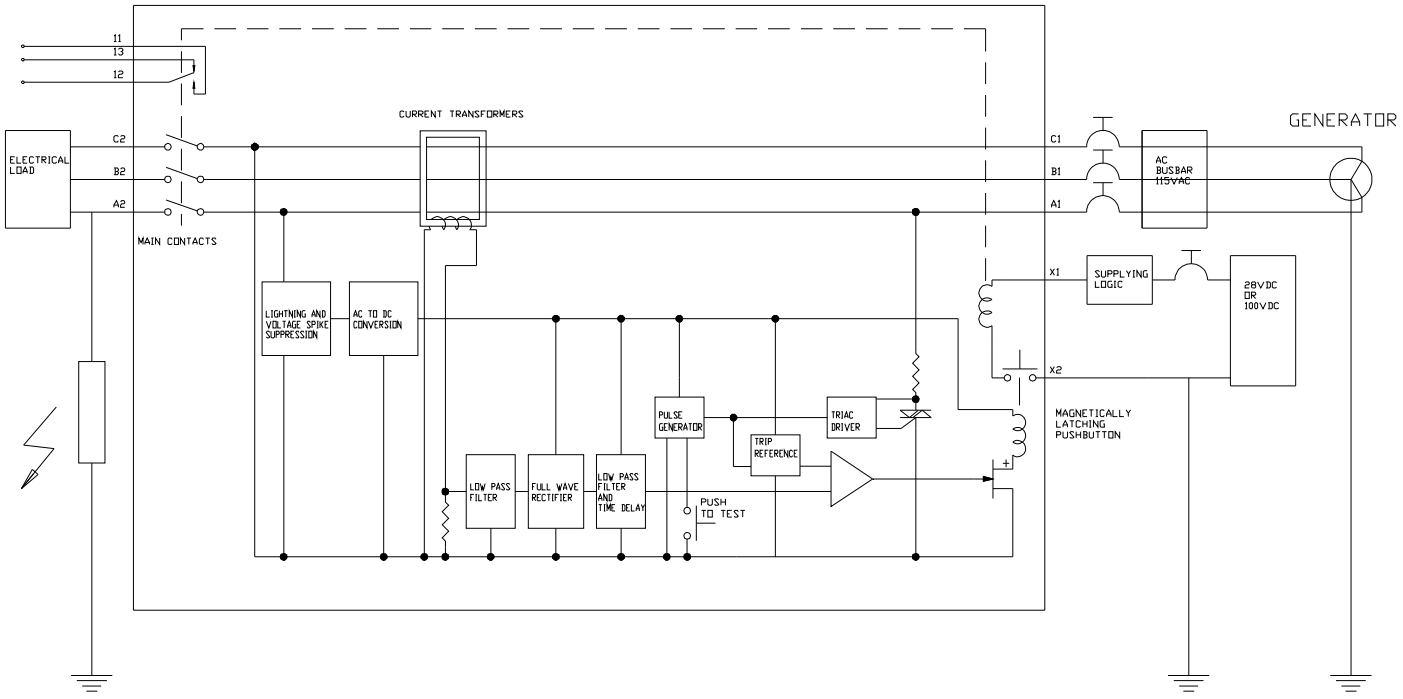
The Tyco Electronics Ground Fault Interrupter Relay (GFI) is designed to provide protection within the following conditions:

15A – 3 phases – 115/200VAC Delta connected 360 – 800Hz.

The GFI relay minimizes short circuit and arcing damage between wires and structure/ housing by isolating the load in the case of a ground fault. Where electrical ground faults develop internal to the load or between wires and structure, the device shall trip so as to interrupt the power supply to the fault, electrically isolating the load.

System Architecture

The system shall be able to switch 115/200VAC Variable Frequency depending on load supply command and GFI protection



Component Architecture

The GFI Relay is designed such that power is taken from the contactor main HIGH SIDE AC line in order to supply its internal electronic circuitry. This allows for press-to-test validation of the GFI functionality even with no coil power present (main contacts are in open state). The GFI relay includes an isolated 2 amp-rated SPDT auxiliary contact set (ID 11, 12 & 13) which can be used for relay position indicator.

Normal Operation

The GFI Relay is designed with two functionalities:

- Function 1: Provides 15 amp 115/200VAC 3-phase motor load switching ON. The device will operate to close the main contacts when the load is selected to on (relay coil supplied with 28VDC or 100VDC). When the load is selected to OFF, the GFI will open.
- Function 2: Ground Fault Protection for a load and its associated 3-phase wiring. If a ground fault should occur in the load or on the wiring, downstream of the GFI, the GFI Relay will trip to isolate the load and ground fault from the power supply. The GFI Relay provides a visual indication of the trip by release of the trip/latch switch button and is reset after trip by depressing the same trip/latch switch button.

When no ground fault is encountered, the GFI shall switch as per its command line and stay in this state with no inadvertent trip.

Ground Fault Response

The Ground Fault protection function shall operate to isolate the system in the event of a ground fault current. The Ground Fault protection shall trip if the differential current exceeds a maximum differential for more than the detection time.

- Maximum Ground Fault Differential current: 1.5A ±10%.
- Detection time (GFI): less than one supply cycle. (Frequency is from 360 to 800Hz.).
- Total reaction time (GFI) shall not exceed 20ms. Reaction time is the sum of detection and contactor opening time.

BIT Test or Push-to-Test Verification

- With the 'Push-to-Test' button in the 'reset' position (pushed in):
  - Apply 28VDC to the GFI coil terminals (+ to X1, - to X2).
  - Apply 200VAC to the main contacts (A1, B1, C1).
- The GFI relay will energize, the main contacts will transfer to A2, B2, C2, and the fuel pump will turn ON.
- To perform a BIT test, push the 'Push-to-Test' button. The GFI will trip, the relay that is internal to the GFI will be de-energized, and the fuel pump will turn OFF.

Specifications

Physical Data	Units		
Contact Arrangement: Power Contacts		SPST-NO form 3X	
Auxiliary Contacts		SPDT	
Dimensions		See drawing	
Weight, Nominal/Max	g	135/145	
Environmental Data			
Operational Shock		RTCA DO-160E, Section 7 Category D	
Shock: 20mS, Saw Tooth	G_{peak}	6	
Impulse Shock: 20mS, Saw Tooth	G_{peak}	20	
Sustained Shock	G	18	
Bench Handling Shock		MIL-STD-810F Method 516.5 Procedure VI	
Operational Vibration		RTCA DO-160E Section 8 and per graphs attached	
Standard Random, 1.68Grms		See Figure 1	
Due to Engine Fan Blade Loss, High Power		Category R, figure 8-5	
Due to Engine Fan Blade Loss, Windmilling		See Figure 2	
Due to Landing Gear Tire Burst		See Figure 3	
Humidity Performed after Temperature Altitude and Vibration tests		RTCA DO-160E Section 6 Category A.	
Waterproofness		RTCA DO-160E Section 10 Category W	
Fluid Susceptibility Isopropyl Alcohol @ 55°C Halon 1211 @ 23°C		RTCA DO-160E Section 11 Category F, Spray Test	
Sand and Dust		RTCA DO-160E Section 12 Category S	
Fungus Resistance		RTCA DO-160E Section 13 Category F	
Salt Spray		RTCA DO-160E Section 14 Category S	
Hermeticity		EN 60068-2-17 and EN2349	
Flammability		RTCA DO-160E Section 26 category C	
Meets based on review of materials list			
Smoke Density		Non-Flaming	Flaming
Specific Optical Density, Average @ 4 minutes	Ds	0.8	233.2
Toxicity	Corrected	Non-Flaming	Flaming
CO	PPM	15.00	1000.00
HCN	"	0.00	20.00
SO_2	"	0.00	0.00
HCL	"	16.00	5.00
HF	"	10.00	2.00
NO_X	"	2.00	32.00
Constant Acceleration	G	Per ISO 2669 Category B See Figure 4	
Aircraft Attitude		No effect on GFI performance	
Operating Temperature	°C	-40 to +70	
Ground Survival Temperature	°C	-55 to +85	
Temperature Variation		Per RTCA DO-160E Section 5 Category B	
Tested Range	°C	-40C to +85C	

Specifications (cont)

Electrical Data

GFI sensor circuit power consumption (power is taken from Main Contacts)	VA	2.4 Max.
Coil Power consumption 28Vdc coil	mA	120 Max
100Vdc coil	mA	60 Max.
Voltage Rating: Main Contacts (max)	VAC	225 Max.
Auxiliary contacts	VAC	225 Max.
Current Rating, Continuous: Main Contacts (1)	A/Pole	15
Auxiliary contacts	A	2
Mechanical Life	cycles	100,000
Contact Resistance		See Figure 5
Internal Resistance		See Figure 5
Dielectric Withstand Voltage		See Figure 5
Electromagnetic Data (EMC)		
Lightning - damage Test Levels		RTCA DO-160E Section 22 See Figure 6
Lightning - Functional upset Test Levels		RTCA DO-160E Section 22 See Figure 7
RF Susceptibility: Conducted, Radiated Average and Radiated Pulse Test Levels		RTCA DO-160E Section 20 (change 1 applies) See Figure 8
Magnetic Effect		RTCA DO-160E Section 15, Category A
Power Supply voltage spike Test Levels		RTCA DO-160E Section 17 1000V, See Figure 9
Power Supply Audio Frequency Conducted Susceptibility Test Levels		RTCA DO-160E Section 18, Category R See Figure 10
Induced Signal Susceptibility Test Levels		RTCA DO-160E Section 19, Category ZW See Figure 11
Radiated RF Emissions Test Levels		RTCA DO-160E Section 21, Category L 150kHz to 6GHz
Conducted RF Emissions Test Levels -On Power Supply (marginal non-conformance) -On Interconnect Cables (Pass)		RTCA DO-160E Section 21, Category L/M 150kHz to 200MHz See Figure 12
Electrostatic Discharge Test Level		RTCA DO-160E Section 25, and IEC 1000-4-2 8,000Vdc

Specifications (cont)

Coil Data

28V Coil Voltage, Nominal/ Max	Vdc	28/ 32
Pick Up (max)	Vdc	13.5
Drop Out (Min)	Vdc	2.3
Coil Resistance	Ω	290±10%
Internal Coil Suppression (max)	Vdc	42
100V Coil Voltage, Nominal/ Max.	Vdc	100/114
Pick Up (max)	Vdc	75
Drop Out (Min)	Vdc	3
Coil Resistant	Ω	3025±10%
Internal Coil Suppression	Vdc	N/A

Environmental Test Details

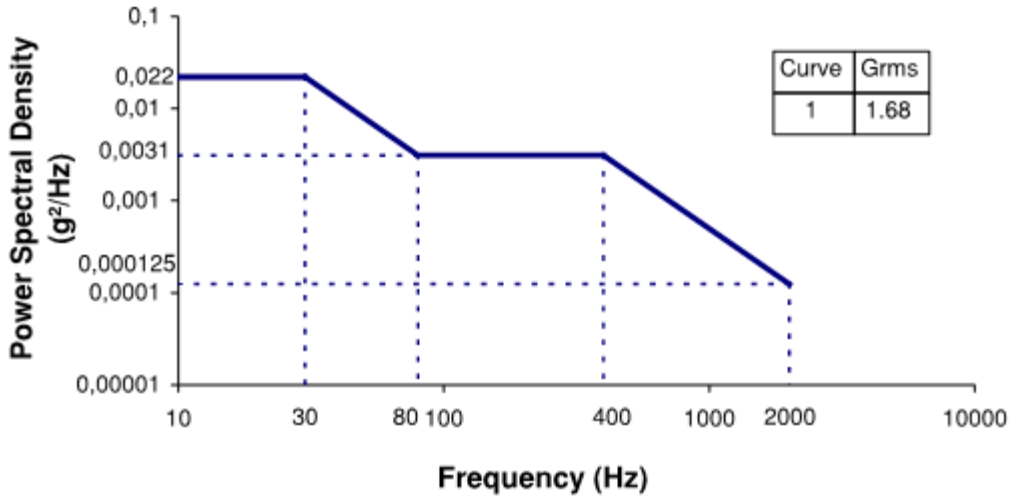


FIGURE 1: Standard Random Vibration

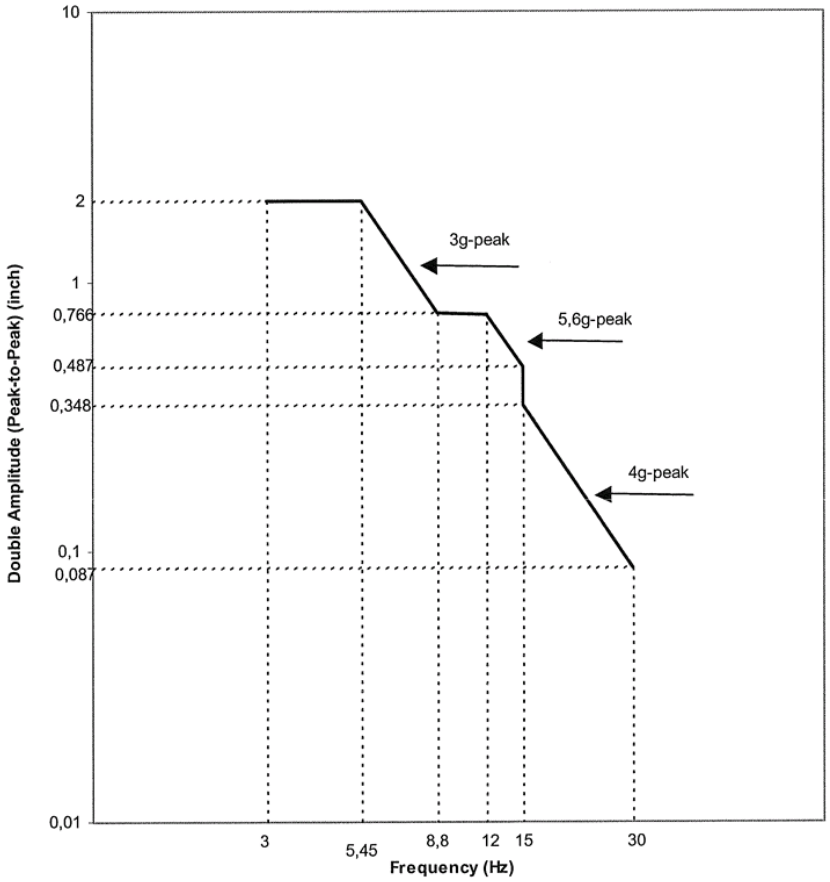


FIGURE 2: Windmilling Vibration

Environmental Test Details (cont)

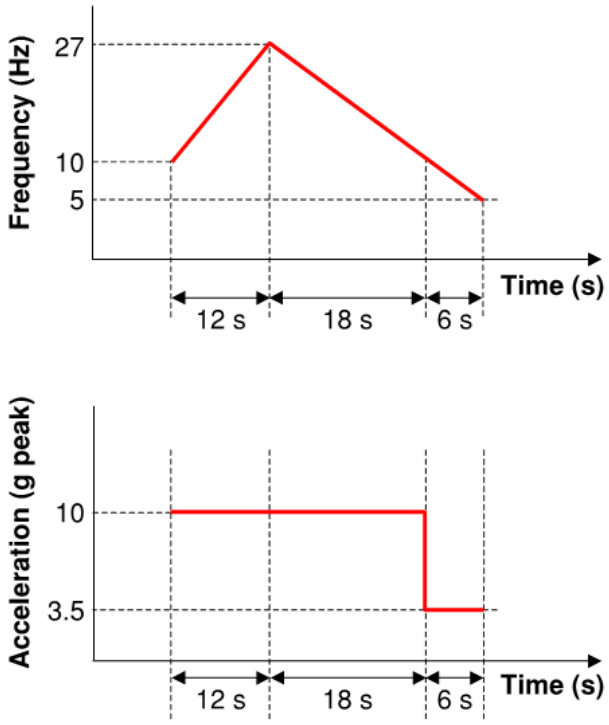


FIGURE 3: Landing Gear Tire Burst Vibration

Forward Axis	Aft Axis	Upward Axis	Downward Axis	Lateral Left Axis	Lateral Right Axis
1.5g	1.5g	6.5g	4.5g	3.0g	3.0g

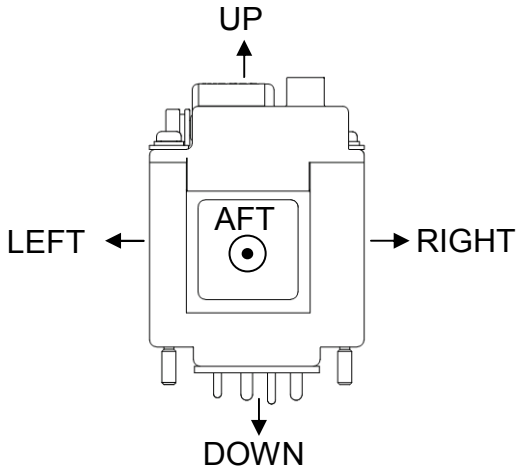


FIGURE 4: Constant Acceleration

Contact Resistance, IR and DWV Tested Levels

TESTS	Before endurance		After endurance	
Dielectric Strength (Vrms)				
1) Coil to Case	1,000		1,000	
	Main contacts	Auxiliary contacts	Main contacts	Auxiliary contacts
2) Coil to Contacts*	1,250	1,000	1,250	1,000
3) Between Open Contacts*	1,250	1,000	1,250	1,000
4) Contacts to Case*	1,250	1,000	1,250	1,000
5) Between 2 Contact Sets*	1,250	1,000	1,250	1,000
* Coil energized and De-energized				
Insulation resistance (MΩ) (same measurement points as dielectric strength tests)	100 MΩ min @ 500Volts		50 MΩ min @ 500Volts	
Altitude 80,000ft (25,000m) All contacts to case (Vrms)	350		350	
Voltage Drop at Line (mV) (connections included)	150	50	200	150

Circuit Breaker Compatibility	Resistive Load (A)	Maximum Duration
(Tested in relay socket with 14 AWG cable)	15	1.0 hr
	50	5.0 sec
	100	1.2 sec
	250	0.2 sec
	350	0.1 sec

FIGURE 5:

Electromagnetic Test Details

Category		Lightning Damage Test Levels		
Equipment Category	**Inputs/ outputs category**	**Long wave Voltage Wave form 4 (*) Fig 22-5**	**Short wave voltage wave form 2 (*) Fig 22-3**	**Oscillatory wave voltage/current wave form3 (*)Fig 22-4**
Category A Critical equipment	Power supply:	750 V/ 150 A	1600 V/ 107 A	1500 V/ 60 A
	Signal:	750 V/ 150 A	1600 V/ 107 A	1500 V/ 60 A

*RTCA D0-160E, Section 22

FIGURE 6: Lighting-Damage

Category		Lightning Upset Test Levels		
Equipment Category	**Inputs/ outputs category**	**Multiple stroke Long wave Voltage wave form4 (*) Fig 22-5**	**Multiple stroke Oscillatory voltage/current wave form 3 (*) Fig 22-4(**)**	**Multiple pulse Oscillatory voltage/current wave form3 (*)Fig 22-4(**)**
Category A Critical Equipment	Power supply:	1st -> 300 V/60 A 13 Sub -> 75 V/15 A	1st -> 1500 V/60 A 13 Sub -> 750 V/30 A	300 V/ 12 A
	Signal:	1st -> 300 V/60 A 13 Sub -> 75 V/15 A	1st -> 1500 V/60 A 13 Sub -> 750 V/30 A	300 V/ 12 A

*RTCA D0-160E, Section 22

FIGURE 7: Lighting-Functional Upset

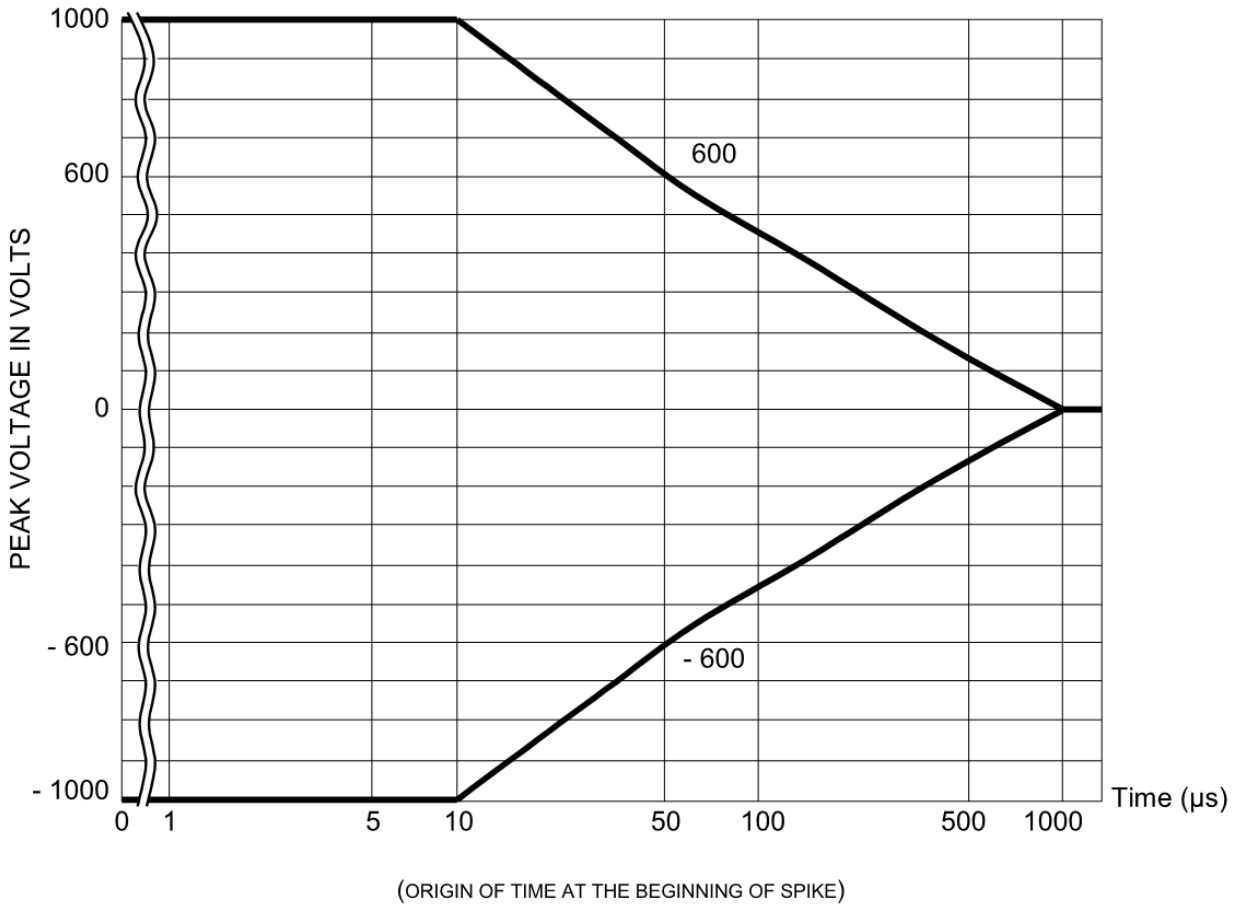
RF Conducted Susceptibility from 10kHz to 400MHz			
Equipment Category	**Wire Group Location**	**Test Level**	**Parameters**
Category A Critical Equipment	Externally Mounted Exposed Area Power supply	75mA	Modulation CS and 50% duty cycle square wave @ 1kHz to >90% depth

RF Radiated Susceptibility in the 100MHz to 18GHz band (CW/AM Levels)			
Equipment Category	**Equipment Location**	**Test Levels**	**Parameters**
Category A Critical Equipment	Pressurized area/ Electronics bay	100MHz - 1GHz @ 30V/m 1GHz - 18Ghz @ 60V/m	Modulation CW and 50% duty cycle square wave @ 1kHz to >90% depth

RF Radiated Susceptibility in the 400MHz to 18GHz band (Pulse Signal Levels)			
Equipment Category	**Equipment Location**	**Test Levels**	**Parameters**
Category A Critical Equipment	Electronics bay	400MHz - 1GHz @ 100V/m 1GHz - 18Ghz @ 300V/m	Modulation 10uS width, 1mS duration

FIGURE 8: RF Susceptibility

Electromagnetic Test Details (cont)



Time (µs)	Amplitude of positive and negative spikes (Volts)
0	1000
10	1000
30	727
50	600
100	461
400	184
700	71
1000	0

FIGURE 9: Power Supply Voltage Spike

Electromagnetic Test Details (cont)

Equipment Category	Test Levels	Parameters
R	15Vrms	-When powered at 400Hz test frequency range of 700Hz to 32kHz -When powered at 800Hz test frequency range of 700Hz to 32kHz

FIGURE 10: Power Supply Conducted AF Susceptibility

Equipment Category	Test Levels	Note
ZW	Magnetic fields induced into equipment: 20A @ 350Hz and 800Hz	Tests performed at both 400Hz and 800Hz power frequencies
	Magnetic fields induced into interconnecting cables: Starting at 30A-m from 350Hz Reducing to 0.8A-m at 32kHz	
	Electric fields induced into interconnecting cables: Swept at 1800V-m from 350Hz to 800Hz	
	Spikes Induced into interconnecting cables: Figure 19-4*, L = 3.0m	

*RTCA D0-160E, Section 19

FIGURE 11: Induced Signal Susceptibility

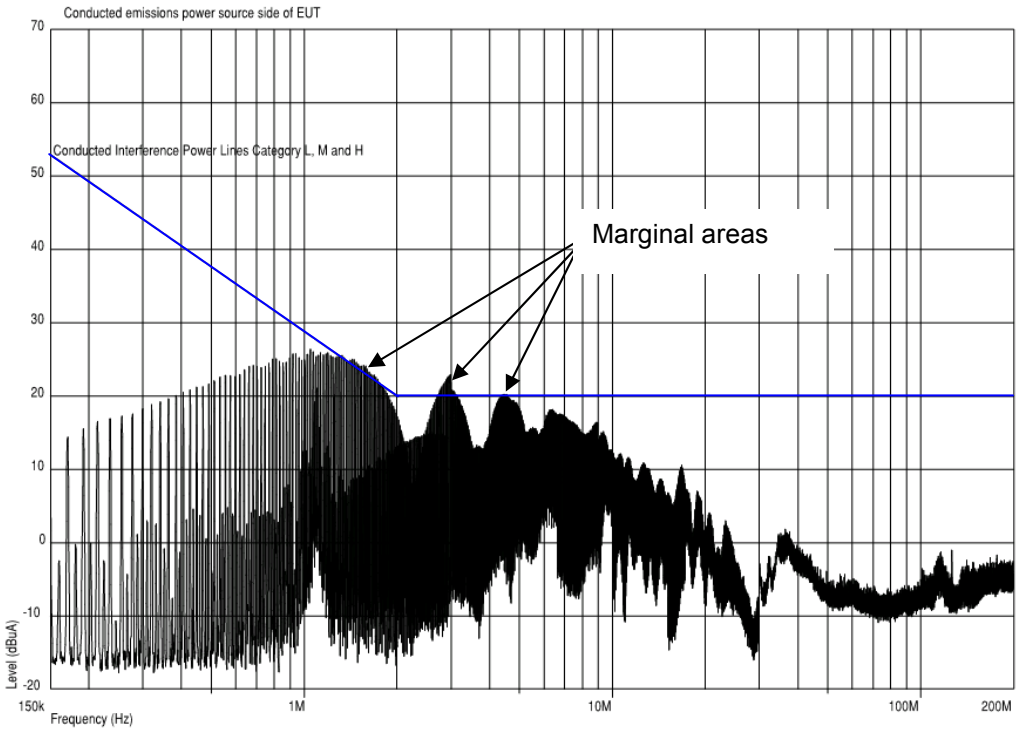


FIGURE 12: Conducted RF Emissions (power supply test "marginal areas" shown)

Rev.
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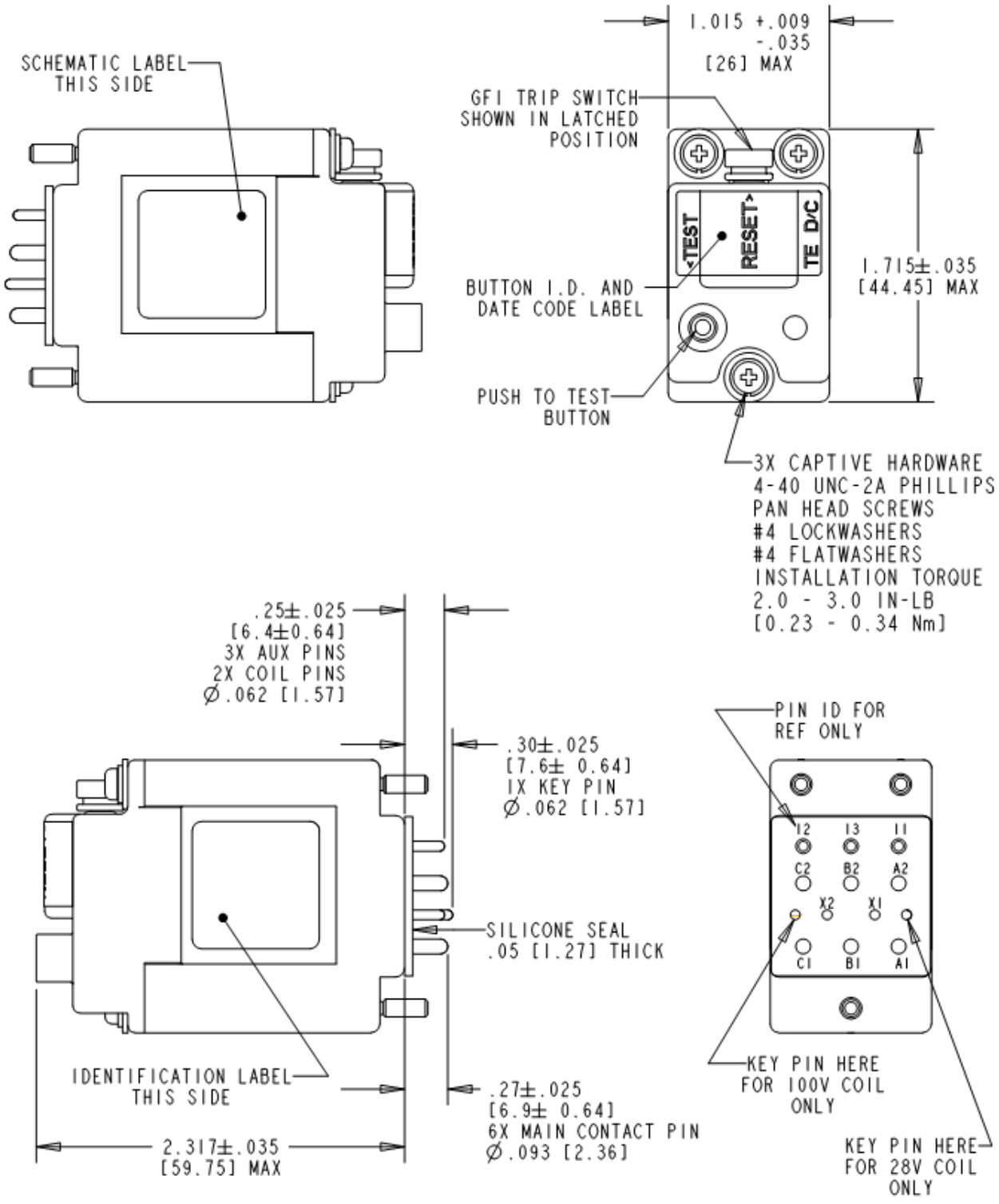
Relay Drawing

28V and 100V relays differ only by key pin location shown

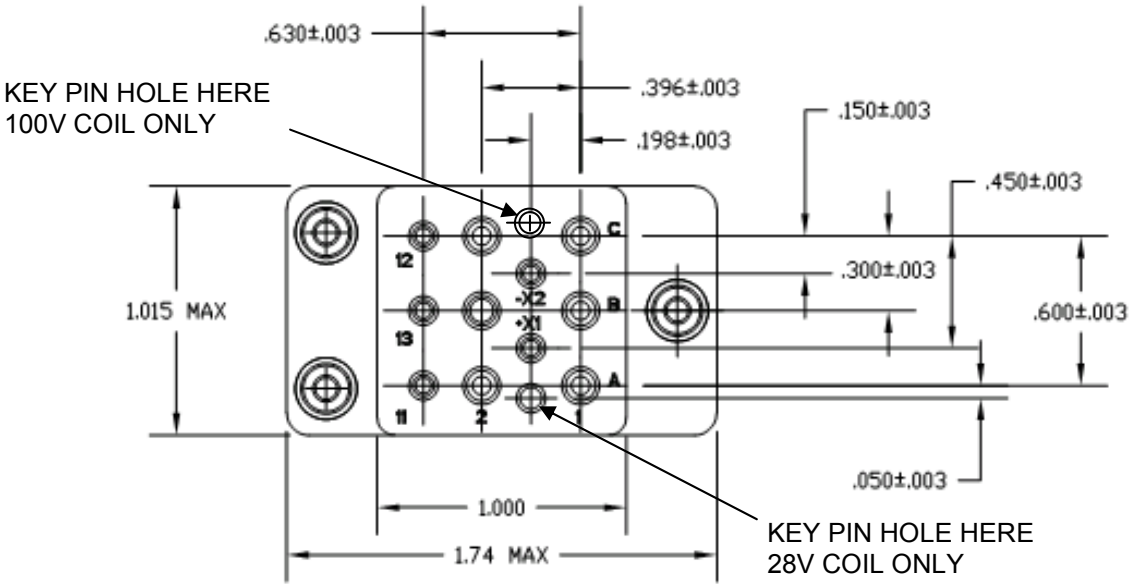


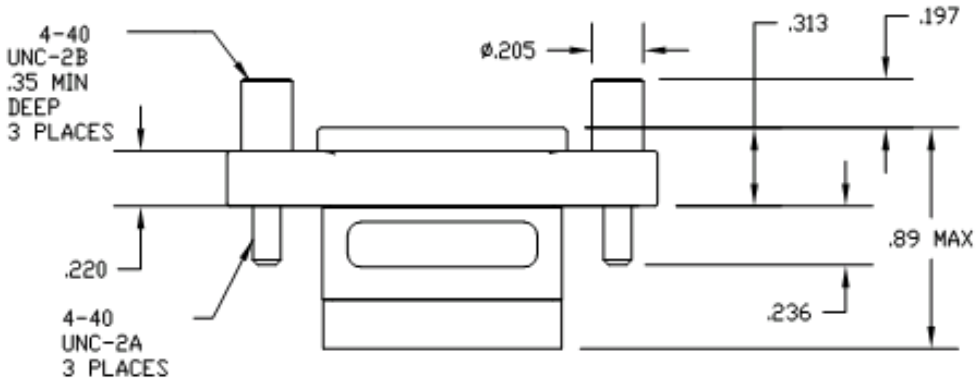
TE Kilovac connectivity		**CUSTOMER DRAWING**		
		SD-	**CAP30**	
THIRD ANGLE PROJECTION	THIS DRAWING PREPARED IN ACCORDANCE WITH ANSI/ASME Y14.5M-1982	CAGE CODE 18741	SCALE NONE	SHEET 13 of 16

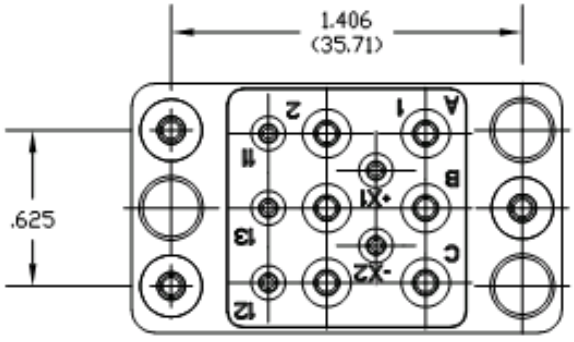
Rev.
E

Standard Socket Drawing

Available for 28V or 100V relay. Purchased separately.
Key pin hole prevents miss-installation of relay with incorrect coil voltage.







TE Kilovac connectivity		**CUSTOMER DRAWING**		
		SD-	**CAP30**	
THIRD ANGLE PROJECTION	THIS DRAWING PREPARED IN ACCORDANCE WITH ANSI/ASME Y14.5M-1982	CAGE CODE 18741	SCALE NONE	SHEET 14 of 16

Rev.
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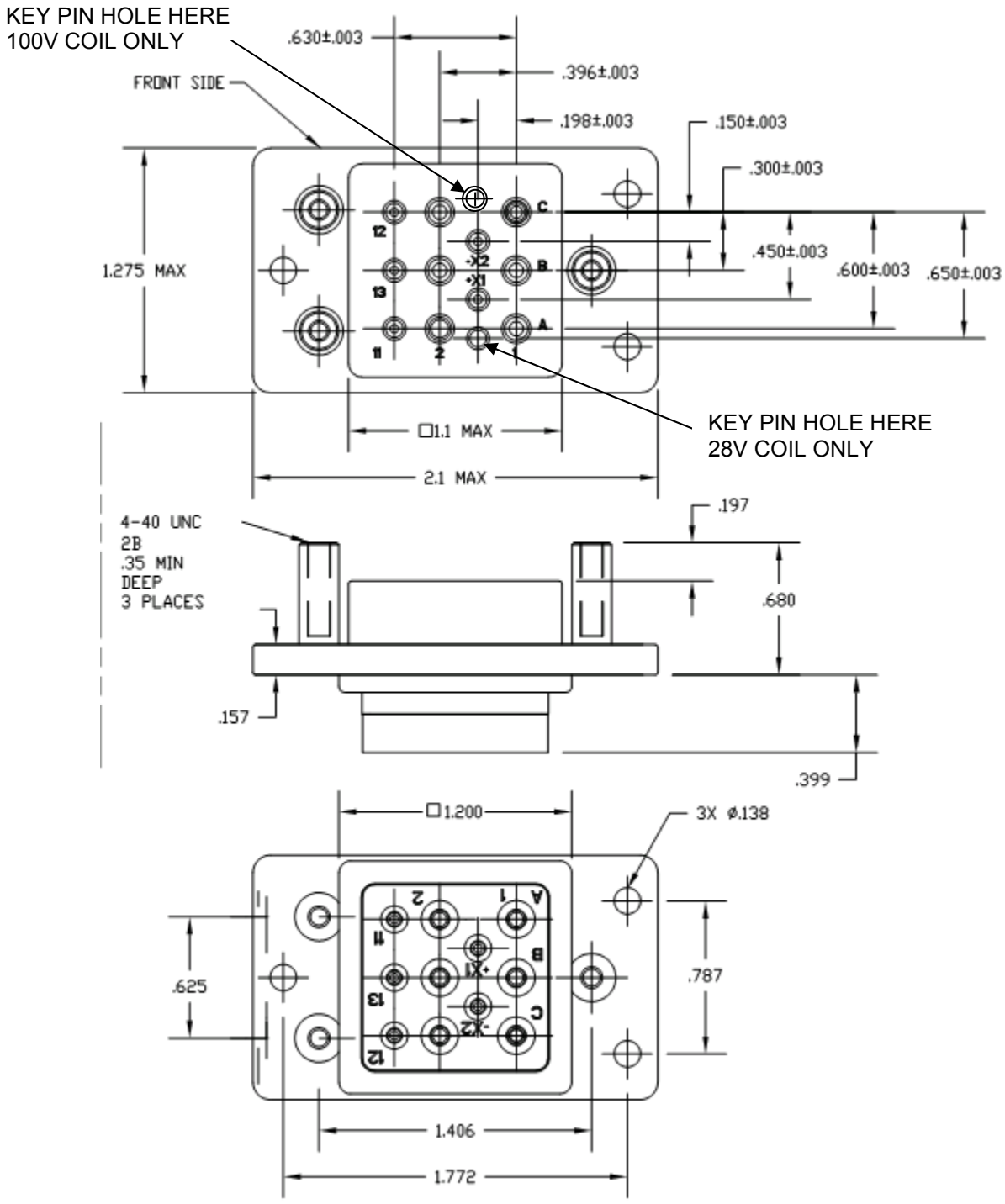
Wide Socket Drawing

Available for 28V or 100V relay. Purchased separately.
Key pin hole prevents miss-installation of relay with incorrect coil voltage.



TE Kilovac connectivity		**CUSTOMER DRAWING**		
		SD-	**CAP30**	
THIRD ANGLE PROJECTION	THIS DRAWING PREPARED IN ACCORDANCE WITH ANSI/ASME Y14.5M-1982	CAGE CODE 18741	SCALE NONE	SHEET 15 of 16

Revisions

REV.	DESCRIPTION	DCO	DATE	APP.
A	Initial Release	15622	08-02-10	B. Bush
B	Updated Drawings	15629	08-16-10	B. Bush
C	Clarified Test Specifications	15758	03-29-11	B. Bush
D	CORRECT FREQ. FROM 480 TO 360Hz on page 3	15909	12-20-11	TN
E	Added Bit Test Verification on Page 3	15926	02-08-12	MN