Type KO-1 Relay

Effective : April 1992
Supersedes 41-931A Dated May 1976
(|) Denotes Change Since Previous Issue

CAUTION

Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

1. APPLICATION

The type KO-1 high speed overcurrent relay is used to start the transmission of a carrier blocking signal or to trip a breaker for a ground fault in which the direction of power flow is not involved.

2. CONSTRUCTION AND OPERATION

The type KO-1 relay consists of a high speed overcurrent unit and an indicating contactor switch.

3. OVERCURRENT UNIT

The overcurrent unit is a product induction cylinder type unit. The time phase relationship of the two air gap fluxes necessary for the development of torque is achieved by means of a capacitor connected in series with one pair of pole windings.

Mechanically, the overcurrent unit is composed of four basic components: a die-cast aluminum frame, an electromagnet, a moving element assembly, and a molded bridge.

The frame serves as the mounting structure for the magnetic core. The magnetic core which houses the lower pin bearing is secured to the frame by a locking nut. The bearing can be replaced, if necessary, without having to remove the magnetic core from the frame.

The electromagnet has two pairs of coils. The coils of each pair are mounted diametrically opposite one another. In addition, these are two locating pins. The locating pins are used to accurately position the lower pin bearing, which is mounted in the frame, with respect to the upper pin bearing, which is threaded into the bridge. The electromagnet is secured to the frame by four mounting screws.

The moving element assembly consists of a spiral spring, contact carrying member, and an aluminum cylinder assembled to a molded hub which holds the shaft. The shaft has removable top and bottom jewel bearings. The shaft rides between the bottom pin bearing and the upper pin bearing with the cylinder rotating in an air gap formed by the electromagnet and the magnetic core.

The bridge is secured to the electromagnet and frame by two mounting screws. In addition to holding the upper pin bearing, the bridge is used for mounting the adjustable stationary contact housing. The stationary contact housing is held in position by a spring type clamp. The spring adjuster is located on the underside of the bridge and is attached to the moving contact arm by a spiral spring. The spring adjuster is also held in place by a spring type clamp.

When the current in the overcurrent unit exceeds the pick-up value, the normally closed contacts

open, allowing positive potential to be applied to the carrier transmitter. The moving contact will also close to energize the trip circuit.

A transformer and varistor assembly is used in conjunction with the overcurrent unit. The transformer is of the saturating type which limits the energy to the overcurrent unit and reduces the burden on the operating CT.

The primary of the transformer is tapped and brought out to a tap connector block for ease in changing the pick-up current of the relay. The use of a tapped transformer provides approximately the same energy level at a given multiple of pick-up current for any tap setting, resulting in one time curve throughout the range of the relay.

Across the secondary is connected a non-linear resistor known as a varistor. The effect of the varistor is to reduce the voltage peaks applied to the overcurrent unit and phase shifting capacitor.

3.1 Indicating Contactor Switch Unit (ICS)

The indicating contactor switch is a small dc operated clapper type device. A magnetic armature, to which leafspring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pick-up value of the switch.

4. CHARACTERISTICS

The relays are available in the following current ranges:

Range	Taps					
0.5-2 amps	0.5	0.75	1.0	1.25	1.5	2.0
1-4	1.0	1.5	2.0	2.5	3.0	4.0
2-8	2.0	3.0	4.0	5.0	6.0	8.0
4-16	4.0	6.0	8.0	9.0	12.0	16.0
10-40	10.0	15.0	20.0	24.0	30.0	40.0

The tap value is the minimum current required to just close the overcurrent relay contacts. For pick-up settings in between taps refer to the section under adjustments.

Range	Continuous Rating Amps	One Second Rating Amps
.5-2	5	100
1-4	8	140
2-8	8	140
4-16	10	200
10-40	10	200

4.1 Contacts

The moving contact assembly in the overcurrent unit has been factory adjusted for low contact bounce performance and should not be disturbed.

4.2 Trip Circuit

The main contacts will safely close 30 amperes at 250 volts and the seal-in contacts of the indicating contactor switch still safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has a pickup of approximately 1 ampere.

5. SETTINGS

5.1 Overcurrent Unit (I)

The only setting required is the pick-up current setting which is made by means of the connector screw located on the tap plate. By placing the connector screw in the desired tap, the relay will just close its contacts at the tap value current.

CAUTION

Since the tap block screw carries operating current, be sure that the screws are turned tight.IN ORDER TO AVOID OPENING CURRENT TRANSFORMER CIRCUITS WHEN CHANGING TAPS UNDER LOAD, THE RELAY MUST BE FIRST REMOVED FROM THE CASE. Chassis operating shorting switches on the case will short the secondary of the current transformer. The taps should then be changed with the relay outside of the case and then re-inserted into the case.

6. INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

7. ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay no customer adjustments, other than those covered under "SETTINGS" should be required.

7.1 Acceptance Check

The following check is recommended to insure that the relay is in proper working order.

7.1.1 Overcurrent Unit (I)

Contact Gap: The gap between the stationary and moving contacts with the relay in the de-energized position should be approximately .020".

The pickup of the overcurrent unit can be checked by inserting the tap screw in the desired tap hole and applying rated tap value current. The contact should close within ±5% of the tap value current.

7.1.2 Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient dc current through the trip circuit to close the contacts of the ICS This value of current should be between 1 and 1.2 amperes. The indicator target should drop freely.

8. ROUTINE MAINTENANCE

All relays should be inspected periodically and the operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended because of the danger of imbedding small particles in the face of the soft silver and thus impairing the contact.

8.1 Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments have been disturbed. This procedure should not be used unless it is apparent that the relay is not in proper working order. (See "Acceptance Check").

8.1.1 Overcurrent Unit (I)

1. The upper pin bearing should be screwed down until there is approximately 1/64" clearance between it and the top of shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

2. The contact gap adjustment for the overcurrent unit is made with the moving contact in the reset position, i.e., against the right side of the bridge. Advance the right hand stationary contact until the contacts make. Then advance the stationary contact an additional one-half turn.

   Now move the left-hand stationary contact until it just touches the moving contact. Then back off the stationary contact 2/3 of one turn for a contact gap of approximately .020".

   The clamp holding the stationary contact housing need not be loosened for the adjustment since the clamp utilizes a spring-type action in holding the stationary contact in position.

   With the tap screw in the desired tap hole, pass rated ac current through the relay terminals.

   The sensitivity adjustment is made by varying the tension of the spiral spring attached to the moving element assembly. The spring is adjusted by placing a screwdriver or similar tool into one of the notches located on the periphery of the spring adjuster and rotating it. The spring adjuster is located on the underside of the bridge and is held in place by a spring type clamp that

does not have to be loosened prior to making the necessary adjustments.

Adjust the spring until the contacts just open. With this adjustment, the pick-up of the relay for ay other tap setting should be within ±5% of the tap value.

If settings in between taps are desired, place the tap screw in the next lower tap hole and adjust the spring until the contacts just open at the desired pick-up current.

8.2 Indicating Contactor Switch (ICS)

For proper contact adjustment, insert a .030" feeler gauge between the core pin and the armature. Hold the armature closed against the core pin and gauge and adjust the stationary contacts such that they just make with the moving contact. Both stationary contacts should make at approximately the same time. The contact follow will be approximately 1/64" to 3/64".

Close the main relay contacts and check to see that the relay picks up and the target drops between 1 and 1.2 amperes dc.

To increase the pickup current, remove the molded cover and bend the springs out or away from the cover. To decrease the pick-up current, bend the springs in toward the cover.

9. RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

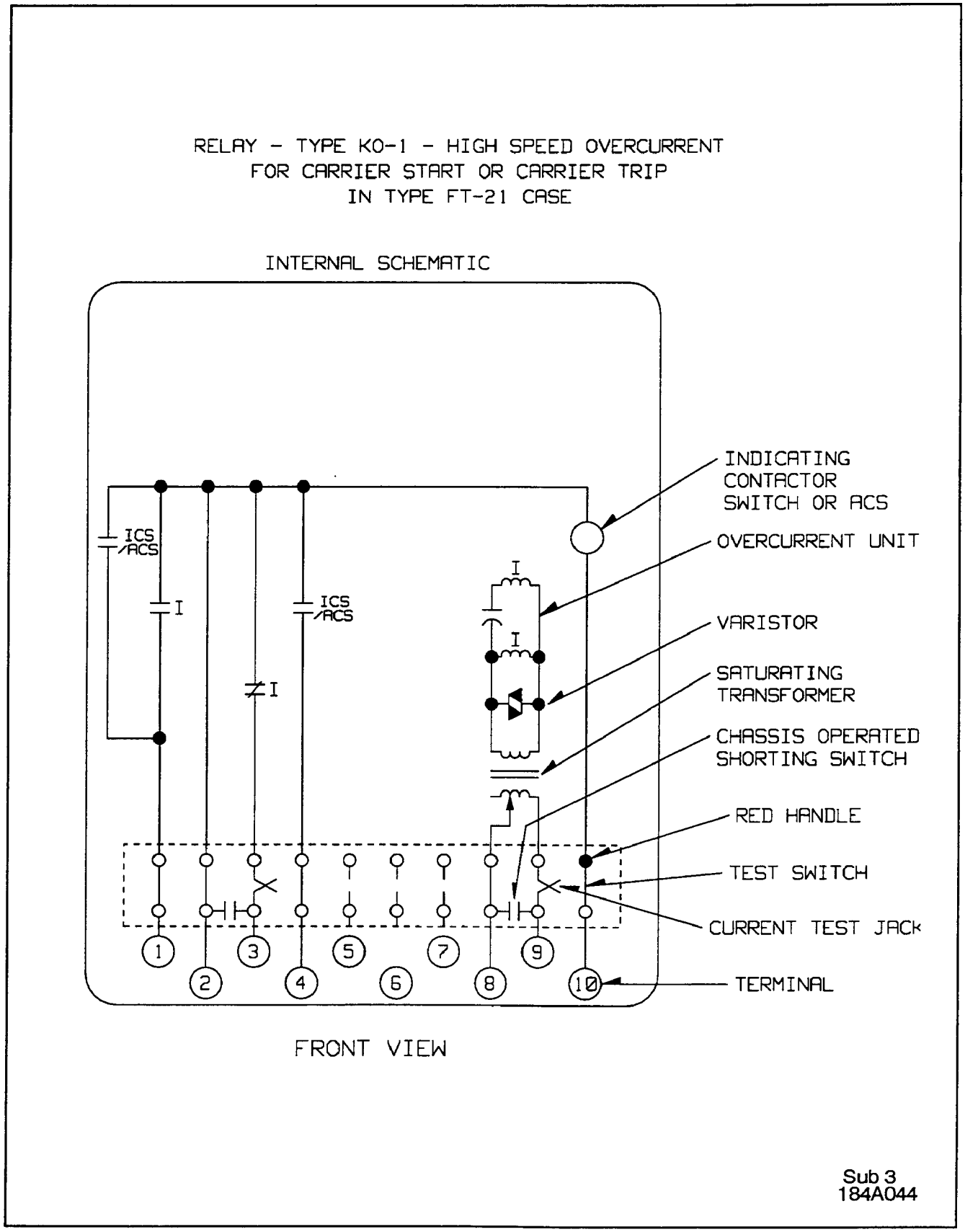

Figure 1. Internal Schematic

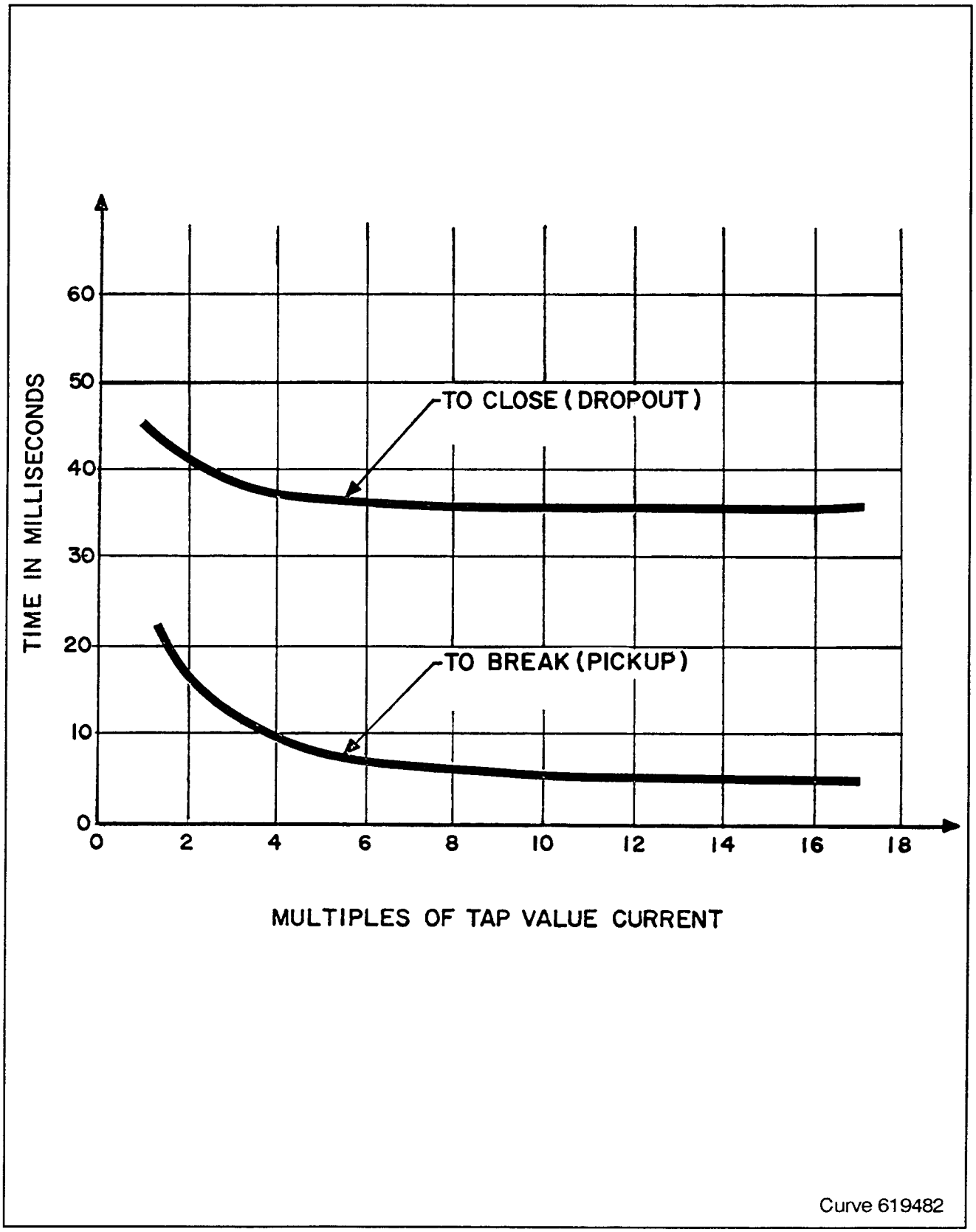

Figure 2. Typical Time Curve of the Type KO-1 - N.C. Contacts

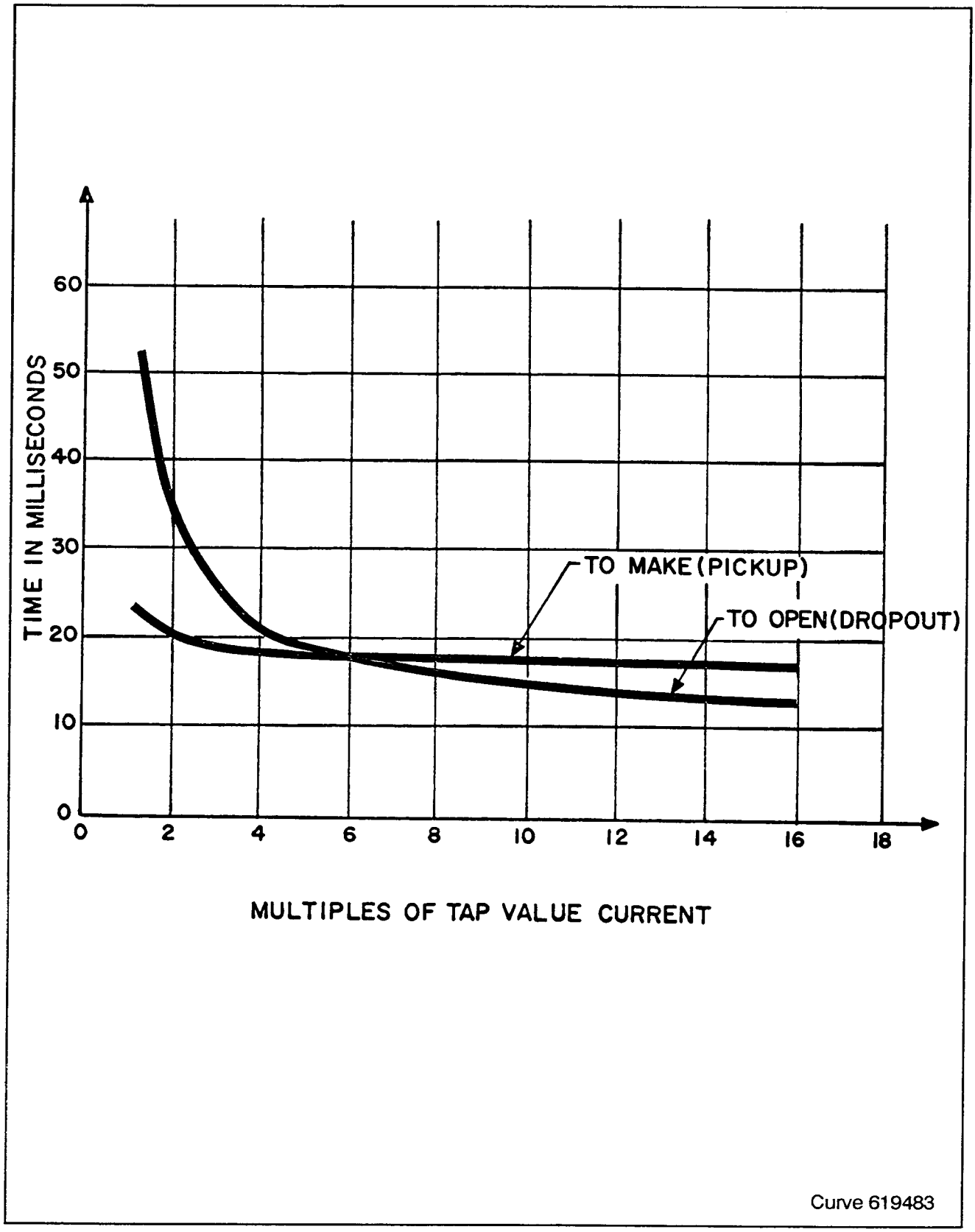

Figure 3. Typical Time Curve of the Type KO-1 - N.O. Contacts

ENERGY REQUIREMENTS

BURDEN DATA OF OPERATING CURRENT CIRCUIT - 60 HERTZ

RANGE AMPS	TAPS	VOLT-AMPERES TAP VALUE CURRENT	POWER FACTOR ANGLE ϕ°	VOLT-AMPERES AT 5 AMPERES	POWER FACTOR ANGLE ϕ°
.5-2	.5	.37	39	24.0	46
	.75	.38	36	13.0	37
	1.0	.39	35	8.5	34
	1.25	.41	34	6.0	32
	1.5	.43	32	4.6	31
	2.0	.45	30	2.9	28
1-4	1.0	.41	36	9.0	36
	1.5	.44	32	5.0	32
	2.0	.47	30	3.0	29
	2.5	.50	28	2.1	27
	3.0	.53	26	1.5	26
	4.0	.59	24	0.93	24
2-8	2.0	1.1	49	6.5	48
	3.0	1.2	43	3.3	42
	4.0	1.3	38	2.1	37
	5.0	1.4	35	1.4	35
	6.0	1.5	33	1.1	33
	8.0	1.8	29	0.7	29
4-16	4.0	1.5	51	2.4	51
	6.0	1.7	45	1.2	45
	8.0	1.8	40	0.7	40
	9.0	1.9	38	0.6	38
	12.0	2.2	34	0.37	34
	16.0	2.5	30	0.24	31
10-40	10.0	1.7	28	.43	28
	15.0	2.4	21	.27	21
	20.0	3.1	16	.20	17
	24.0	3.6	15	.15	15
	30.0	4.2	12	.11	13
	40.0	4.9	11	.08	12

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184A093

Figure 4. Burden Data

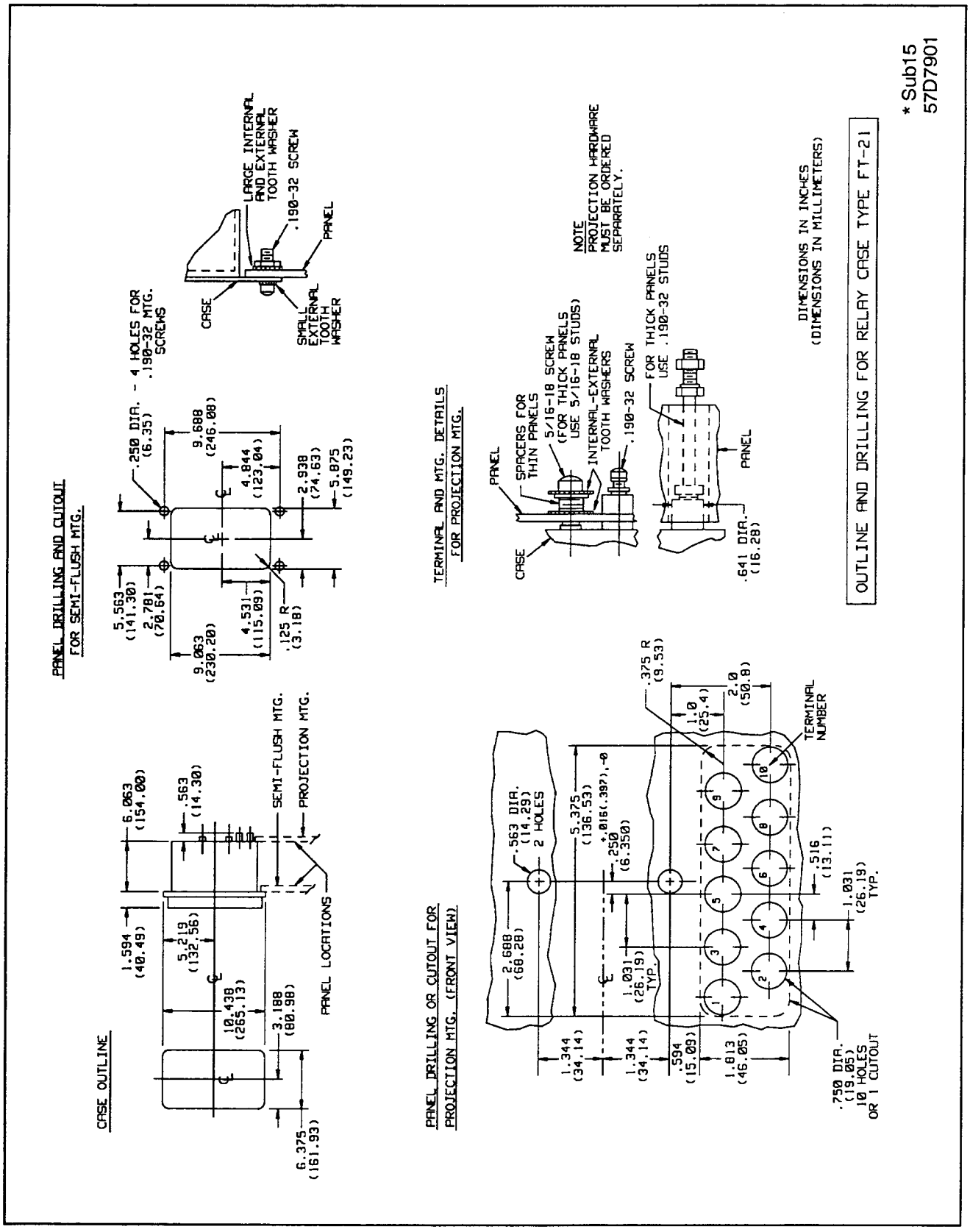

Figure 5. Outline and Drilling (Type FT-21 Case)

* Denotes Change

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