Instruction Leaflet

41-138D

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Supersedes I.L. 41-138C, dated April 1995

(|) Denotes Text Change since previous issue

(*) Denotes Figure Change since previous issue

Type KH-2 Instantaneous Directional Overcurrent Relay

CAUTION

Before putting protective relays into service, remove all blocking 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.

1.0 APPLICATION

The type KH-2 instantaneous directional overcurrent relay is used whenever a directional unit with an adjustable pickup is desired.

A typical application is for directional lockout for current balance paralleling when two or more load tap changing transformers are connected in parallel. The KH-2 will operate to allow only the proper control circuit (either the raise or lower control) to function which will decrease the circulating current. The KH-2 is suitable since the normal voltage does not vary more than 10% of rated value and the power factor angle is between 60° and 90°.

For the type KH-2 relay with separate overcurrent unit, proceed to the section of this instruction leaflet describing this type.

2.0 CONSTRUCTION and OPERATION

The type KH-2 consists of two cylinder directional overcurrent units (D).

2.1. DIRECTIONAL OVERCURRENT UNIT (D)

The directional overcurrent unit is a product induction cylinder type unit operating on the interaction between the polarizing circuit flux and the operating circuit flux.

Mechanically, the directional 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 series-connected polarizing coils mounted diametrically opposite one another; two series connected operating coils mounted diametrically opposite one another; two magnetic adjusting plugs; upper and lower adjusting plug clips, and two locating pins. The locating pins are used to accurately position the lower 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

All possible contingencies which may arise during installation, operation or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding this particular installation, operation or maintenance of this equipment, the local ABB Inc. representative should be contacted.

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.

With the contacts closed, the electrical connection is made through the stationary contact housing clamp to the moving contact, through the spiral spring out to the spring adjuster clamp.

The pickup is changed by rotating the spring adjuster connected to the spiral spring.

3.0 CHARACTERISTICS

The KH-2 is an instantaneous directional overcurrent induction cylinder unit. It is designed for potential polarization and has its maximum torque when the current lags the voltage by approximately 75°. The shifting of the maximum torque angle is accomplished by means of an internally mounted phase shifter. At rated voltage the pickup at maximum torque can be varied from .020 to 0.1 amperes. A second range is available having a pickup of 0.5 to 2.0 amperes.

The upper and lower units are similar except for connections of the polarizing winding which causes the lower unit to remain open when the instantaneous polarity is as shown in the internal schematic.

3.1. CYLINDER UNIT CONTACTS

The moving contact assembly has been factory adjusted for low contact bounce performance and should not be changed.

The set screw in each stationary contact has been shop adjusted for optimum follow and this adjustment should not be disturbed.

4.0 SETTINGS

The only setting required is the pickup current setting which is made by varying the tension of the spiral spring attached to the moving element assembly. With the relay connected to rated voltage apply the desired pickup current at the maximum angle (75° current lagging). The spring tension can be varied by placing a screwdriver or tool style 774B180G01 into one of the notches located on the periphery of the spring adjuster and rotating it.

5.0 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 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.

For detailed information, refer to I.L. 41-076.

6.0 ADJUSTMENTS & 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.

6.1. ACCEPTANCE CHECK

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

1. Contact Gap – The contact gap should be approximately 0.025”.
2. Sensitivity – With rated voltage applied to the relay the upper contact should close at minimum pickup current (0.020 amperes or 0.5 amperes, depending on the range) with the current lagging 75°. The internal schematic should be consulted for the proper polarity. Interchange the current

connections to the relay and observe that the lower contact closes under the above condition.

7.0 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 style 182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

7.1. 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").

1. The upper pin bearing should be screwed down until there is approximately 0.025" 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 directional 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-quarter turn.

   Now move in the left-hand stationary contact until it just touches the moving contact. Then back off the stationary contact 3/4 of one turn for a contact gap of approximately 0.025".

   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.

   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 tool style 774B180G01 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.

   With rated voltage and minimum pickup current applied at the maximum torque angle (75° current lagging) adjust the spring of the upper unit until the moving contact just makes with the left hand stationary contact.

Reverse the current connections to the relay and repeat the above for the lower unit.

8.0 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 information.

9.0 ENERGY REQUIREMENTS

The burden of the potential circuit at 120 volts, 60 hertz is 15.2 volt-amperes (7.6 VA per unit). The continuous rating of the potential circuit is 132 volts.

The burden of the current circuit is as follows:

Range	Burden
.02 to 0.1 amps	4.24 VA at 0.2 amps (2.12 VA per unit).
0.5 to 2.0 amps	5.6 VA at 5 amps (2.8 VA per unit)

RATINGS

Range	Continuous Rating	One Second Rating
.02 to 0.1 amps	0.4 amps	12 amps
0.5 to 2.0	10	230

TYPE KH-2 DIRECTIONAL OVERCURRENT RELAY FOR DIRECTIONAL LOCKOUT WITH IT UNITS

These instructions are supplementary to those explained previously and pertain to a relay similar to the one described, except to have, in addition, one or two overcurrent units.

1.0 APPLICATION

Similar to the relay without the IT unit except the directional unit contact supervises the overcurrent unit contact. The overcurrent unit can be adjusted to the desired pickup current value over its range of operation.

2.0 CONSTRUCTION and OPERATION

Directional Unit: As described previously except the pickup of the directional unit at rated voltage is adjusted at the factory below the overcurrent unit minimum operate current.

Overcurrent Unit (0.5-2 ampere range): This is a small ac operated clapper-type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the coil. When the switch closes, the moving contacts bridge two stationary contacts completing the circuit.

A core screw, accessible from the top, provides the adjustable pickup range.

Overcurrent Unit (0.02-0.1 ampere range): The overcurrent element is a small solenoid type element. A cylindrical plunger rides up and down on a vertical guide rod in the center of the solenoid coil. The guide rod is fastened to the stationary core which in turn screws into the element frame. A silver disc is fastened to the moving plunger through a helical spring. When the coil is energized, the plunger moves upward carrying the silver discs which bridges three conical-shaped stationary contacts. In this position, the helical spring is compressed and the plunger is free to move while the contact remains stationary. Thus, ac vibrations of the plunger are prevented from causing contact bounce. A Micarta disc mounted on a tapped bushing can be screwed up or down on the threaded guide rod to change the initial position of the plunger, thus determining the pickup current. A locknut secures the disc in its selected position.

3.0 CHARACTERISTICS

Directional Unit: The same as that described earlier except that the pickup has been set for approximately 0.25 amperes at 75° lagging rated voltage. For the 0.02 to 0.1 ampere range, the directional unit pickup is set for approximately 0.01 amperes at 75° lagging rated voltage.

4.0 SETTINGS

The only setting required is the overcurrent unit which can be set to the desired pickup by means of the adjustable core screw.

5.0 ADJUSTMENT and MAINTENANCE

Same as that shown earlier, except modified as follows:

The pickup of the directional unit should be 0.25 amperes (for the 0.5 to 2 ampere range) or 0.01 amperes (for the 0.2 to 0.1 ampere range) and 75° lagging rated voltage.

The overcurrent unit should have a 0.5 to 2 ampere range of adjustment which is set by means of the adjustable core screw. The contact wipe should be a minimum of 1/32”. The bridging moving contact should touch both stationary contacts simultaneously.

For the 0.02 to 0.1 ampere overcurrent unit, the position of the Micarta disc at the bottom of the overcurrent element determines the pickup setting of the element, and the position of the core screw at the top of the element determines the dropout ratio and also affects the pickup point. If the element has been dismantled, or must be readjusted, the core screw should otherwise be adjusted so that the ratio of dropout current to pickup current at the lower end of the specified adjustment range is about 60 or 65%. The contact gap should be about 3/64” to 1/16” at

minimum pickup setting. At currents 5 to 10% above pickup, the plunger will vibrate up and down slightly at a uniform rate but without opening the contacts. Occasional plunger movements of greater amplitude which may open the contacts are objectional and usually are due to too high a dropout setting.

6.0 ENERGY REQUIREMENTS

The burden of the potential circuit at 120 volts, 60 Hertz is 15.2 VA (7.6 VA per unit). The continuous rating of the potential circuit is 132 volts

The burden of the current circuit is as follows:.

Range	Burden
DIRECTIONAL UNIT	
0.5 to 2.0 amperes	5.6 VA (2.8 VA per unit) at 5 amperes
0.02 to 0.1 amperes	4.24 VA (2.12 VA per unit) at 0.2 amperes
OVERCURRENT UNIT	
0.5 to 2.0 amperes	4.5 VA at 0.5 amperes (.5 amp. adj.)
	32 VA at 2.0 amperes (2.0 amp. adj)
0.2 to 0.1 amperes	0.5 VA at .02 amperes (.02 amp. adj.)
	7.5 VA at 0.1 amperes (0.1 amp. adj.)

RATINGS:

Range	Continuous Rating	One Second	One Minute
0.5 to 2.0 amperes	0.6 amperes	18.0 amperes	2.0 amperes
.02 to 0.1 amperes	.03 amperes	0.87 amperes	0.1 amperes

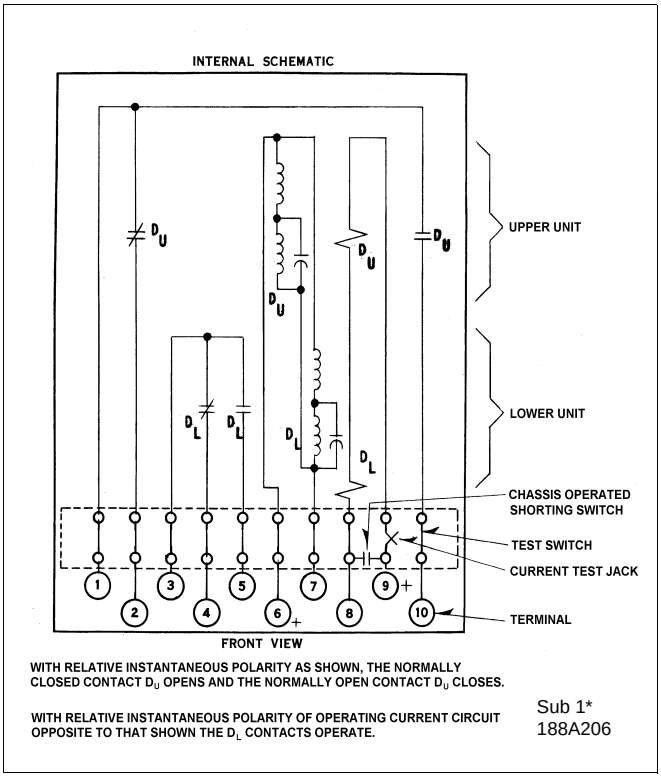

Figure 1, Internal Schematic (without IT Unit).

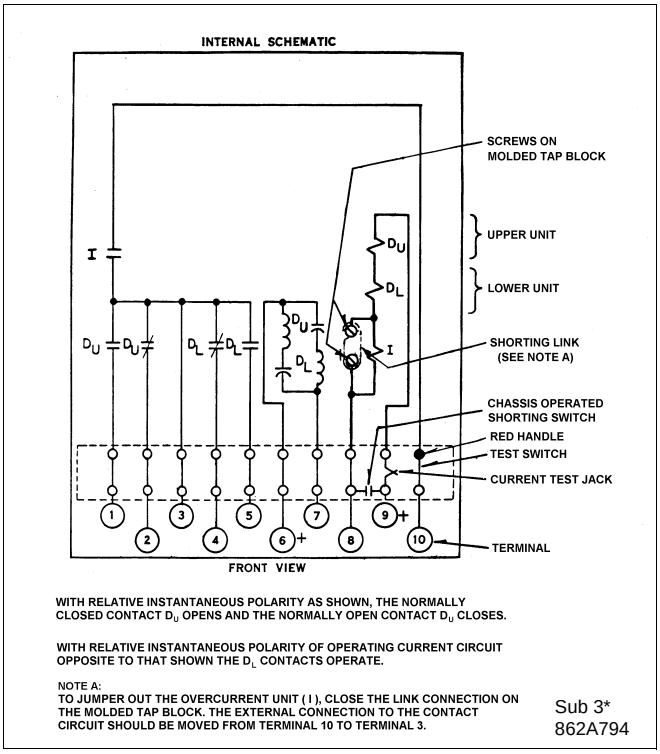

Figure 2, Internal Schematic (with IT Unit - 0.02 to 0.1 Amp range). Relays with suffix letter "A" on nameplate Style Number have shorting link feature.

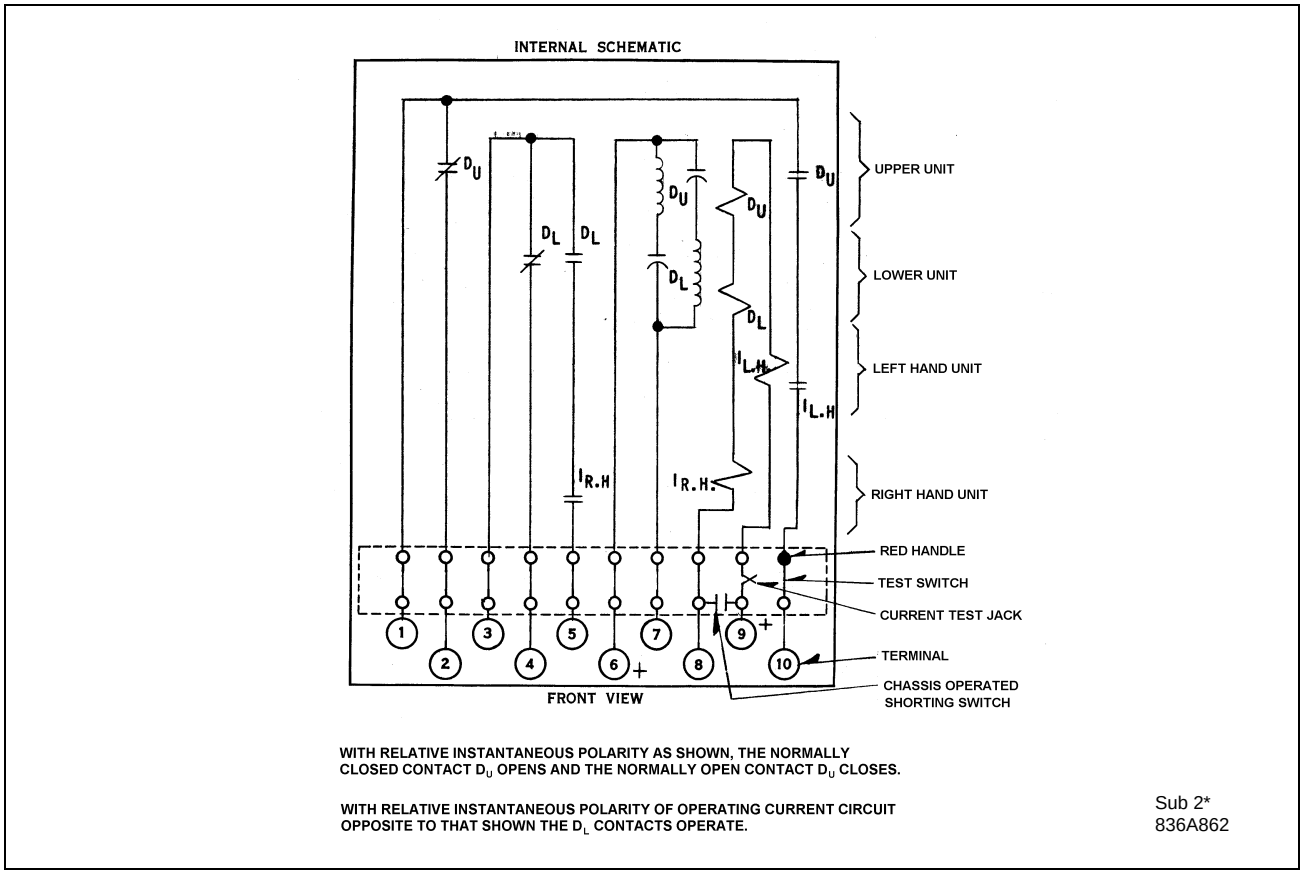

Figure 3. Internal Schematic (with IT Units - 0.5 to 2 Amp range)

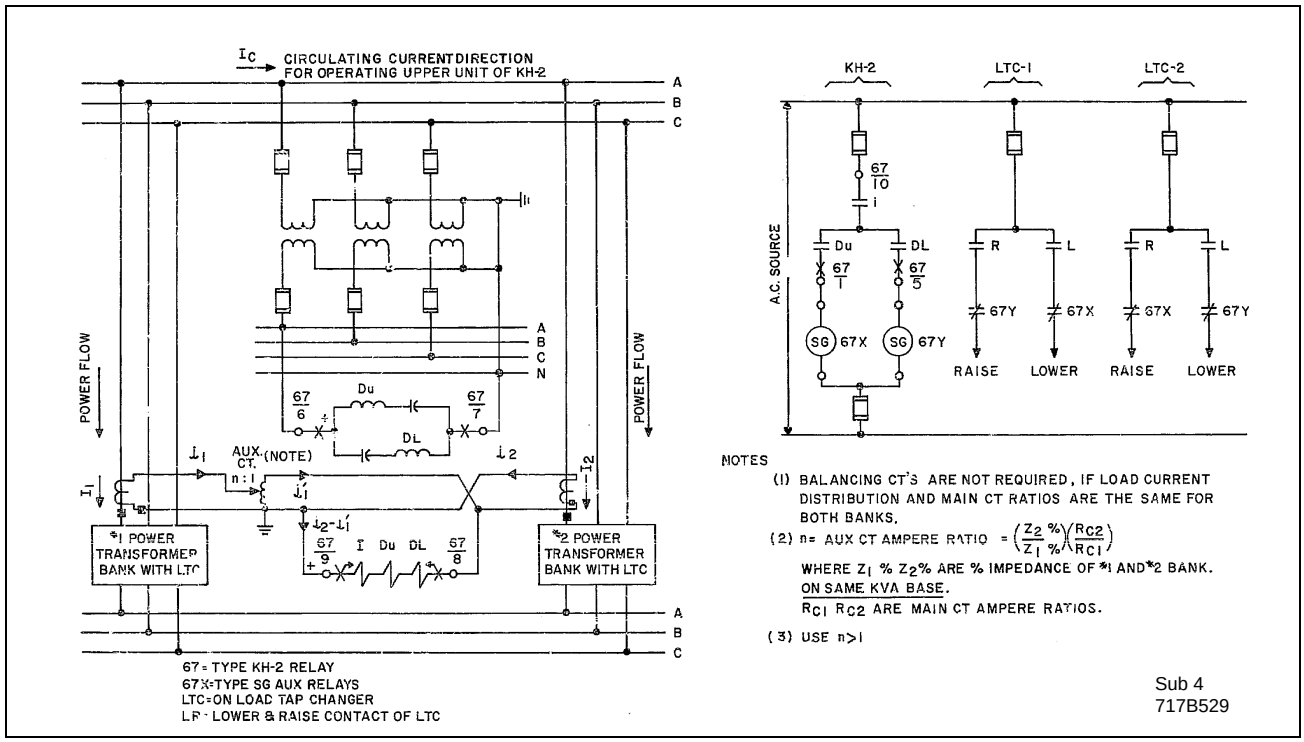

Figure 4. External Schematic

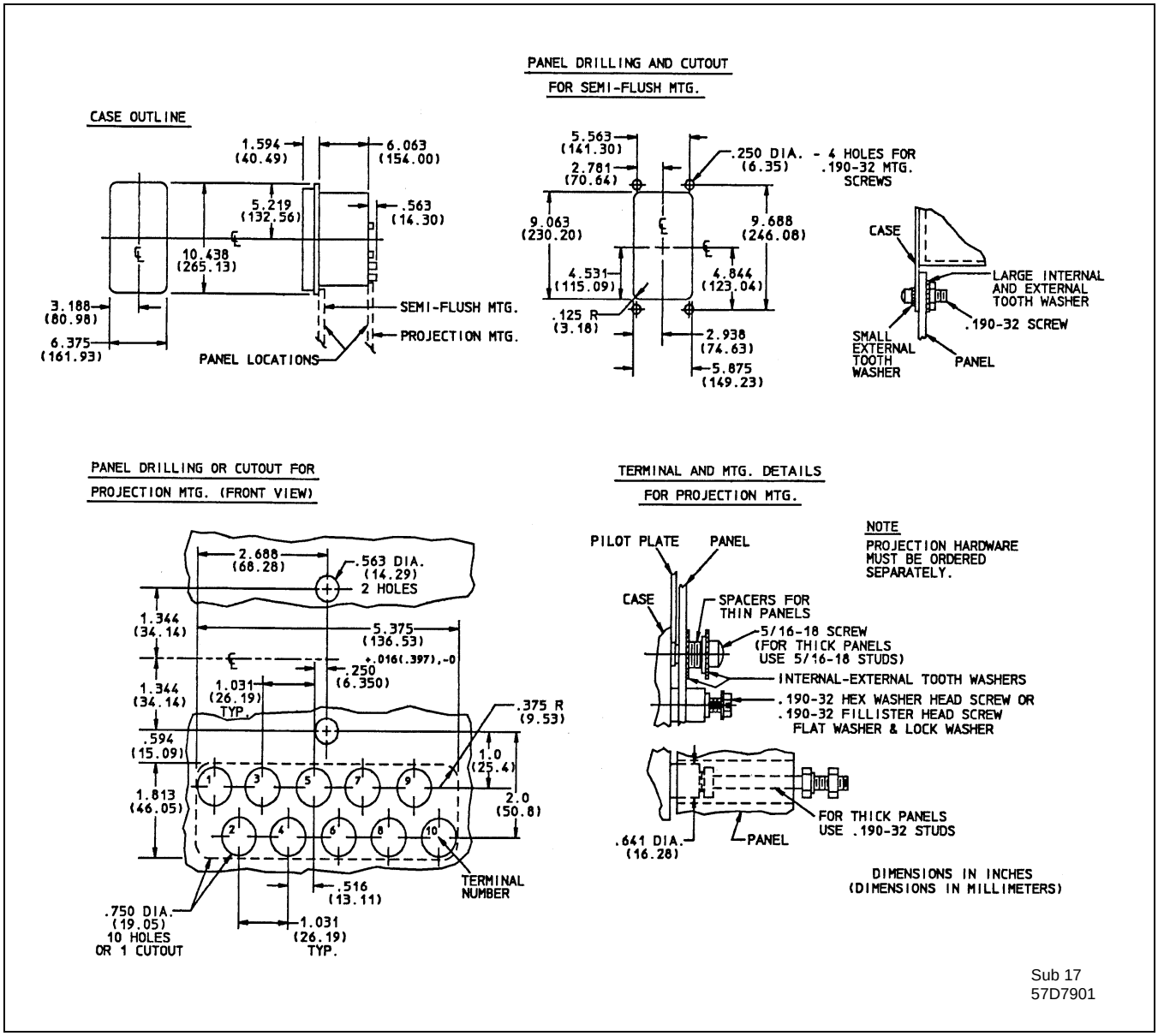

Figure 5. Outline and Drilling (FT-21 Case)

IL 41-138 - Revision D

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