Instructions for Type WL-2 Switch
Electric Trip—Hand Reset
600 Volts AC or DC 20 Amperes Continuous

I.L. 34-253-1A

CONTENTS

CONSTRUCTION

Figure 21 shows a general layout and the interchangeable parts that comprise the standard design of WL2 switches. Along with the pictorial view is the identification nomenclature of parts and assemblies.

The WL2 switch consists of an operating handle, face plate, control housing, and contact frame. It is built up in any number of stages from 1 to 10 and clamped together by 2 tie bolts to the control housing. A common steel operating shaft ties the contact rotors together. A metal cap is on the rear to hold the position stop pin, to retain shaft, and to give switch identification.

Two contact frames are available: (1) One with 6 contacts, 3 sets on top at 11, 12, and 1 o'clock locations, and 3 sets on bottom at 5, 6, and 7 o'clock locations, and (2) the other with 12 contacts each set at the 12 positions of a clock. The contacts for standard applications are between terminals front and rear. Both frames are made of glass polyester insulating material.

A stage of contacts consists of a frame (either 6 or 12 contact) and a rotor inside. Switches are usually described as so many stages long. A standard stage can have 6 contacts or 12 depending on the frame size used. (See Figures 3 and 4.)

The rotors are standard in design to hold the roller contacts. Each rotor is made of glass polyester insulating material; it rotates independently between the stage spacer plates. The roller contacts are made of bronze material and silver plated. The contact springs are made of stainless steel.

The head of the terminal screw is the contact face and is silver plated bronze material. The polycarbonate windows that hold the terminals in place also serve to lock the terminal nut.

The control housing is aluminum die cast and shaped to house the latching and tripping details.

Three molded phenolic compositon handles are available in the shapes of oval*, pistol grip, and round. The nameplate is a molded white cycolac ABS material upon which are hot press stamped markings as required. The dial plate is aluminum die cast and seats the mounting screws and holds the nameplate. The nameplate snaps onto the dial plate and covers the mounting screws.

Two magnet-coil assemblies are available; one for 24/48 volts D.C. and one for 120 volts through 480 volts A.C. or D.C.

OPERATION

The Type WL-2 is a two position device having manual operation to the "reset" position and electric trip (spring operated) to the "trip" position. The escutcheon is

* Oval shape is standard.

marked "trip" and "reset". This device can be supplied as either (1) handle reset and electrical trip, or (2) handle reset and both handle trip and electric trip. The rotor is held in the reset (normal) position by means of a permanent magnet. Tripping is accomplished by energizing the release coil, which induces a magnetic field in opposition to the holding magnet (electromagnetic induction) thus cancelling the lines of force of the magnet which release the rotor to turn to the "trip" position under spring stored energy.

The permanent magnet has a minimum holding force of at least double the tripping spring pressure; therefore, the reserve force of the magnet is sufficient to hold the rotor in reset position under conditions of shock and vibration normally found in commercial application. *The magnet must hold a 13 pound test weight.

The trip coil is factory wired to a coil cutoff contact. In all cases, this coil cutoff contact is closed when the rotor is in the reset position. In the tripping sequence, the coil cutoff contact is opened as the rotor moves from the "reset" to the "trip" position.

Warning: **To prevent coil damage the handle should not be manually held in the reset position when the trip circuit remains energized. When the trip circuit is energized and the switch is hand operated to the reset position, the operator will feel vibration through the switch handle and a buzzing sound will be audible.**

Important Note: **A Type WL-2 Switch of the non-handle trip design, although equipped with a handle, cannot be tripped by handle operation. To trip, a voltage corresponding to the coil rating shown on the switch nameplate must be applied to the trip coil.**

Trip Circuit Wiring

On each switch, specific contacts are used for trip coil circuitry; thus, on control voltages of 24 volts through 250 volts, one contact is used for trip coil cutoff. For 440 volt control, two contacts are wired in series for trip coil cutoff.

On the first stage of each switch, a second contact is used to connect the positive lead from the trip coil. The terminals of this contact are connnected by means of an external connector which bears a positive (+) sign. (Disregard for Ac Control Voltage.) In the case of the six contact stage, the factory will connect the coil leads to terminals A-5 and A-7, with A-7 being the positive (+) side. Customer connections being made at terminals B-5 and B-7. B-7 being the positive side. (See Wiring Diagram). In the case of the twelve contact stage, the factory will connect the coil leads to terminals A-6 and A-8, with A-8 being the positive (+) side. Customer connections being made at terminals B-6 and B-8, B-8 being the positive side. By this means, factory wiring need not be disturbed to accomplish field connections.

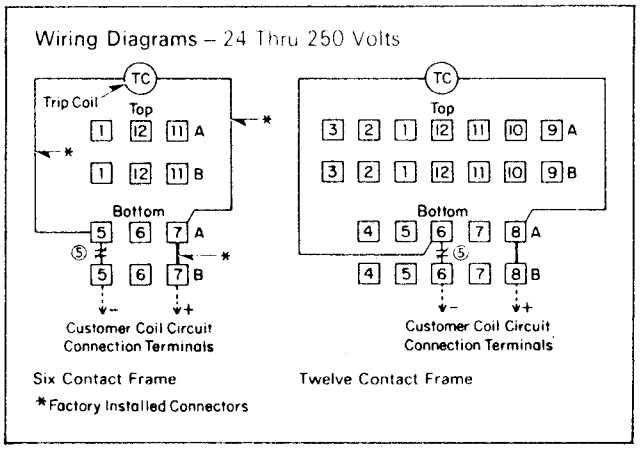


Figure 1

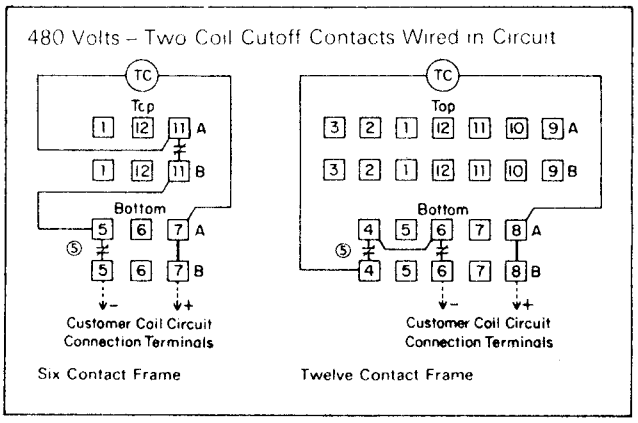
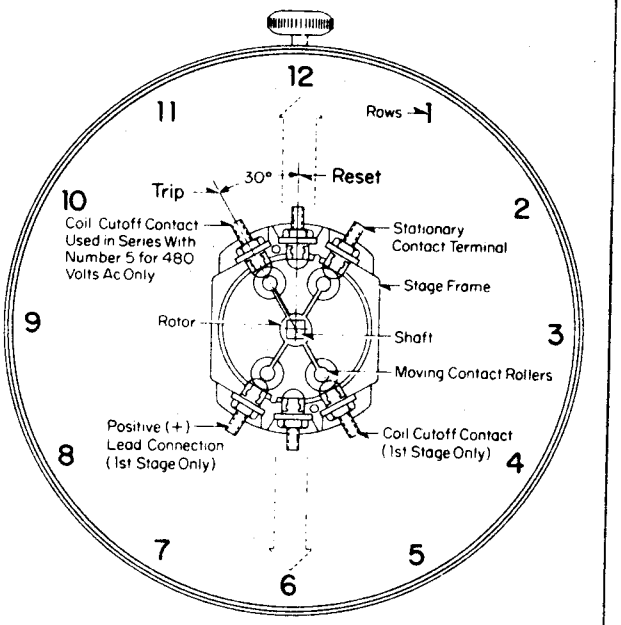


Figure 2

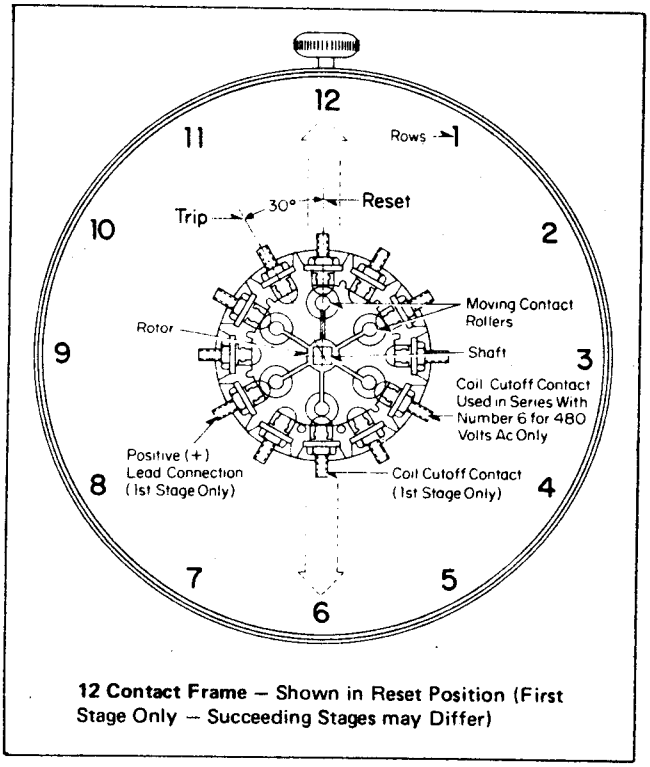
The Type WL-2 Switch is not available with all contacts normally closed or all normally open. Due to the nature of design, there is a combination of both normally open and normally closed contacts on each unit. These may be varied to best suit the intended application. (Refer to contact tabulation section of Descriptive Bulletin 34-253.)

Important Note: **The magnet-coil assembly used on type WL-2 switches is designed for intermittant duty only; this coil assembly has no continuous duty rating. The design incorporates a contact used to cutoff all current flow when the switch is tripped. No device should be applied to**



6 Contact Frame – Shown in Reset Position (First Stage Only – Succeeding Stages may Differ)

Figure 3



12 Contact Frame – Shown in Reset Position (First Stage Only – Succeeding Stages may Differ)

Figure 4

or used with the Type WL-2 switch coil circuit which would cause a continuous current flow, of more than 45 milliamperes, through the coil. Any higher current flow can cause heating of the coil and possible coil burn out.

Contact Interpretation

The contacts of the Type WL-2 Switch are identified by the combination of Bands and Rows.

Rows

Viewing the switch from the handle end (front), it is noted the terminals are arranged in rows from front to back. The rows are set 30 degrees apart as is the face of a clock. On the six contact frame, the top three rows are identified as 11, 12 and 1 o'clock. The three rows at the bottom of the stage are 5, 6 and 7 o'clock. On the twelve contact frame, the rows are set as per each number on the face of a clock. (Refer to Figures 3 and 4.)

Row numbers are marked on the rear end plate of each switch and on the rear surface of each barrier.

Bands

As the switch is viewed from the side, bands of terminals are readily seen around the outer perimeter of the stage frame. Such bands are lettered. The band nearest the handle end is band "A", the second band is band "B", etc. Bands "A" and "B" constitute stage one, bands "C" and "D" constitute stage two, etc.

The row numbers and band letters are then combined to form full terminal identification as shown on Figure 5.

Contacts

The stationary contact (terminal) is a solid one piece forging. The moving (roller) contact is a solid bar. (See Figure 6.)

To complete a circuit the roller contact internally bridges the stationary terminals in adjacent bands in the same row, for example, bands A & B in row twelve (A12-B-12) etc.

Type WL-2 Switch Materials

Handle	Moldarta, General Purpose
Nameplate	Cycolac
Dial Plate	Aluminum Die Cast

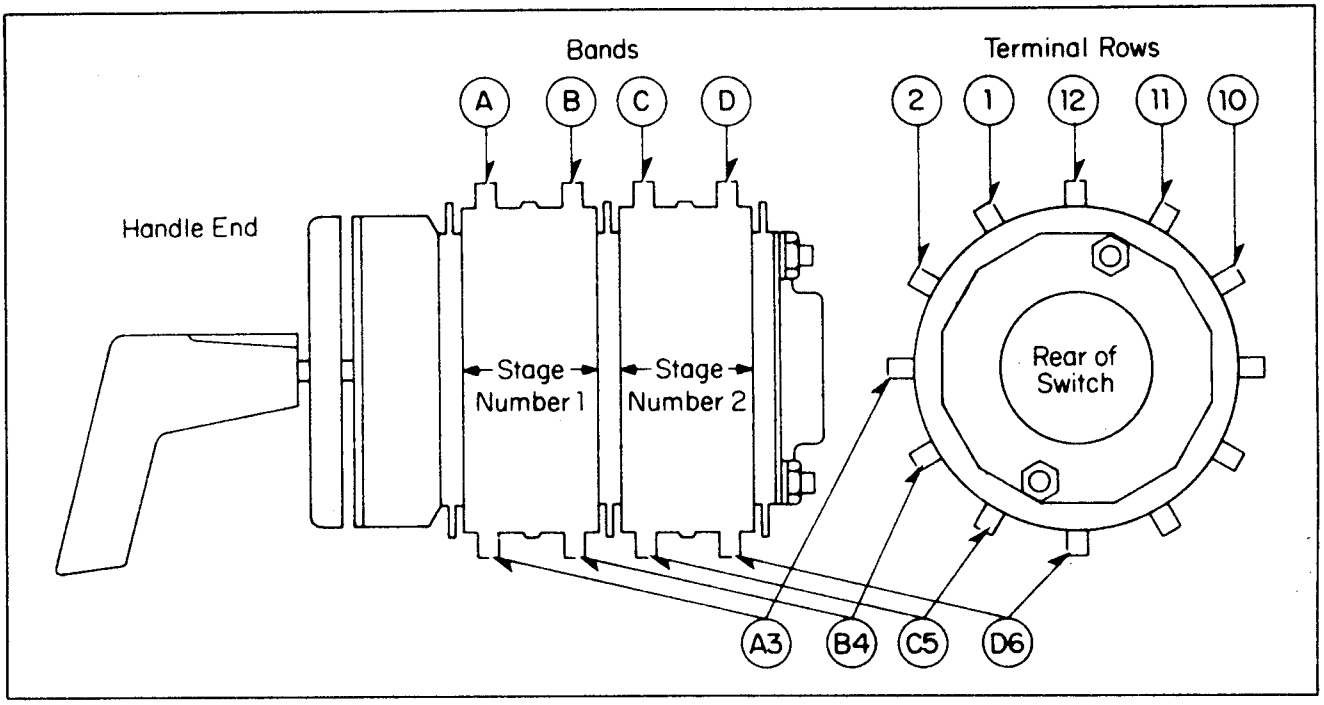


Figure 5

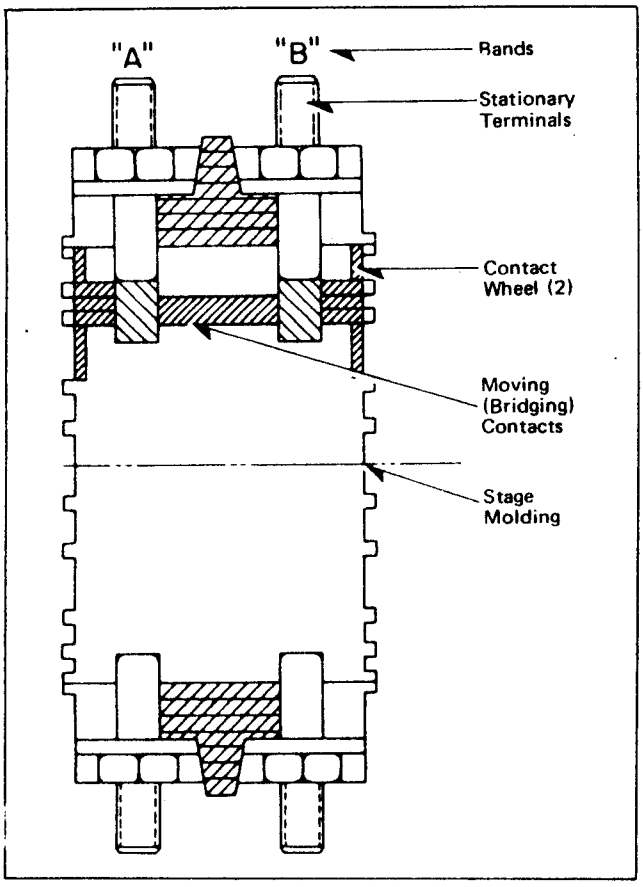


Figure 6

Housing	Aluminum Die Cast
Stage Frame	Glass Polyester
Rotor	Glass Polyester
Stationary Contact	Silicon Bronze, Silver Plated
Roller Contact	Silicon Bronze, Silver Plated
Springs	Stainless Steel
Locking Spacer (Window)	Lexan, Polycarbonate

MAINTENANCE INSTRUCTIONS

Mounting on Panel:

Each WL-2 switch is supplied with a die cast aluminum dial plate and two .250-20 mounting screws. These items must be removed from the switch unit. Place the switch unit behind the panel with shaft extension through the appropriate hole. Place dial plate at front of panel with center hole of dial plate over shaft extension. Then line up the two smaller holes of dial plate with panel drilling and insert the .250 -20x 1.88 mounting screws through the dial plate and panel, into switch unit. Screws should turn into threads in switch unit freely by hand. Then final tightening should be done with a large screwdriver. (Refer Figure 9.)

Disassemble Switch Unit:

To disassemble switch, remove from tie bolts, the two #8-32 Keps nuts at rear end of switch. Lift off formed

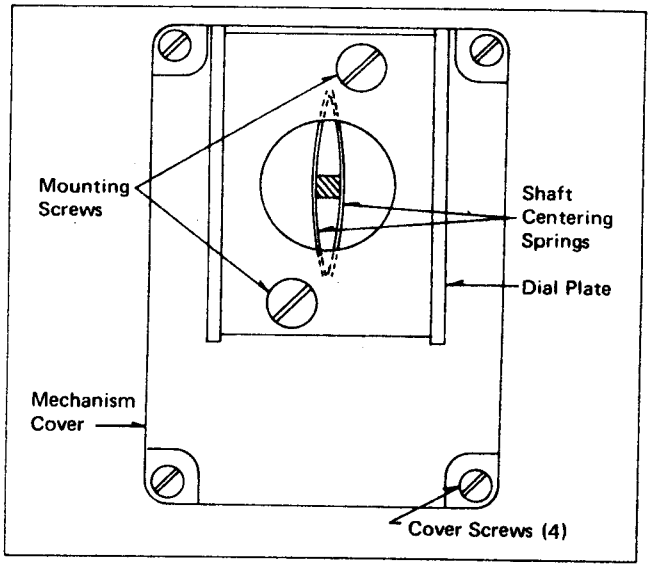


Figure 7

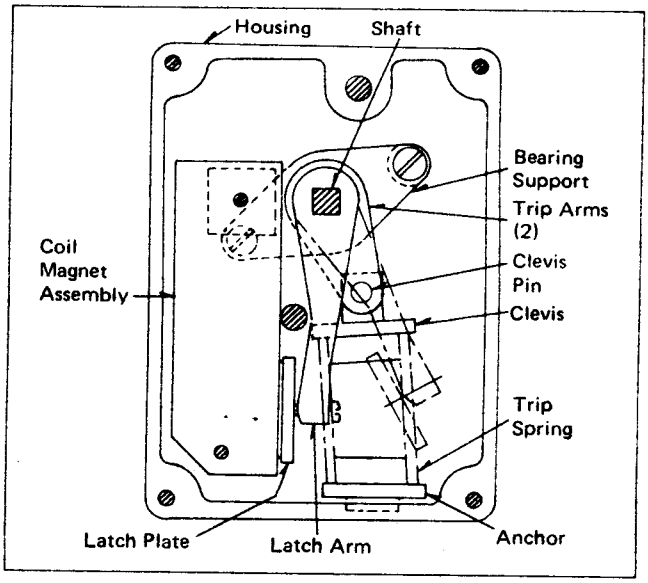


Figure 8

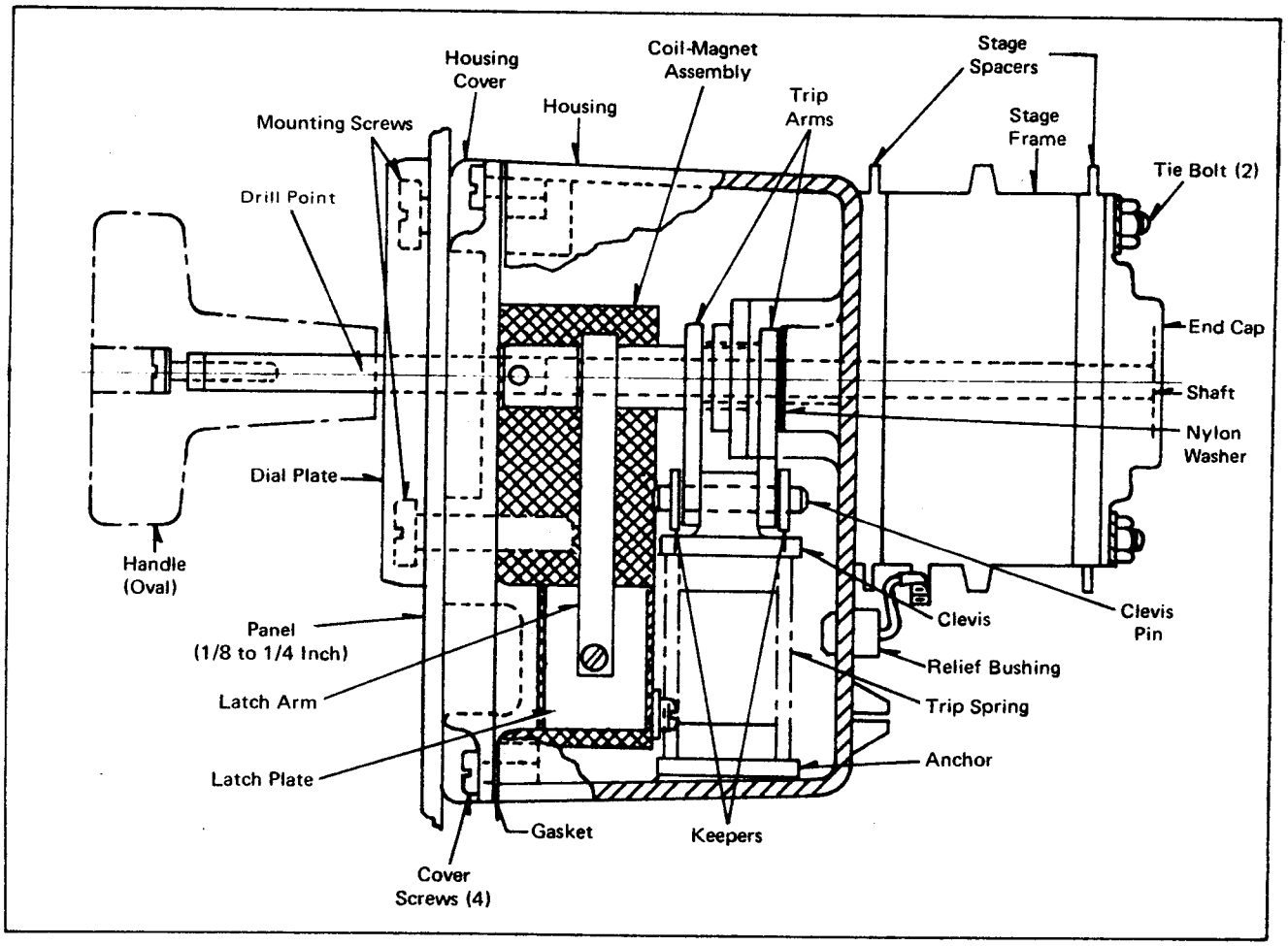


Figure 9

aluminum cover plate which will then expose the position stop. (Note that stop pin is located in hole marked "11". There is a duplicate stop pin located at the front of the switch between the mechanism housing and the first stage).

Remove the cotter pin, washer and stop lever. Now the stage spacer can be removed.

Remove the wheels from exposed end of roller contacts. At this point, note the numbers molded on the rotor beside each contact location and their relation to the "reset" or twelve o'clock position. This information will aid in expediting reassembly. (Also see heading "Rotor Settings".) The stage frame can now be lifted off the tie bolts. The rotor can then be removed from the opposite side of the stage frame.

Each successive stage is similarly removed.

Reassembly is accomplished in reverse order of that given above, with care given to rotor position within the stage frame. Be certain to replace wheels on end of roller contacts.

Rotor Settings:

On the six contact frame switch assemblies, the rotors may be assembled onto the switch shaft in two variations as follows:

(1) Rotors with contacts in locations 2-3 and 5-6 are assembled onto the shaft with the number "one" contact location 90^{O} CW (rear view) from the drill point on the shaft. Such drill point marking should always be assembled in the twelve o'clock or "reset" position.

(2) Rotors with contacts in locations 1-2 and 4-5 are assembled onto the shaft with the number "one" contact in line with the drill point.

The roller contact location on the rotor with its proper assembly position (1 or 2 above) will determine in which position, i.e., "Trip" or "Reset", the greater number of contacts will be closed. (See Figure 3.)

The twelve contact frame switch assemblies use the same rotor assembly throughout and all rotors must be assembled with the number "one" roller contact in line with the drill point marking on the shaft.

The first stage of any type WL-2 switch shall not be altered in its contact configuration. (See Figure 4.)

Moving Contact Replacement:

Follow directions given in heading of "Disassembling Switch Unit" to gain access to rotor assembly. With rotor in hand and numbered side facing you, insert blade of penknife or small screwdriver in coil of spring close to rotor hub and press spring toward contact; at same time exert an outward force and spring will fall free of slot. Spring seat and contact can then be removed.

By this time you have noted that one contact wheel is captive, this captive wheel is always assembled on the non-numbered side of the rotor molding. Upon examination you will note that the spring seat has one side with a smooth radius. This side assembles against the contact shaft. Having so placed the spring seat, the spring can then be laid in spring seat and then compressed with blade of penknife or small screwdriver and moved into place. The spring and seat may be placed as a unit by setting spring on seat and then compressing and holding such compression with thumb and index finger as assembly is slid over roller contact into place in slot in the rotor.

Stationary Contact Replacement

Stationary contacts can be removed from the stage frame without dismantling the entire switch.

Place the switch handle in a position where no roller contact engages the stationary terminal to be removed.

Loosen the terminal locking nut approximately 2/3's the length of threads but do not remove nut. Press downward on the terminal. You will feel it fall free, then move terminal outward and lift out.

To install new terminal, first place polycarbonate window on terminal stud. Place nut on terminal and turn nut on threads to thickness of nut. Place contact end of terminal in slot in stage frame as far as it will go, then move terminal inward and tighten nut to approximately 18 inch pounds. This tightening process will draw the contact into proper position. (See Figure 10.)

Trip Coil Replacement:

To replace the trip coil-magnet assembly, the switch must be removed from the panel. The trip coil assembly is located inside the mechanism housing and is secured to the backside of the housing cover. (See Figures 8 and 9.)

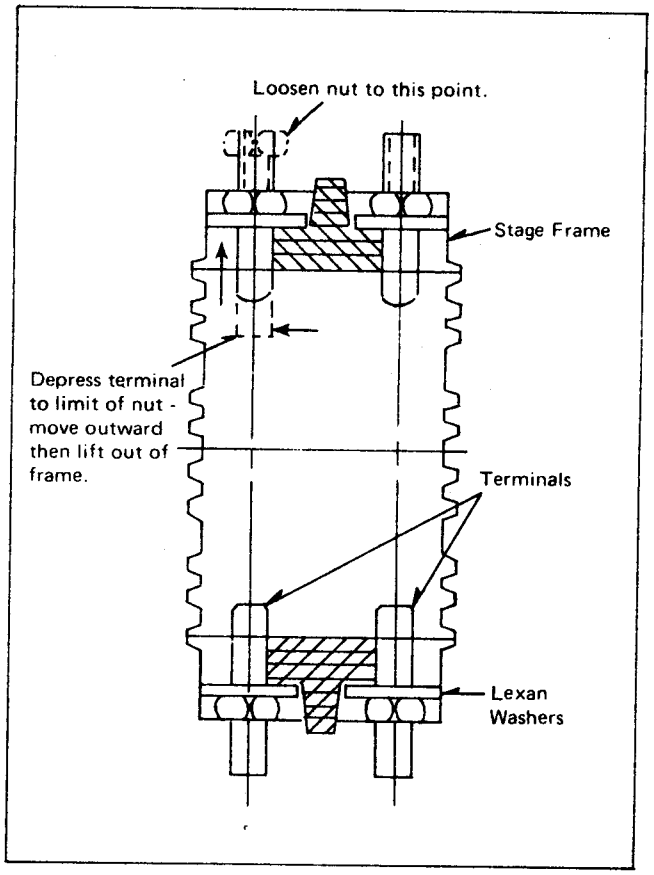


Figure 10

Remove coil leads from switch terminals.

Remove wire relief bushing from rear of housing.

Remove the four (4) screws (.164 - 32 x .50) securing cover to housing.

Remove cover and gasket.

From the backside of the cover, you can now remove the coil-magnet assembly by removing the two screws (.138 - 32 x 1.75) with flat washers.

Reassembly is accomplished in reverse order of above instructions except that loctite composition #75 should be applied to the screws securing the coil-magnet to the housing cover.

The coil-magnet assembly must be installed with magnet at the bottom of the cover and in the direction of the vertical centerline.

LUBRICATION:

Any parts of the type WL-2 switch requiring lubrication are lubricated at the factory during assembly and should require no further attention for the lift of the switch.

RECOMMENDED SPARE PARTS:

*1. Contact Kit S#499A433G02

2. Trip Coil:

S#349A556G01 for 24/45 volts D.C.
S#349A556G02 for 120 V thru 480 volts

3. Trip Spring S#437B112H02

4. Housing Cover Gasket S#795A876H01.

5. Stationary SW parts:

6 Contact Frame 499A435G01
12 Contact Frame 499A435G02

6. Handle Centering Spring - Two per unit (For non-handle trip switches) S#795A879H01.

*Style Number covers one each, roller contact, spring & seat.

TEST DATA

Ratings
Average Coil Operating Current

Ac	120	240	480	Dc	24	48	125	250
Amperes	1.4	3.0	6.0	Amperes	3.6	7.0	1.2	2.4
Inductance	.030H	.030H	.030H		.0029H	.0029H	.030H	.030H

Figure 11

Operating Time

Operating time is the elapsed time from the initiation of voltage applied to the coil until the normally open contact of the switch "makes" or closes a circuit.

Average Operating Time in Cycles

Ac Volts	120	240	480	Dc Volts	24	48	125	250
Avg. Time	1.58	1.54	1.50	Avg. Time	1.06	.96	1.05	1.01
Ac Volts Rectified	120	240						
Avg. Time	1.08	1.05						

Figure 12

The following interrupting ratings apply only to those contacts closed in the reset position (B contacts) and which are opened by electric tripping of the Type WL-2 Switch mechanism.

Interrupting Ratings – Single Contact

Arcing ends one millisecond before contact makes

Voltage	Ac/Dc	Inductive Amperes Henries .0045	.012	.031	.063	.130	.243		Resistive Amperes
125	DC	4.65	3.67	2.85	2.1	1.53	0.9	.....	7.55
250	DC	1.6	1.6	1.0	1.0	0.98	0.78	....	1.6
500	DC	....	....	....	....	....	....	....	....
120	AC	....	....	....	....	....	....	7.53	7.95
240	AC	....	....	....	....	....	....	1.16	1.95
480	AC	....	....	....	....	....	....	.54	.9

Figure 13

Interrupting Rating – Two Contacts in Series

Arcing ends one millisecond before contact makes

Voltage	Ac/Dc	Inductive Amperes Henries .0045	.012	.031	.063	.130	.243		Resistive Amperes
125	DC	27.0	14.75	7.7	4.85	2.92	1.9	....	7.8
250	DC	6.4	5.0	3.85	3.1	2.4	1.6	....	6.7
500	DC	1.5	1.7	1.5	1.35	1.15	0.98	....	1.7
120	AC	....	....	....	....	....	....	68.0	....
240	AC	....	....	....	....	....	....	9.1	9.0
480	AC	....	....	....	....	....	....	1.5	1.55

The values in the above tables are a maximum at which the arc, during interruption, will not carry to the adjacent "make" contact. Where a circuit to be interrupted has a rating exceeding those listed in above table, the adjacent "make" contact should not be used. Refer to Table 1, Page 9, column "Number of Paired Contacts" for details.

Figure 14

Trip Coil Minimum Pick-up

Nominal Voltage Direct Current	Pick-up Volts	Nominal Voltage Alternating Current	Pick-up Volts
24	19	120	90
48	19	240	90
125	90	480	90
250	90		

Figure 15

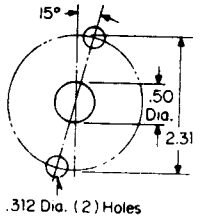
Reset Torque

Torque Required to Return Rotor to "Reset" Position

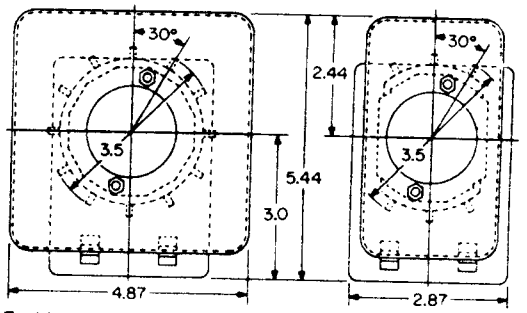
22 to 24 Inch Pounds Initial
8 Inch Pounds Final

Figure 16

Dimensions in Inches
Drilling Plan



Line No.	No. of Stage	A	B
1	1	2.40	5.31
2	2	3.90	6.81
3	3	5.40	8.31
4	4	6.90	9.81
5	5	8.40	11.31
6	6	9.90	12.81
7	7	11.40	14.31
8	8	12.90	15.81



End View
(12 Contact Stage)
Figure 17A

End View
(6 Contact Stage)
Figure 17B

Figure 17

Type WL-2 Switch
With Protective Cover

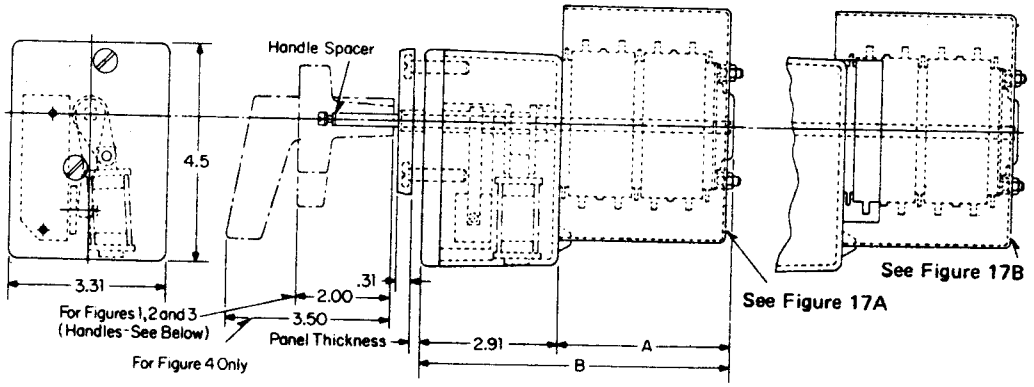


Figure 18

Type WL-2
Without
Protective Cover

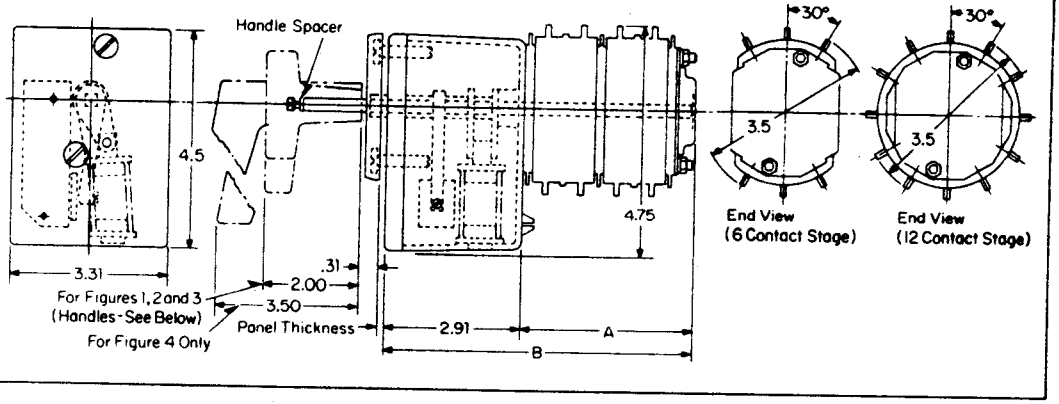


Figure 19

Handles

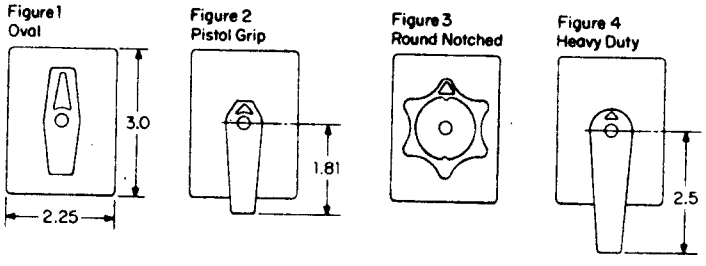
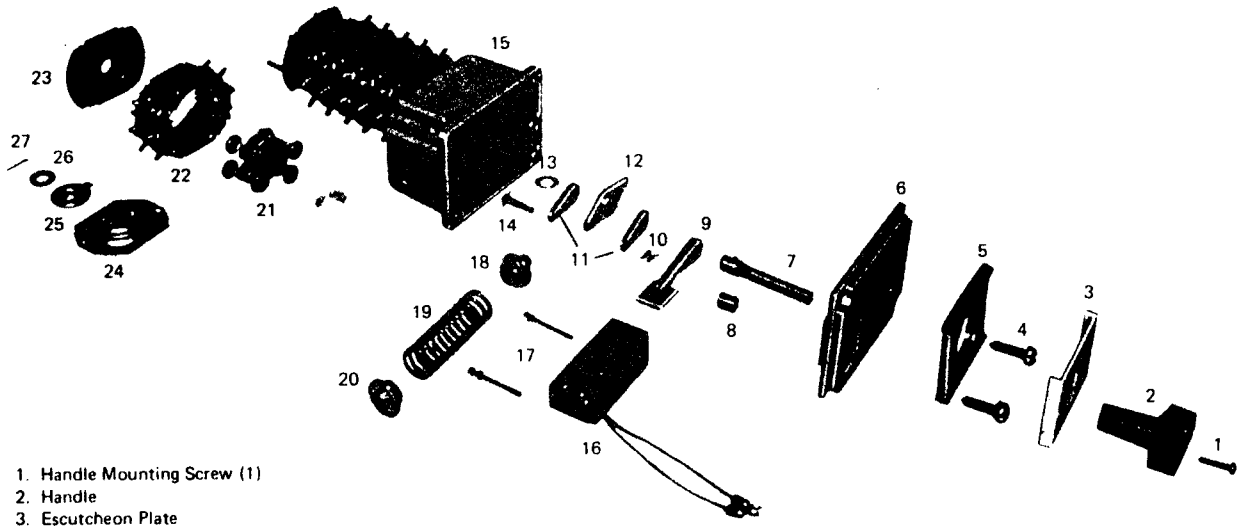


Figure 20

Exploded View of Typical WL-2 Switch



1. Handle Mounting Screw (1)
2. Handle
3. Escutcheon Plate
4. Switch Mounting Screws (2)
5. Dial Plate
6. Mechanism Cover Plate
7. Shaft (Handle trip design only)
8. Arm Spacer
9. Reset Arm Assembly
10. Keeper (2)
11. Tripping Arm (2)
12. Support with Bearing
13. Washer
14. Pin
15. Mechanism Housing
16. Coil-Magnet Assembly
17. Mounting Screws for Coil Assembly
18. Clevis
19. Spring-tripping
20. Anchor
21. Rotor
22. Stator Frame
23. Stage Spacer
24. End Cap
25. Stop
26. Washer
27. Cotter Pin

Figure 21

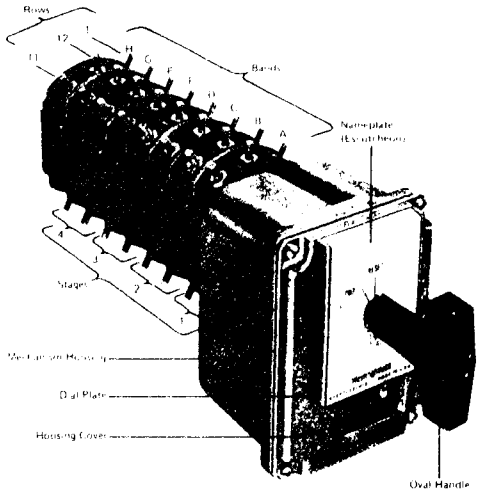


Figure 22

Westinghouse Electric Corporation
Switchgear Division, East Pittsburgh, Pa. 15112

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