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**Figure 1A.**
QD3 Tap-changer.

**Figure 1B.**
QD3 Tap-changer.
SAFETY FOR LIFE

Cooper Power Systems products meet or exceed all applicable industry standards relating to product safety. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Cooper Power Systems employees involved in product design, manufacture, marketing and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high-voltage lines and equipment and support our “Safety For Life” mission.

SAFETY INFORMATION

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians, who are familiar with this equipment should install, operate and service it.

A competent technician has these qualifications:

- Is thoroughly familiar with these instructions.
- Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.
- Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.
- Is trained in the care and use of protective equipment such as flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, hotstick, etc.

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Safety Instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

⚠️ DANGER:

Hazardous voltage. Contact with high voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.

⚠️ WARNING:

Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage.

⚠️ WARNING:

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply may result in death, severe personal injury and equipment damage.

⚠️ WARNING:

Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

⚠️ DANGER:

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠️ WARNING:

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠️ CAUTION:

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION: Indicates a hazardous situation which, if not avoided, could result in equipment damage only.
**PRODUCT INFORMATION**

**Introduction**

The QD3 Quik-Drive™ tap-changer combines 50 years of experience with the latest technology, providing the most advanced and reliable Voltage Regulator tap-changer. Cooper Power Systems provides the proven value customers have come to expect. By using advanced thermal set material rather than phenolic material, Cooper Power Systems has been able to design a product that has the strength for the most demanding applications as well as increasing the tracking resistance within the parts. By simplifying the bridging within the tap-changer, Cooper was able to simplify the contact design and at the same time improve product life. The QD3 tap-changer incorporates Cooper Power Systems exclusive holding switch circuit, which has set the standard for tap-changer tracking reliability.

The Cooper Power Systems QD3 Quik-Drive tap-changer provides endless possibilities when used with the control technology, starting with the CL-6A control, with applications such as Preventative Maintenance Tapping (PMT™), Duty Cycle Monitor, and TIME-ON-TAP™ features.

**Instructions**

These instructions apply to Distribution Voltage Regulators. Read these instructions carefully before attempting to use the voltage regulator.

The equipment covered by these instructions should be operated and serviced only by competent personnel familiar with good safety practices. These instructions are written for such personnel and are not intended as a substitute for adequate training and experience in safe procedures for this type of equipment.

The text of this instruction includes information concerning hazards to safety, which are common to all regulators. This safety hazard information is offered for guidance when installing and operating the descriptive matter to aid in preventing damage to the equipment and to advise of possible hazards to personnel. When reading this text, the meaning and content of these statements should be understood and followed carefully.

**General**

S225-12-1 covers operating, maintenance and replacement instructions for the QD3 Quik-Drive tap-changer in Cooper Power Systems VR-32 voltage regulators. The QD3 tap-changer in 2005 replaced the spring drive tap-changers for Cooper Power Systems low current application single-phase voltage regulators. Replacing the spring drive model 928, 95 KV BIL and model 170, 150 KV BIL tap-changers. The QD3 tap-changer as like the spring drive tap-changer are use on voltage regulators with load rating up to 219 Amps. The QD3 tap-changer is also rated for voltage regulator up to 219 Amps 150 KV BIL.

**Motor**

S225-12-1 covers operating, maintenance. The QD3 Quik-Drive tap-changer uses an AC Synchronous Motor that shaft speed is synchronous with the line voltage frequency. The motor has rapid stating and stopping, stopping with a minimal coast when the motor is de-energized without the need for a mechanical brake. The motor runs at an exact speed with no variation with load or voltage using a permanent magnet rotor to hold the motor shaft in position when the motor is de-energized. Since the connection between the rotor and stator is magnetic, the motor can be stalled without damage. The motor operates in both clockwise and counter-clockwise directions. A resistor and capacitor is required for starting and providing a phase-shifting network to operate the motor.

**CAUTION:**

Do not operate the motor in air for excessive time or overheating and failure may result.

**Motor Resistance**

To measure the motor resistance of each motor directional winding, see the following:

Motor Ground “White Lead” to “Blue Lead”

- Raise = 27.5 ohms

Motor Ground “White lead” to “Red Lead”

- Lower = 27.5 ohms

Raise “Blue Lead” to Lower “Red Lead” = 54 ohms
Motor Capacitors

The QD3 tap-changer uses two different motor capacitors depending on whether the tap-changer is being used with 50 Hz or 60 Hz power. The motor capacitor is not part of the tap-changer assembly. The capacitor for regulators supplied with a QD3 tap-changer will be found in the voltage regulator control box assembly.

<table>
<thead>
<tr>
<th>Capacitor Size</th>
<th>Power</th>
<th>Size</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50 Hertz</td>
<td>15 ufd</td>
<td>440 Vac</td>
</tr>
<tr>
<td></td>
<td>60 Hertz</td>
<td>12 ufd</td>
<td>440 Vac</td>
</tr>
</tbody>
</table>

It is important to use the correct size capacitor with the QD3 tap-changer hanger. For example: If a 12 ufd is used on a tap-changer that is being applied to a 50 Hz system, the tap action of the tap change can be affected by the number of steps taken and the directional operation of the tap-changer. The same can occur if a 15 ufd is used for a 12 ufd on a 60 Hz system. Other problems can occur if smaller or larger capacitors are used in place of the specified capacitor size. It is always recommended to use the motor capacitor supplied by the manufacture of the tap-changer and voltage regulators.

QD3 Motor Resistor

Resistor Size:

40 Ohm
100 Watt

The motor resistor on the QD3 tap-changer is used for proper phasing of the motor. An open resistor, resistor connection, or different size resistor will affect operation of the motor. Either of these conditions can cause the motor to take more tap steps then required as well as causing the motor to run or start to run in the opposite direction.

⚠️ CAUTION:

Operating the QD3 Tap-Changer in air for an excessive amount of time, or if operating continues without pulsing, will cause the resistor to become hot to the touch. Overheating can be a harasser causing injury if touched and can affect the operation of the tap-changer motor.

Holding Switch

The QD3 tap-changer uses a micro-switch assembly for the holding switch instead of a three-blade contact holding switch assembly that was used on the spring drive tap-changer assembly. The micro-switch assembly eliminates the need and requirements for making adjustments in the alignment and gape settings when working on or around the holding switch assembly.

All Cooper Power System tap-changers are equipped with a holding switch to assure that a tap-changer in process is completed. This switch also provides a repetitive and accurate opening action causing the motor to stop the drive components with correct alignment. A signal from the holding switch activates the operations counter and prevents time delay reset during a tap change. The holding switch is operated by a pinion cam causing the holding switch lever to close in on either the raise or lower micro-switches. If a holding switch needs to be worked on due to problems with one of the two micro-switches, the micro-switch should not be replaced with a new one. The complete assembly needs to be replaced with a micro-switch assembly from the factory. Replacement of the micro-switch can cause problems with the assembly and tap-changer. Special fixtures are used for the assembly to prevent alignment gap setting requirements.
Contacts
All moveable and main stationary contacts employ copper-tungsten copper alloy tips at points subjected to arcing duty. Contact points not subjected to arcing employ a combination of EPT copper to provide a high conductivity current path. Moveable contacts are split to make contact on both sides of mating parts and resist separation during high current surges. Contact pressure is maintained by steel compression springs.

The main stationary contact has two arcing tips, one on each side. Each arcing tip is composed of tungsten copper alloy. Tungsten is used to help reduce the erosion of the contacts due to arcing. The main stationary contact is used for stationary contacts tap 1 through 8.

Reversing Switch
The reversing switch changes the polarity of the tapped winding. When the QD3 Quik-Drive tap-changer is in the neutral position; the reversing switch is open (not making contact with either of the reversing stationary contacts). In the open position, the reversing switch is not in the load current circuit.

The reversing switch motion on the QD3 tap-changer occurs as the main moveable contact enters or leaves the neutral position. The main moveable contact assembly has a pivot roller located between the two moveable contacts. The pivot roller is engaged in a pivot slot in the reversing switch moveable contact assembly when the main moveable contacts are in the neutral position. The first tap step rotates the reversing moveable contact assembly, causing the reversing switch moveable contacts to engage the reversing stationary contact. This will be either the VL or VR reversing stationary contacts.

QD3 tap-changer reversing switches may be exposed to arcing duty. The main Geneva/contact drive assembly and the reversing switch arm provide a mechanical stop located approximately 320 degrees on either side of neutral.

Figure 5.
Main stationary contact.

The receiving stationary contact is used in two positions, VL and VR, and sees less operating duty than the main stationary contacts. The reversing stationary contacts do not utilize tungsten alloy arcing tips. The reversing stationary contact is symmetrical and can be use for either the VL or VR positions.

Reversing Switch
The reversing switch changes the polarity of the tapped winding. When the QD3 Quik-Drive tap-changer is in the neutral position; the reversing switch is open (not making contact with either of the reversing stationary contacts). In the open position, the reversing switch is not in the load current circuit.

QD3 tap-changer reversing switches may be exposed to arcing duty. The main Geneva/contact drive assembly and the reversing switch arm provide a mechanical stop located approximately 320 degrees on either side of neutral.
The reversing moveable contact assembly consists of the reversing segment, neutral main stationary contact, and reversing moveable contact. The reversing moveable button-contact makes or engages the reversing stationary contacts as the tap-changer is moved off of the Neutral Position. The other end of the moveable contact has a button contact that stays engaged with the neutral stationary contact at all times.

If the neutral stationary contact is in need of being replaced, the complete reversing switch moveable contact assembly should be replaced.

**Micro-Switches**

Micro-switches are used for the holding switch, reversing logic, neutral indication, and taping limit logic switches.

Two sets of normally closed switches are used to provide a safety switch circuit to prevent the tap-changer from trying to tap beyond 16R and 16L. This assists the mechanical stop. These two switches allow the tap-changer to reverse in the opposite direction when the mechanical stop is reached, causing the holding switch to become closed.

The micro switches used are rated for –40 °C to 130 °C, 5 mp 125/250 Vac rating. The switches are designed to exceed one million operations at QD3 tap-changer current.

**Housing, Geneva, Gears, Cams and Bearings**

Housing, geneva, gears, cams and bearings are constructed of reinforced thermoplastic engineered grade polymer providing these characterizes.

- Transformer oil compatible
- Envirotemp™ FR3™ fluid compatible
- High heat resistance with an operating temperature over 200 °C
- High mechanical strength
- High electrical creep resistance
- Molded part reduces number of total tap changer parts
- Lower water absorption and power factor than phenolic board
- Good mechanical creep resistance
- Corrosion resistant
- High dielectric strength
- Good wear resistance
- High chemical resistance

Some typical applications include:

- Under-hood high temperature automotive applications such as engine manifolds
- Electrical applications such as circuit breakers and stand-off insulators
- High temperature lighting applications

**QD3 Drive Mechanism**

Once a tap change is initiated, a holding switch energizes the motor through a separate circuit until the indexing motion is completed. The indexing occurs very fast. The total elapsed time to complete the action is approximately 270 milliseconds from the time the indexing signal is started by the control. The motor turns a Geneva drive gear that is coupled to the motor shaft. Each full turn of the Geneva drive gear rotates the main Geneva/contact drive assembly 20 °C. The moving contacts are assembled directly to the main Geneva/contact drive assembly. This direct connection achieves accurate indexing of the contacts.

The permanent magnet rotor arrests the inertia of the system once the tap change is completed and the power is removed from the motor. A safety switch circuit and a backup mechanical stop prevents rotation of the main Geneva/contact drive assembly beyond the maximum position.
QD3 Operating Sequence

When the tap-changer is in the neutral position and the control calls for a tap change, the following events occur:

1. The motor is energized and begins to turn using 120 V power supplied by the control.
2. The motor gear drives the Geneva drive gear.
3. The pin on the Geneva drive gear enters a slot on the main Geneva/contact drive assembly and the main Geneva/contact drive assembly begins to index.
4. The holding switch closes to ensure the tap change will go to completion. The control removes the initial 120 V power. The motor is now energized only through the hooding switch (also 120 V).
5. The reversing switch pin on the main Geneva/contact drive assembly begins to drive the reversing switch arm.
6. One of the two main interrupting moveable contacts slides out of engagement with the neutral stationary contact and interrupts the circuit through that branch.
7. The reversing switch arm rotates, which causes the reversing switch contacts to pivot. A bridge between the neutral contact and a stationary contact connected to one end of the series winding is thus established. NO arcing occurs across the reversing switch contacts. When the reversing arm rotates, a finger on the reversing switch arm engages a normally closed logic switch that determines whether the tap-changer is raising or lowering the voltage.
8. The main interrupting contacts slide over and onto the number one stationary contact, making a bridging position from contact N to contact 1 through the reactor.
9. The pin on the Geneva drive gear exits the main Geneva/contact drive assembly slot. The Geneva/contact drive assembly stops moving and rotation is all locked.
10. The holding switch opens and de-energizes the motor. The magnetic rotor in the motor stops all motion.
11. The motor shaft has completed a 120-degree turn. The elapsed time from step 1 to step 13 is approximately 270 ms.
12. If the control issues another signal to index in the same direction, the same sequence is repeated except the reversing switch is not actuated. The reversing switch does not move until the tap-changer is reversed and stepped the opposite direction back in neutral.
13. If the tap-changer is switching from position 15 to position 16, a normally closed limit switch is engaged that is connected in parallel with the logic switch. With both the logic and the limit switches activated, the control cannot provide power to the motor to index the tap-changer past the 16 position. The tap-changer can be indexed back to the 15 position.

MAINTENANCE, SERVICE, AND TROUBLESHOOTING

The following outlines maintenance procedures relating to the QD3 voltage regulator tap-changer and components. Before any internal or external maintenance is performed, the regulator must be removed from service.

It is necessary to open the regulator for inspection of the tap-changer. It is also necessary and recommended to remove the QD3 tap-changer from the regulator to perform inspections and repairs to moveable and stationary contacts. This section provides procedures for removing and replacing various components of the tap-changer with replacement kits.

Before removing the voltage regulator from service for maintenance, refer the Removal From Service section of the voltage regulator manual S225-10-30.

Troubleshooting and service functions of the QD3 / T350 tap-changer are performed with the regulator un-tanked and the tap-changer removed from the regulator.
Figure 10.
Tap-changer front view.
Figure 11.
Back side of QD3 Tap-changer.
Figure 12.
QD3 wiring schematic.
Contact Erosion Patterns

Contact life stages.

Contact Inspection

Tap-changer contacts are exposed to a combination of electrical, mechanical, and thermal conditions that result in deterioration. Erosion at the points subjected to arcing duty is the most visible indication of wear. Figure 13 illustrates typical contact erosion patterns resulting from normal service. Contact at the end-of-life stage shown in Figures 16 and 19 must definitely be replaced. The following figures show the actual contact after varies stage of contact erosion.

Contact erosion is a function of many variables such as tap voltage, load current and power factor, reactor design and tapped winding design. MEPS employs both equalizer and conventional windings which will produce the typical erosion patterns above.
New Contacts

Figure 14.
QD3 moveable contact.

Intermediate Life Stage

Figure 15.
QD3 moveable contact.

End of Contact Life Stage

Figure 16.
QD3 moveable contact, end of life.

Figure 17.
QD3 stationary contact.

Figure 18.
QD3 stationary contact edge.

Figure 19.
QD3 stationary contact edge, end of life.
**QD3/T350 Torque Requirements**

60-70 lb.-in. Back panel tap connections; Taps 1 thru 8, N- Neutral, VR, VL All 6 P1 and P2 connections.

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50-60 lb.-in. Button Head socket head or Allen head screws, six locations

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50-60 lb.-in. 5.649-6.779 Nm

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50-60 lb.-in. 5.649-6.779 Nm

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50-60 lb.-in. 5.649-6.779 Nm

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60-70 lb.-in. 6.779-7.908 Nm

---

60-70 lb.-in. Tap connections N and 1 thru 8 6.779-7.908 Nm

---

**Figure 20.**

Connect panel connections.

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**Figure 21.**

Front and back panel connections.
100-110 lb.-in. Motor Bracket to Motor Fastener Torque
100-110 lb.-in.
11.298-12.428 Nm

22-28 lb.-in. Motor to Front Panel Torque

12-18 lb.-in. Holding Switch Assembly to Front Panel Fastener Torque

12-18 lb.-in. Tap Position Lob Cover to Front Panel Fastener Torque

24-32 oz.-in. Raise, Lower, and Neutral Micro Switch to Front Panel Fastener Torque

22-28 oz.-in. Position Indicator Drive Assembly to Front Panel Fastener Torque

Figure 22.
Motor mount bracket.

Figure 23.
Front panel component torques.
22-28 lb.-in. Motor Resistor clips to tap-changer base mounting hardware torque
24-32oz.-in. Tap Position raise and lower limit micro switch mounting hardware torque

Figure 24.
Front panel component torques.

18-20 lb.-in. Tap-Changer Terminal Board Mounting Hardware Torque

Figure 25.
Tap-changer terminal board fastener torques.
When identifying if the tap-changer is in the neutral position without being on a voltage regulator, check the following:

1. Actuator Arm has the “N” (center switch) switch depressed causing the neutral switch to apply a 120 V source to light the neutral light on the control panel.
2. The tap position lob pointer is pointing at “N” on the tap position indicator.
3. The Pinion Cam point is over the white holding switch lever and is pointing in the three o’clock position.
QD3/T350 Replacement Part Kit Pictures

Figure 27.
Main moveable contact assembly 5741325B04.

Figure 30.
Motor resistor replacement kit 5791844A01.

Figure 28.
Main stationary contact assembly 5791822A01.

Figure 31.
P.I. Drive cam replacement kit 5740783B21.

Figure 29.
Motor replacement kit 57A63675100B.

Figure 32.
TC-LTC P.I. Drive face gear kit 5740787B11.
PART KIT INSTRUCTIONS

The following instructions are documents/sections of this manual that supply guidance and instructions for replacing various parts of the QD3 tap-changer and for making repairs or for servicing the tap-changer.

Document Numbers and Descriptions

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S225-50-35</td>
<td>QD3/T350 Motor Replacement Kit</td>
</tr>
<tr>
<td>S225-50-37</td>
<td>QD3/T350 Motor Resistor Replacement Kit</td>
</tr>
<tr>
<td>S225-50-40</td>
<td>QD3/T350 PI Drive Cam Replacement Kit</td>
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<tr>
<td>S225-50-41</td>
<td>QD3/T350 Main Stationary Contact Assembly Kit</td>
</tr>
<tr>
<td>S225-50-42</td>
<td>QD3/T350 Main Moveable Contact Assembly Kit</td>
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<tr>
<td>S225-50-43</td>
<td>QD3/T350 Reversing Stationary Contact Assembly</td>
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<tr>
<td>S225-50-44</td>
<td>QD3/T350 Reversing Moveable Contact and Neutral Stationary Contact Assembly Kit</td>
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<tr>
<td>S225-50-45</td>
<td>QD3/T350 TC-LTC. PI. Drive Face Gear Kit</td>
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<tr>
<td>S225-50-20</td>
<td>Quik Drive holding Switch Assembly Kit</td>
</tr>
</tbody>
</table>

Figure 33.
Reversing moveable contact and neutral stationary contact assembly kit 5741325B03.

Figure 34.
Reversing stationary contact assembly 5791822A02.

Figure 35.
Holding switch 5740794B04
**QD3/T350 MAIN MOVEABLE CONTACT ASSEMBLY KIT**

**Kit 5741325B04**

Refer to Service Information S225-50-42

**GENERAL**

The purpose of this replacement kit is to provide the parts and installation instructions for replacing the main stationary contacts on a QD3 Quik-Drive Tap-changer.

This installation instruction is made up of four different procedure sections:

- Tap-changer Removal from Voltage Regulator
- QD3/T350 Tap-changer Assembly Separation
- Main Moveable and Neutral Stationary Contact Removal and Re-assembly
- Tap-changer Re-assembly

**TABLE 1**

**Parts Supplied**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>2241325B04</td>
<td>Main Moveable Neutral Contact Assembly</td>
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</table>

**TABLE 2**

**Tools Required**

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needle Nose Pliers</td>
<td>1</td>
</tr>
<tr>
<td>9/16 inch Deep Well Socket</td>
<td>1</td>
</tr>
<tr>
<td>3/8 inch Drive Ratchet Wrench</td>
<td>1</td>
</tr>
<tr>
<td>5/32 Allen Wrench</td>
<td>1</td>
</tr>
<tr>
<td>Phillips Head Screwdriver Size 1 Point</td>
<td>1</td>
</tr>
<tr>
<td>Diagonal Cutters</td>
<td>1</td>
</tr>
<tr>
<td>Phillips Head Screwdriver</td>
<td>1</td>
</tr>
<tr>
<td>Standard Screwdriver</td>
<td>1</td>
</tr>
<tr>
<td>Torque Wrench inch pounds</td>
<td>1</td>
</tr>
</tbody>
</table>

**PRODUCT INFORMATION**

**Introduction**

Cooper Power Systems QD3/T350 Main Moveable Contact Assembly Kit and installation instructions gives customers the ability and guidance to replace the main moveable contacts during maintenance cycles when contact erosion has occurred to the point of needing replacement.

**Additional Information**

These instructions cannot cover all details or variations in the equipment, procedures, or process described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your representative.

**Acceptance and Initial Inspection**

Each moveable contact board is in good condition when accepted by the carrier for shipment. Upon receipt, inspect the shipping container for signs of damage. Unpack the moveable contact board and inspect it thoroughly for damage incurred during shipment. If damage is discovered, file a claim with the carrier immediately.

**Handling and Storage**

Be careful during handling and storage of the moveable contact board to minimize the possibility of damage. If the moveable contact board is to be stored for any length of time prior to installation, provide a clean, dry storage area.

**Standards**

ISO 9001 Certified Quality Management System
INSTALLATION PROCEDURE

Tap-Changer Removal from Voltage Regulator

1. Remove the internal position indicator shaft from the tap-changer indicator drive tube. (See Figure 37.)

2. Using a pair of diagonal side cutters, cut and remove the cable-ties from the control winding hard insulation tube and tap-changer top bracket assembly. (See Figure 38.)

3. Use a 9/16 inch socket and ratchet to loosen and remove the nut and carriage bolt fastening the tap-changer bracket to the regulator side channel. (See Figure 39.)
4. Using a Phillips head screwdriver, loosen and remove the TCB terminal board leads from the 14 position terminal board located on the top right of the QD3 tap-changer. (See Figure 40.)

<table>
<thead>
<tr>
<th>Lead Color</th>
<th>TCB Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue/White</td>
<td>1</td>
</tr>
<tr>
<td>Green/White</td>
<td>5</td>
</tr>
<tr>
<td>Blue</td>
<td>9</td>
</tr>
<tr>
<td>Green</td>
<td>10</td>
</tr>
<tr>
<td>Orange</td>
<td>11</td>
</tr>
<tr>
<td>Red/Black</td>
<td>13</td>
</tr>
<tr>
<td>White</td>
<td>G</td>
</tr>
</tbody>
</table>

5. Use a Phillips head screwdriver and needle nose pliers to disconnect the white E control winding leads and P leads, if available, from the seven position terminal board located on the left top of the tap-changer. (See Figure 41.)

Control Winding E Lead and P Lead, If Available, Connections.

6. Use a deep well 9/16 inch socket with a ratchet or a 9/16 inch wrench to loosen and remove all lead connections from the back of the tap-changer contact board. (See Figure 42.)

**CAUTION:**

Do not remove lead ties from lead bundles holding the tap leads in a certain position. Try to keep from moving the lead bundles from normal position. Doing so can result possibly in de-electric failures.

**TABLE 3**

<table>
<thead>
<tr>
<th>Lead Color</th>
<th>TCB Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue/White</td>
<td>1</td>
</tr>
<tr>
<td>Green/White</td>
<td>5</td>
</tr>
<tr>
<td>Blue</td>
<td>9</td>
</tr>
<tr>
<td>Green</td>
<td>10</td>
</tr>
<tr>
<td>Orange</td>
<td>11</td>
</tr>
<tr>
<td>Red/Black</td>
<td>13</td>
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<tr>
<td>White</td>
<td>G</td>
</tr>
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**TABLE 4**

<table>
<thead>
<tr>
<th>Lead Marker</th>
<th>Terminal Board ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Could be on either E1, E2, or E3</td>
</tr>
<tr>
<td>E1</td>
<td>E1</td>
</tr>
<tr>
<td>E2</td>
<td>E2</td>
</tr>
<tr>
<td>E3</td>
<td>E3</td>
</tr>
<tr>
<td>P</td>
<td>If available, could be on either P1, P2, or P3</td>
</tr>
<tr>
<td>P1</td>
<td>P1</td>
</tr>
<tr>
<td>P2</td>
<td>P2</td>
</tr>
<tr>
<td>P3</td>
<td>P3</td>
</tr>
</tbody>
</table>

Figure 40.

TCB lead color and termination points.

Figure 41.

E & P lead connections.

Figure 42.

Tap leads and reactor connections.
7. Remove the mounting bolts fastening the tap-changer-mounting bracket to the top core clamp. (See Figure 43.) Remove the tap-changer from the regulator and place on a work surface.

QD/T350 Tap-changer Assembly Separation

1. After removing the tap-changer from the regulator assembly, use a Phillips head one point screwdriver to loosen and remove the six screws mounting the Reversing, Lower, Raise and Neutral switch located in the upper left corner of the tap-changer assembly. (See Figure 44.)

2. Using a Phillips head screwdriver, loosen and remove the three mounting screws fastening the position indicator micro switch hub to the front of the tap-changer assembly. (See Figure 45.)

3. Remove the tapping indicator position lob pointer from the tap-changer. The lob may have to be pried a little to be removed. (See Figure 46.)
4. Disconnect and remove the blue and red strip leads from the 40-ohm resistor. These connections are push-on connections. (See Figure 47.)

5. Lay the tap-changer assembly flat on a work surface with the tap contact studs down on the surface.

6. Using a 5/32 Allen wrench loosen and remove the two pan head Allen screws from the tap-changer-mounting bracket. (See Figure 48.)

7. Using a 5/32 Allen wrench, loosen and remove the pan head Allen screws fastening the front drive assembly section and the contact panel assembly section together. (See Figure 49.)

8. Lift the front drive assembly off of the contact assembly and set aside. (See Figure 50.)

---

**Figure 47.**
40-Ohm resistor connections.

**Figure 48.**
Tap-changer bracket mounting.

**Figure 49.**
Drive panel and contact panel fastening.

**Figure 50.**
Tap-changer sections.
Main Moveable Contact Removal and Re-assembly

Removing Main Moveable and Geneva Assembly
1. Use a 9/16 wrench or a deep well 9/16 socket and ratchet, loosen and remove the number one main stationary contact stud mounting nut, lock washer, and flat washer. (See Figure 51.)

2. Remove stationary contact one from the contact assembly board. (See Figure 52.)

3. By hand, rotate the main moveable contact and Geneva gear assembly so that the moveable contact is in the stationary one contact position. (See Figure 53.)

4. Use a 9/16 wrench or deep well 9/16 socket and ratchet to remove the six nuts, lock washer, and flat washer fastening the P1 and P2 slip ring studs to the contact panel located in the center back of the stationary contact panel. (See Figure 53.)

5. Facing the Main moveable contact and Geneva gear assembly, pull forward removing the main contact assembly and P1 and P2 slip ring assemblies for the contact board assembly. (See Figure 54.)
6. Remove the P1 and P2 slip ring from the moveable contact and Geneva Gear Assembly by lifting the ring stud assembly upward on the opposite side of the moveable contact button. To help in identifying the slip ring see Figure 56. Slide the slip ring out of from between the moveable contact button. (See Figure 55.) Repeat this process for the second slip ring stud assembly.

![Figure 55. Slip ring removal.](image)

7. Place one of the Slip Ring Studs (see Figure 57) assembles over the hub of the moveable contact and Geneva gear assembly (see Figure 58). When putting the slip ring on the Geneva gear, angle the ring so that the ring can be inserted between the moveable contact buttons on the lower left hand moveable contact. (See Figure 58.)

![Figure 56. Slip ring.](image)

![Figure 57. Moveable contact assembly.](image)

![Figure 58. Slip ring & moveable contact assembly.](image)
8. Place the second slip ring stud assembly over the first ring assembly studs and the Geneva hub. Angle the ring assembly so that the ring can be inserted between the button contacts on the right hand upper moveable contact. (See Figure 59.)

9. Align the moveable contact and Geneva gear assembly so that the moveable contacts align up where the number one stationary contact has been removed. (See Figure 60.)

10. Align the stud of the slip rings with the mounting holes in the contact panel. The studs on the slip ring that is between the left hand lower button contact (Figure 61) will go into the holes that have the higher shoulder spacer as part of the contact panel. (See Figure 62.)

11. You may need to rotate the slip ring assemblies in the bottom contact to make the proper alignment.

12. Press the moveable and Geneva contact assembly to insert the studs.

13. You may find that after starting the studs the moveable and Geneva contact assembly will need to be rotated to position the moveable contact so that the contacts are not interfering with other stationary contacts during the installation.
14. Rotate the main moveable contact Geneva gear assembly onto the neutral stationary contact located under the reversing switch assembly. (See Figure 63.)

![Figure 63. Neutral position.](image)

15. Place a flat brass flat washer, external tooth lock washer, and 3/8 nut on each of the P1 and P2 slip ring studs and tighten with a 9/16 wrench or socket and ratchet. Torque the nut on the studs to 60-70 pound-inch (6.779-7.908 Nm).

16. Replace the number 1 stationary contact by inserting the contact stud into the contact-mounting hole in the contact panel. The contact position number is located on the contact panel. (See Figure 64.)

![Figure 64. Stationary contact one assembly.](image)

17. Place a brass flat washer, external tooth lock washer, and nut on the number 1 stationary contact stud. Tighten and torque the hardware 60-70 pound-inch (6.779-7.908 Nm).

**Tap-changer Re-Assembly**

1. Lay the contact panel assembly section flat on a table surface. (See Figure 65.)

![Figure 65. Stationary contact panel assembly.](image)

2. Place and align the tap-changer drive assembly section on top of the contact panel assembly. (See Figure 66.)

![Figure 66. Tap-changer Sections.](image)
3. Align the center hub of the main moveable contact assembly with the center hole in the tap-changer drive assembly. (See Figures 67 and 68.)

![Figure 67. Contact assembly and main moveable contacts.]

4. Press both of the tap-changer assembly sections together and stand up-right. (See Figure 69.)

![Figure 69. View of panel assembly.]

5. Insert four pan head Allen screws into the tap-changer assemblies. Two screws will mount the two tap-changer assemblies and the terminal block bracket at the top of the tap-changer. The other two screws are inserted in the mounting holes along both side centers of the tap-changer. (See Figure 70.)

![Figure 70. Panel assembly fastening.]

---

28
6. Place the mounting bracket (see Figure 71) to the base of the tap-changer assembly and fasten with two pan head hex screw and tighten with a 5/32 Allen Wrench. (See Figure 72.)

![Figure 71. Tap-changer mounting bracket.]

7. Place the neutral position pointer lob (see Figure 73) into the main moveable contact hub located in the lower front center of the drive assembly panel. (See Figure 74.)

![Figure 73. Position indicator lob.]

![Figure 72. Bracket fastening.]

![Figure 74. Lob placement.]
8. Fasten the tap position switch assembly to the front of the drive panel assembly with three pan head Phillip screws. (See Figure 75.)

9. Position the position actuator arm between the center position and L by rotating the pinion counter clockwise. (See Figure 76.) This will allow for mounting the micro switches without interference with the micro switch arms.

10. Place and fasten the reversing logic and neutral logic micro switches on the upper left of the drive assembly panel. The micro switch with a blue white striped wire and blue black striped wire is located on the R position. The micro switch with a red white striped wire and red black striped wire is located on the L position. The micro switch with an orange wire and a white wire is located on the center position between the R and L position. (See Figure 77.)

11. Rotate the pinion back clockwise until the arm in Figure 77 is in the center and the neutral switch is depressed.

12. Connect the blue wires with red stripes to the 40-ohm resistor by pushing the female connector onto the resistor terminals. (See Figure 78.)
13. Check and set the tap-changer for neutral position. The tap-changer can be set for any tap position by rotating the pinion cam in either the clockwise or counter clockwise direction. For rotating to the neutral position, the reversing logic switch actuator must be in the center with the neutral switch arm depressed. The tap position lob must have the pointer pointing at N. The pinion cam point is pointing at the three o’clock position over the holding switch lever arm. The holding switch is open. (See Figure 79.)

![Figure 79. Neutral position.](image)

**Re-assembly of Tap-changer to Voltage Regulator Assembly**

1. Once the tap-changer has been re-assembled, reverse the process in the procedure titled “Tap-changer Removal from Voltage Regulator” at the beginning of these instructions.
QD3/T350 Main Moveable Contact Assembly Kit
Kit 5741325B04

Refer to Service Information S225-50-41

GENERAL

The purpose of this replacement procedure is to provide the parts and installation instructions for replacing the main stationary contacts on a QD3 Quik-Drive Tap-changer.

This installation instruction is made up of four different procedure sections:
- Tap-changer Removal from Voltage Regulator
- QD3/T350 Tap-changer Assembly Separation
- Main Stationary Contact Removal and Re-Assembly
- Tap-changer Re-assembly

TABLE 5
Parts Supplied

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0791822A01</td>
<td>Main Stationary Contact</td>
<td>1</td>
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</tbody>
</table>

TABLE 6
Tools Required

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needle Nose Pliers</td>
<td>1</td>
</tr>
<tr>
<td>9/16 inch Deep Well Socket</td>
<td>1</td>
</tr>
<tr>
<td>5/32 Allen Wrench</td>
<td>1</td>
</tr>
<tr>
<td>Phillips Head Screwdriver size 1 point</td>
<td>1</td>
</tr>
<tr>
<td>Diagonal Cutters</td>
<td>1</td>
</tr>
<tr>
<td>Phillips Head Screwdriver</td>
<td>1</td>
</tr>
<tr>
<td>Standard Screwdriver</td>
<td>1</td>
</tr>
<tr>
<td>Torque Wrench inch pounds</td>
<td>1</td>
</tr>
<tr>
<td>3/8 inch Drive Ratchet Wrench</td>
<td>1</td>
</tr>
</tbody>
</table>

Acceptance and Initial Inspection

Each Stationary Contact Assembly is in good condition when accepted by the carrier for shipment. Upon receipt, inspect the shipping container for signs of damage. Unpack the Stationary Contact Assembly and inspect it thoroughly for damage incurred during shipment. If damage is discovered, file a claim with the carrier immediately.

Handling and Storage

Be careful during handling and storage of the Stationary Contact Assembly to minimize the possibility of damage. If the moveable contact board is to be stored for any length of time prior to installation, provide a clean, dry storage area.

Standards

ISO 9001 Certified Quality Management System

PRODUCT INFORMATION

Introduction

The QD3/T350 Main Stationary Contact Assembly Kit and installation instructions give customers the ability and guidance to replace the stationary contact during maintenance cycles when contact erosion has occurred to the point of needing replacement.

Additional Information

These instructions cannot cover all details or variations in the equipment, procedures, or process described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your representative.

INSTALLATION PROCEDURE

Tap-Changer Removal from Voltage Regulator

1. Remove the internal position indicator shaft from the tap-changer indicator drive tube. (See Figure 80.)

Figure 80.
Internal flex shaft.
2. Use a pair of diagonal side cutters to cut and remove the cable-ties from the control winding hard insulation tube and tap-changer top bracket assembly. (See Figure 81.)

3. Use a 9/16 inch socket and ratchet to loosen and remove the nut and carriage bolt fastening the tap-changer bracket to the regulator side channel. (See Figure 82.)

4. Use a Phillips head screwdriver to loosen and remove the TCB terminal board leads from the 14 position terminal board located on the top right of the QD3 tap-changer. (See Figure 83.)

<table>
<thead>
<tr>
<th>Lead Color</th>
<th>TCB Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue/White</td>
<td>1</td>
</tr>
<tr>
<td>Green/White</td>
<td>5</td>
</tr>
<tr>
<td>Blue</td>
<td>9</td>
</tr>
<tr>
<td>Green</td>
<td>10</td>
</tr>
<tr>
<td>Orange</td>
<td>11</td>
</tr>
<tr>
<td>Red/Black</td>
<td>13</td>
</tr>
<tr>
<td>White</td>
<td>G</td>
</tr>
</tbody>
</table>

5. Use a Phillips head screwdriver and needle nose pliers to disconnect the white E control winding leads, and P leads if available, from the seven position terminal board located on the left top of the tap-changer. See Figure 84.

Control winding E lead and (P lead if available) Connections. The E lead will have E lead ID markers and the P leads if available will have P lead markers.

<table>
<thead>
<tr>
<th>Lead Marker</th>
<th>Terminal Board ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Could be on either E1, E2, or E3</td>
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<tr>
<td>E1</td>
<td>E1</td>
</tr>
<tr>
<td>E2</td>
<td>E2</td>
</tr>
<tr>
<td>E3</td>
<td>E3</td>
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<tr>
<td>P</td>
<td>If available could be on either P1, P2, or P3</td>
</tr>
<tr>
<td>P1</td>
<td>P1</td>
</tr>
<tr>
<td>P2</td>
<td>P2</td>
</tr>
<tr>
<td>P3</td>
<td>P3</td>
</tr>
</tbody>
</table>
6. Use a deep well 9/16 inch socket with ratchet or a 9/16 inch wrench to loosen and remove all lead connections from the back of the tap-changer contact board. (See Figure 85.)

**CAUTION:**
Do not remove lead ties from lead bundles holding the tap leads in a certain position. Try to keep from moving the lead bundles from normal position. Doing so can result, possibly, in de-electric failures.

7. Remove the mounting bolts fastening the tap-changer-mounting bracket to the top core clamp. See (Figure 86.) Remove the tap-changer from the regulator and place on a work surface.

**QD3/T350 Tap-Changer Assembly Separation**

1. After removing the tap-changer from the regulator assembly, use a Phillips one point screwdriver to loosen and remove the six screws mounting the Reversing Lower, Raise and Neutral switch located in the upper left corner of the tap-changer assembly. (See Figure 87.)
2. Use a Phillips head screwdriver to loosen and remove the three mounting screws fastening the position indicator micro switch hub to the front of the tap-changer assembly. (See Figure 88.)

![Figure 88. Position indicator hub.](image)

3. Remove the tapping indicator position lob pointer from the tap-changer. The lob may have to be pried a little to be removed. (See Figure 89.)

![Figure 89. Indicator position lob.](image)

4. Disconnect and remove the blue and red strip leads from the 40-ohm resistor. These connections are push-on connection. (See Figure 90.)

![Figure 90. 40 Ohm resistor connections.](image)

5. Lay the tap-changer assembly flat on a work surface with the tap contact studs down on the surface.

6. Use a 5/32 Allen wrench to loosen and remove the two pan head Allen screws from the tap-changer-mounting bracket. (See Figure 91.)

![Figure 91. Tap-changer bracket mounting.](image)

7. Using a 5/32 Allen wrench loosen and remove the pan head Allen screws fastening the front drive assembly section and the contact panel assembly section together. (See Figure 92.)

![Figure 92. Driver panel and contact panel fastening.](image)
Main Stationary Contact Removal and Re-Assembly.

1. Use a 9/16 wrench or a deep well 9/16 socket and ratchet, loosen and remove the brass nut on the stationary contact that is to be removed, remove the external tooth lock washer and brass flat washer. (See Figure 94.)

2. Push the contact stud through the mounting hole in the contact panel. (See Figure 95.)

3. Remove the stationary contact from the contact panel.

4. Insert the new stationary contact stud through the mounting hole for that number of stationary contact. Make sure that the stationary contact is aligned for proper fitting in the contact board assembly. (See Figure 96.)

5. Place a brass flat washer, external tooth lock washer, and nut onto the stationary contact stud. Tighten and torque the hardware to 60-70 pound-inch (6.779-7.908 Nm) torque.

6. The above process is used for each of the eight stationary contacts on the QD3 contact panel.

QD3 has eight main stationary contacts all labeled with the tap number on the contact panel.

Tap-Changer Re-Assembly

1. Lay the contact panel assembly section flat on a table surface. (See Figure 96.)
2. Place and align the tap-changer drive assembly section on top of the contact panel assembly. (See Figure 97.)

3. Align the center hub of the main moveable contact assembly with the center hole in the tap-changer drive assembly. (See Figures 98 and 99.)

4. Press both of the tap-changer assembly sections together and stand up-right. (See Figure 100.)
5. Insert four pan head Allen screws into the tap-changer assemblies. Two screws will mount the two tap-changer assemblies and the terminal block bracket at the top of the tap-changer. The other two screws are inserted in the mounting holes along both side centers of the tap-changer. (See Figure 101.)

6. Place the mounting bracket (see Figure 102) to the base of the tap-changer assembly and fasten with two pan head hex screw and tighten with a 5/32 Allen Wrench. (See Figure 103.)

7. Place the neutral position pointer lob, see (Figure 104), into the main moveable contact hub located in the lower front center of the drive assembly panel. (See Figure 105.)

8. Fasten the tap position switch assembly to the front of the drive panel assembly with three pan head Phillip screws. (See Figure 106.)
9. Position the position actuator arm between the center position and L by rotating the pinion counter clockwise. (See Figure 107.) This will allow for mounting the micro switches without interference with the micro switch arms.

10. Place and fasten the reversing logic and neutral logic micro switches on the upper left of the drive assembly panel. The micro switch with a blue white striped wire and blue black striped is located on the R position. The micro switch with a red white striped wire and red black striped wire is located on the L position. The micro switch with an orange wire and a white wire is located on the center position between the R and L position. (See Figure 108.)

11. Rotate the pinion back clockwise until the arm in Figure 108 is in the center and the neutral switch is depressed.

12. Connect the blue wires with red strips to the 40 ohm resistor by pushing the female connector on to the resistor terminals. (See Figure 109.)

13. Check and set the tap-changer for neutral position. The tap-changer can be set for any tap position by rotating the pinion cam in either the clockwise or counter clock wise direction. For neutral position the reversing logic switch actuator must be in the center with the neutral switch arm depressed. The tap position lob must have the pointer pointing at N. The pinion cam point is pointing at the three o’clock position over the holding switch lever arm. The holding switch is open. (See Figure 110.)

Re-Assembly of Tap-Changer to Voltage Regulator Assembly

1. Once the tap-changer has been re-assembled, reverse the process in the procedure titled “Tap-changer Removal from Voltage Regulator” at the beginning of the installation instructions.
QD3/T350 MOTOR REPLACEMENT KIT
KIT NUMBER 57A63675100B
Refer to Service Information S225-50-35

GENERAL

The purpose of this replacement kit is to provide the parts and installation instructions for replacing the motor on a QD3 Quik Drive Tap-changer.

**TABLE 9**
Parts Supplied

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
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<td>Ring Terminal</td>
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</tr>
<tr>
<td>2</td>
<td>TAA136263002</td>
<td>Cable Tie</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>TAA136263001</td>
<td>Cable Tie</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>0692044A060</td>
<td>Creep Insulation Tube</td>
<td>6 inches</td>
</tr>
<tr>
<td>5</td>
<td>08000731992Z</td>
<td>“E” Clip</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>2291846A01</td>
<td>Motor</td>
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**TABLE 10**
Tools Required

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<th>Description</th>
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<td>Crimper</td>
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</tr>
<tr>
<td>Diagonal Cutters</td>
<td>1</td>
</tr>
<tr>
<td>Phillips Screw Driver</td>
<td>1</td>
</tr>
<tr>
<td>Standard Screw Driver</td>
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</tr>
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<td>Allen Wrench 1/8 inch</td>
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</tr>
<tr>
<td>Allen Wrench 5/32 inch</td>
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<td>Allen Wrench 3/16 inch</td>
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</tr>
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<td>9/16 Socket</td>
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</tr>
<tr>
<td>Ratchet</td>
<td>1</td>
</tr>
<tr>
<td>Needle Nose Pliers</td>
<td>1</td>
</tr>
</tbody>
</table>

**Motor Removal Instructions**

1. Remove the internal position indicator shaft from the tap-changer indicator drive tube. (See Figure 112.)

![Figure 112. Internal flex shaft.](image-url)
2. Use a pair of diagonal side cutters and cut and remove the cable ties from the control winding hard insulation tube and tap-changer top bracket assembly. (See Figure 113.)

3. Use a 9/16 inch socket and ratchet to loosen and remove the nut and carriage bolt fastening the tap-changer bracket to the regulator side channel. (See Figure 114.)

4. Using a 1/8 inch Allen wrench, remove the three button Allen head screws fastening the motor bracket to the tap-changer assembly. (See Figure 115.)

5. Using a Phillips screwdriver, loosen and remove the blue motor lead terminal from the tap-changer larger terminal board terminal position 2, red lead from terminal position 6 and the white ground lead from terminal position G. (See Figure 116.)
6. Using a pair of diagonal side cutters, cut and remove the two cable ties fastening the motor wires to the main harness. (See Figure 117.)

7. Using a pair of diagonal side cutters, cut and remove the two medium cable ties fastening the motor harness and main wiring harness to the tap-changer top terminal board. (See Figure 117.)

8. Use a 5/32 inch Allen wrench and remove the two button Allen head screws mounting the top tap-changer bracket to the tap-changer. See Figure 118.

9. Lift the top bracket clearing the position indicator tube and the main wiring harness. (See Figure 119.)

10. Lift the motor and gear assembly out of the tap-changer assembly and place on a work surface.

11. Use a pair of needle nose pliers and remove the "E" clip fastening the motor gear to the motor shaft. (See Figure 120.)
12. To remove the gear from the motor, use a standard screwdriver to pry the gear off of the motor shaft. Place the screwdriver between the motor and the gear. Pry the gear forward until the gear clears the shaft. (See Figure 121.)

![Motor and gear.](image1)

Figure 121.
Motor and gear.

13. Using a 3/16 inch Allen wrench, loosen and remove the Allen button head screws fastening the bracket to the motor. (See Figure 122.)

![3/16 inch Allen Head Screws](image2)

Figure 122.
Motor bracket.

New Motor Assembly

14. Place the red, blue, and white motor leads through item #4 creep insulation.

15. Position the motor onto the motor mount bracket so that the motor leads are on the side where there are two mounting ears. (See Figure 123.)

![Motor Bracket Mounting Ears](image3)

Figure 123.
Motor and bracket alignment.

16. Fasten the motor mount bracket onto the motor using four button Allen head 3/16 inch screws and tighten with a 3/16 inch Allen wrench.

17. Place the motor gear onto the motor shaft with the hex nut to the outside. (See Figure 124.)

![Gear Hex Nut](image4)

Figure 124.
Motor gear placement.
18. Using a pair of needle nose pliers, press the "E" clip over the motor shaft groove. The center "E" Clip point must be on the flat surface of the motor shaft. (See Figure 125.)

19. With the motor leads to the outside, place the motor gear between the tap-changer sections. The motor gear must match up with the pinion drive gear. (See Figure 126.)

20. Place one drop of locktite on each motor button Allen head screw thread (1/8).

21. Position the top bracket so that the position indicator drive tube and main wiring harness is through the bracket holes. Align the bracket and motor mounting holes. (See Figure 127.)

22. Place the 1/8 inch button Allen head screws into the right side and right top of the plate. The bottom right screw also requires a flat washer. (See Figure 128.) Use a 1/8 inch Allen wrench and tighten the connection between the motor bracket and the front plate.
23. Place the 5/32 inch button Allen head screws in the top bracket and front plate, tightening with a 5/32 Allen wrench. (See Figure 129.)

24. The inside 1/8 inch motor mounting button head screw may be easier to start after tightening the 5/32 inch button Allen head screws.

25. Crimp a ring tongue terminal item #1 to each of the motor wires after cutting and stripping to fit.

26. Connect the blue motor wire to post 2 of the large terminal board, connect the red wire to post 6, and the white wire to the ground post G. (See Figure 130.)

27. Use two cable ties item #2, to fasten the motor leads to the main wiring harness.

28. Place the insulation paper tubing and motor wires in the bracket slots at the end of the bracket above the motor and cable tie with one item #3. (See Figure 131.)

29. Bundle with plastic cable ties the main wiring harness insulator tube to the bracket with one cable tie, item #3. (See Figure 131.)

30. Place the carriage bolt into the square hole of the tap-changer top bracket. Place the 9/16 nut onto the bolt through the side channel and tighten with the socket and ratchet. (See Figure 114.)

31. Place the control winding hard tubing insulation against the tap-changer top bracket and bundle with plastic cable ties with item #3. (See Figure 113.)
QD3/T350 MOTOR RESISTOR REPLACEMENT KIT

KIT NUMBER 5791844A01

Refer to Service Information S225-50-37

GENERAL

The purpose of this replacement kit is to provide the parts and installation instructions for replacing the motor resistor on a QD3 Quik Drive Tap-changer.

TABLE 11
Parts Supplied

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2291844A01</td>
<td>T350TC-HL 100 15N 40 ohm 5% Resistor</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 132.
Kit parts.

Resistor Removal Instructions

1. Using a pair of needle nose pliers, remove the push on connections from each end of the resistor. The colors for the resistor wires are blue/red. (See Figure 133.)

![Figure 133. Resistor connectors.]

2. Use a 1/8 inch Allen wrench and remove the button head screw from one resistor mounting clips. (See Figure 134.)

![Figure 134. Removing resistor clip fasteners.]

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen Wrench 1/8 inch</td>
<td>1</td>
</tr>
<tr>
<td>243 Locktite</td>
<td>1</td>
</tr>
<tr>
<td>Needle Nose Pliers</td>
<td>1</td>
</tr>
</tbody>
</table>
3. Remove the mounting clip from the resistor. (See Figure 135.)

![Figure 135. Resistor clip removed.](image1)

4. Work the resistor off of the second mounting clip by rotating the resistor clockwise and counter clockwise while pulling on the resistor.

**Resistor Installation**

5. Push the new resistor onto the mounting clip that is fastened to the lower tap-changer mounting bracket. The resistor terminals must be pointing upward. (See Figure 136.)

![Figure 136. Installing new resistor.](image2)

6. Press the loose mounting clip into the open end of the resistor. (See Figure 137.)

![Figure 137. Installing resistor clip.](image3)

7. Align the mounting clip along the slotted mounting hole up with the mounting hole in the tap-changer's lower mounting bracket.

8. Fasten the resistor mounting clip with the button head Allen screw after placing a drop of 243 Locktite on the screw threads and tighten with a 1/8 inch Allen wrench. (See Figure 138.)

![Figure 138. Fastening resistor assembly.](image4)
9. Push the blue/red wire push-on connectors onto each of the terminals on each end of the resistor. (See Figure 139.)

Figure 139.
Resistor lead connectors.
**QD3/T350 PI DRIVE CAM REPLACEMENT KIT**

**Kit Number 5740783B21**

**GENERAL**

The purpose of this replacement kit is to provide the parts and installation instructions for replacing the PI Drive Cam on a QD3 Quik Drive Tap-changer.

**TABLE 13**

Parts Supplied

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2240783B21</td>
<td>PI Drive Cam</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2291652A06</td>
<td>Sprocket Key</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>0891663A09</td>
<td>PI Cam Wave Washer</td>
<td>1</td>
</tr>
</tbody>
</table>

**TABLE 14**

Tools Required

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips Screw Driver</td>
<td>1</td>
</tr>
<tr>
<td>243 Locktite</td>
<td>1</td>
</tr>
</tbody>
</table>

**PI Cam Removal**

1. If possible, rotate the PI Cam so that the point of the cam is pointing toward the holding switch actuator. (See Figure 141.) The PI Cam can be easily rotated by hand.

2. Hold the PI Cam so that the cam does not rotate. Use a Phillips screwdriver and loosen and the mounting screw. (See Figure 141.)

3. Pull the cam forward removing the cam from the tap-changer drive shaft. (See Figure 142.)

---

Figure 140.
Kit parts.

Figure 141.
PI cam and holding switch actuator.

Figure 142.
Tap-changer drive shaft.
4. Remove the Sprocket Key from the PI Cam slot. (See Figure 143.)

![Figure 143. PI cam and sprocket key.]

5. Remove the PI Cam Wave Washer that is located between the PI Cam and the front surface of the tap-changer. (See Figure 144.)

![Figure 144. PI cam wave washers.]

6. Place the new PI Cam wave washer over the shaft. (See Figure 145.)

7. Place either the new sprocket key or the original sprocket key in the slot of the new PI Cam.

8. Align the new PI Cam up so that the sprocket key matches up with the key slot in the shaft. Insert the sprocket key in the slot between the shaft and the PI Cam.

9. Rotate the PI Cam point so it is pointing at the actuator located on the holding switch. (See Figure 145.) The large radius end of the cam should be match with the radius arc of the PT Drive Geneva Gear. (See Figure 145.)

![Figure 145. PI cam assembly.]

10. Place the washer over the PI Cam fastening screw.

11. Place a drop of 243 Locktite on to the screw threads. Place the screw into the tapped hole on the shaft and hold the PI Drive Cam so it does not rotate while tighten with a Phillips Screw Driver.
QD3/T350 REVERSING STATIONARY CONTACT ASSEMBLY

Instructions Kit Number 5791822A02

Refer to Service Information S225-50-43

GENERAL

The purpose of this replacement kit is to provide the parts and installation instruction for replacing the reversing stationary contacts on a QD3 Quik Drive Tap-changer. The VR and VL reversing stationary contacts are symmetrical; therefore, one stationary contact can be used either for the VR or the VL stationary.

This installation instruction is made up of four different procedures sections:
- Tap-changer Removal from Voltage Regulator
- QD3/T350 Tap-changer Assembly Separation
- Reversing Stationary Contact Removal and Re-assembly
- Tap-changer Re-assembly

TABLE 15
Parts Supplied

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2291844A01</td>
<td>T350TC-HL 100 15N 40 ohm 5% Resistor</td>
<td>1</td>
</tr>
</tbody>
</table>

TABLE 16
Tools Required

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needle Nose Pliers</td>
<td>1</td>
</tr>
<tr>
<td>9/16 inch Deep Well Socket</td>
<td>1</td>
</tr>
<tr>
<td>3/8 inch Drive Ratchet Wrench</td>
<td>1</td>
</tr>
<tr>
<td>5/32 Allen Wrench</td>
<td>2</td>
</tr>
<tr>
<td>Phillips Head Screwdriver Size 1 Point</td>
<td>1</td>
</tr>
<tr>
<td>Diagonal Cutters</td>
<td>1</td>
</tr>
<tr>
<td>Phillips Head Screwdriver</td>
<td>1</td>
</tr>
<tr>
<td>Standard Screwdriver</td>
<td>1</td>
</tr>
<tr>
<td>Torque Wrench inch pounds</td>
<td>1</td>
</tr>
<tr>
<td>3/8 inch drive 0-200 lb-in (0-25 Nm) torque wrench</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 146.
Kit part.
Tap-Changer Removal From Voltage Regulator

1. Remove the internal position indicator shaft from the tap-changer indicator drive tube. (See Figure 147.)

![Figure 147. Internal flex shaft.](image)

2. Use a pair of diagonal side cutters to cut and remove the cable-ties from the control winding hard insulation tube and tap-changer top bracket assembly. (See Figure 148.)

![Figure 148. Control cable fastening.](image)

3. Use a 9/16 inch socket and ratchet to loosen and remove the nut and carriage bolt fastening the tap-changer bracket to the regulator side channel. (See Figure 149.)

![Figure 149. Tap-changer and side channel fastener.](image)

4. Use a Phillips head screwdriver to loosen and remove the TCB terminal board leads from the 14 position terminal board located on the top right of the QD3 tap-changer. (See Figure 150.)

**TABLE 17**

<table>
<thead>
<tr>
<th>Lead Color</th>
<th>TCB Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue/White</td>
<td>1</td>
</tr>
<tr>
<td>Green/White</td>
<td>5</td>
</tr>
<tr>
<td>Blue</td>
<td>9</td>
</tr>
<tr>
<td>Green</td>
<td>10</td>
</tr>
<tr>
<td>Orange</td>
<td>11</td>
</tr>
<tr>
<td>Red/Black</td>
<td>13</td>
</tr>
<tr>
<td>White</td>
<td>G</td>
</tr>
</tbody>
</table>

![Figure 150. TCB lead color and termination points.](image)
5. Use a Phillips head screwdriver and needle nose pliers to disconnect the white E control winding leads, and P leads if available, from the seven position terminal board located on the left top of the tap-changer. (See Figure 151.)

Control winding E lead and (P lead if available) Connections.
The E lead will have E lead ID markers and the P leads if available will have P lead markers.

**TABLE 18**
Lead Marker and Terminal Board ID

<table>
<thead>
<tr>
<th>Lead Marker</th>
<th>Terminal Board ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Could be on either E1, E2, or E3</td>
</tr>
<tr>
<td>E1</td>
<td>E1</td>
</tr>
<tr>
<td>E2</td>
<td>E2</td>
</tr>
<tr>
<td>E3</td>
<td>E3</td>
</tr>
<tr>
<td>P</td>
<td>If available could be on either P1, P2, or P3</td>
</tr>
<tr>
<td>P1</td>
<td>P1</td>
</tr>
<tr>
<td>P2</td>
<td>P2</td>
</tr>
<tr>
<td>P3</td>
<td>P3</td>
</tr>
</tbody>
</table>

**Figure 151.**
E & P lead connections.

6. Use a deep well 9/16 inch socket with ratchet or a 9/16 inch wrench to loosen and remove all lead connections from the back of the tap-changer contact board. (See Figure 152.)

**Figure 152.**
Tap leads and reactor connections.

7. Remove the mounting bolts fastening the tap-changer-mounting bracket to the top core clamp. (See Figure 153.) Remove the tap-changer from the regulator and place on a work surface.

**Figure 153.**
Tap-changer to core clamp fastening hardware.

---

**CAUTION:**
Do not remove lead ties from lead bundles holding the tap leads in a certain position. Try to keep from moving the lead bundles from normal position. Doing so can result, possibly, in de-electric failures.
QD3/T350 Tap-Changer Assembly Separation

1. After removing the tap-changer from the regulator assembly, use a Phillips one point screwdriver to loosen and remove the six screws mounting the Reversing Lower, Raise and Neutral switch located in the upper left corner of the tap-changer assembly. (See Figure 154.)

2. Use a Phillips head screwdriver to loosen and remove the three mounting screws fastening the position indicator micro switch hub to the front of the tap-changer assembly. (See Figure 155.)

3. Remove the tapping indicator position lob pointer from the tap-changer. The lob may have to be pried a little to be removed. (See Figure 156.)

4. Disconnect and remove the blue and red strip leads from the 40-ohm resistor. These connections are push-on connection. (See Figure 157.)
5. Lay the tap-changer assembly flat on a work surface with the tap contact studs down on the surface.

6. Using a 5/32 Allen wrench loosen and remove the two pan head Allen screws from the tap-changer-mounting bracket. (See Figure 158.)

Figure 158.
Tap-changer bracket mounting.

7. Use a 5/32 Allen wrench to loosen and remove the pan head Allen screws fastening the front drive assembly section and the contact panel assembly section together. (See Figure 159.)

Figure 159.
Drive panel and contact panel fastening.

8. Lift the front drive assembly off of the contact assembly and set aside. (See Figure 160.)

Figure 160.
Tap-changer sections.

Reversing Stationary Contact Removal and Re-Assembly

1. The main moveable stationary contact must be located on the neutral stationary contact located under the reversing moveable contact arm. The reversing moveable contact buttons must be located in the center space between the VR and VL stationary contacts. (See Figure 161.)

Figure 161.
Reversing stationary and reversing moveable.

2. If not, by hand rotate the main moveable contact assembly so that statement in step one is true.

3. The VR and VL stationary contact are reversible, or one can be use for the other.
4. Using a 9/16 wrench, or 9/16 socket and ratchet loosen and remove the nut, external lock washer, and flat wash for the VR and/or VL stationary contact. (See Figure 162.)

**Figure 162.**
VL and VR fastening hardware.

5. Push the stationary contact stud through the contact panel removing the stationary contact from the contact panel. (See Figure 163.)

6. Place stationary contacts in either VR or VL position or both. (See Figure 163.)

7. Place a flat brass washer, external tooth lock washer, and nut on the stationary contact stud. Tighten and torque to 60-70 pound-inch torque (6.779-7.908 Nm).

**Figure 163.**
Stationary contact removal.

---

**Tap-Changer Re-Assembly**

1. Lay the contact panel assembly section flat on a table surface. (See Figure 164.)

**Figure 164.**
Stationary contact panel assembly.

2. Place and align the tap-changer drive assembly section on top of the contact panel assembly. (See Figure 165.)

**Figure 165.**
Tap-changer sections.
3. Align the center hub of the main moveable contact assembly with the center hole in the tap-changer drive assembly. (See Figures 166 & 167.)

4. Press both of the tap-changer assembly sections together and stand up-right. (See Figure 168.)

5. Insert four pan head Allen screws into the tap-changer assemblies. Two screws will mount the two tap-changer assemblies and the terminal block bracket at the top of the tap-changer. The other two screws are inserted in the mounting holes along both side centers of the tap-changer. (See Figure 169.)
6. Place the mounting bracket, (see Figure 170), to the base of the tap-changer assembly and fasten with two pan head hex screw and tighten with a 5/32 Allen Wrench. (See Figure 171.)

![Figure 170. Tap-changer mounting bracket.](image)

![Figure 171. Bracket fastening.](image)

7. Place the neutral position pointer lobe, (see Figure 172), into the main moveable contact hub located in the lower front center of the drive assembly panel. (See Figure 173.)

![Figure 172. Position lob indicator.](image)

8. Fasten the tap position switch assembly to the front of the drive panel assembly with three pan head Phillip screws. (See Figure 174.)

![Figure 173. Lob placement.](image)

![Figure 174. Lob placement.](image)
9. Position the position actuator arm between the center position and L by rotating the pinion counter clockwise. (See Figure 175.) This will allow for mounting the micro switches without interference with the micro switch arms.

10. Place and fasten the reversing logic and neutral logic micro switch on the upper left of the drive assembly panel. The micro switch with a blue white striped wire and blue black striped is located on the R position. The micro switch with a red white striped wire and red black striped wire is located on the L position. The micro switch with an orange wire and a white wire is located on the center position between the R and L position. (See Figure 176.)

11. Rotate the pinion back clockwise until the arm in Figure 176 is in the center and the neutral switch is depressed.

12. Connect the blue wires with red strips to the 40-ohm resistor by pushing the female connector on to the resistor terminals. (See Figure 177.)

13. Check and set the tap-changer for neutral position. The tap-changer can be set for any tap position by rotating the pinion cam in either the clockwise or counter clockwise direction. For neutral position the reversing logic switch actuator must be in the center with the neutral switch arm depressed. The tap position lob must have the pointer pointing at N. The pinion cam point is pointing at the three o’clock position over the holding switch lever arm. The holding switch is open. (See Figure 178.)

Re-Assembly of Tap-changer to Voltage Regulator Assembly

Once the tap-changer has been re-assembled, reverse the process in the procedure titled “Tap-changer Removal from Voltage Regulator” at the beginning of these installation instructions.
**QD3/T350 REVERSING MOVEABLE CONTACT AND NEUTRAL STATIONARY CONTACT ASSEMBLY KIT**

**Kit Number 5741325B03**

Refer to Service Information S225-50-44

**GENERAL**

The purpose of this replacement procedure is to provide the instructions for replacing the main stationary contacts on a QD3 Quik Drive Tap-changer. This installation instruction is made up of four different procedure sections:
- Tap-changer Removal from Voltage Regulator
- QD3/T350 Tap-changer Assembly Separation
- Reversing Moveable and Neutral Stationary Contact Removal and Re-assembly
- Tap-changer Re-assembly

**TABLE 19**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>5741325B03</td>
<td>Reversing Moveable Neutral Stationary Contact Assembly</td>
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</tr>
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</table>

**TABLE 20**

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Needle Nose Pliers</td>
<td>1</td>
</tr>
<tr>
<td>9/15 inch Deep Well socket</td>
<td>1</td>
</tr>
<tr>
<td>3/8 inch Drive Ratchet Wrench</td>
<td>1</td>
</tr>
<tr>
<td>5/32 Allen Wrench</td>
<td>1</td>
</tr>
<tr>
<td>Phillips Head Screwdriver Size 1 Point</td>
<td>1</td>
</tr>
<tr>
<td>Diagonal Cutters</td>
<td>1</td>
</tr>
<tr>
<td>Phillips Head Screwdriver</td>
<td>1</td>
</tr>
<tr>
<td>Standard Screwdriver</td>
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</tr>
<tr>
<td>Torque Wrench inch pounds</td>
<td>1</td>
</tr>
</tbody>
</table>

**INSTALLATION PROCEDURE**

Figure 179.
Kit part Item 1.

Figure 180.
Kit part Item 1.
Tap-changer Removal from Voltage Regulator

1. Remove the internal position indicator shaft from the tap-changer indicator drive tube. (See Figure 181.)

![Figure 181. Internal flex shaft.](image)

2. Use a pair of diagonal side cutters cut and remove the cable-ties from the control winding hard insulation tube and tap-changer top bracket assembly. (See Figure 182.)

![Figure 182. Control cable fastening.](image)

3. Use a 9/16 inch socket and ratchet to loosen and remove the nut and carriage bolt fastening the tap-changer bracket to the regulator side channel. (See Figure 183.)

![Figure 183. Tap-changer and side channel fastener.](image)

4. Using a Phillips head screwdriver, loosen and remove the TCB terminal board leads from the 14 position terminal board located on the top right of the QD3 tap-changer. (See Figure 184.)

![Figure 184. TCB lead color and termination points.](image)

### TABLE 21

<table>
<thead>
<tr>
<th>Lead Color</th>
<th>TCB Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue/White</td>
<td>1</td>
</tr>
<tr>
<td>Green/White</td>
<td>5</td>
</tr>
<tr>
<td>Blue</td>
<td>9</td>
</tr>
<tr>
<td>Green</td>
<td>10</td>
</tr>
<tr>
<td>Orange</td>
<td>11</td>
</tr>
<tr>
<td>Red/Black</td>
<td>13</td>
</tr>
<tr>
<td>White</td>
<td>G</td>
</tr>
</tbody>
</table>

![Table 21](image)
5. Use a Phillips head screwdriver and needle noise pliers to disconnect the white E control winding leads and P leads if available from the seven position terminal board located on the left top of the tap-changer. (See Figure 185.)

Control Winding E Lead and (P Lead if Available) Connections
The E lead will have E lead ID markers and the P leads, if available, will have P lead markers.

### TABLE 22
Lead Marker and Terminal Board ID

<table>
<thead>
<tr>
<th>Lead Marker</th>
<th>Terminal Board ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Could be on either E1, E2, or E3</td>
</tr>
<tr>
<td>E1</td>
<td>E1</td>
</tr>
<tr>
<td>E2</td>
<td>E2</td>
</tr>
<tr>
<td>E3</td>
<td>E3</td>
</tr>
<tr>
<td>P</td>
<td>If available, could be on either P1, P2, or P3</td>
</tr>
<tr>
<td>P1</td>
<td>P1</td>
</tr>
<tr>
<td>P2</td>
<td>P2</td>
</tr>
<tr>
<td>P3</td>
<td>P3</td>
</tr>
</tbody>
</table>

6. Use a deep well 9/16 inch socket with ratchet or a 9/16 inch wrench to loosen and remove all lead connections from the back of the tap-changer contact board. (See Figure 186.)

---

**CAUTION:**
Do not remove lead ties from lead bundles holding the tap leads in a certain position. Try to keep from moving the lead bundles from normal position. Doing so can result possibly in de-electric failures.
QD3/T350 Tap-Changer Assembly Separation

8. After removing the tap-changer from the regulator assembly, use a Phillips head one point screwdriver too loosen and remove the six screws mounting the Reversing Lower, Raise and Neutral switch located in the upper left corner of the tap-changer assembly. (See Figure 188.)

9. Using a Phillips head screwdriver, loosen and remove the three mounting screws fastening the position indicator micro switch hub to the front of the tap-changer assembly. (See Figure 189.)

10. Remove the tapping indicator position lob pointer from the tap-changer. The lob may have to be pried a little to be removed. (See Figure 190.)

11. Disconnect and remove the blue and red strip leads from the 40-Ohm resistor. These connections are push-on connections. (See Figure 191.)

12. Lay the tap-changer assembly flat on a work surface with the tap contact studs down on the surface.
13. Using a 5/32 Allen wrench loosen and remove the two pan head Allen screws from the tap-changer-mounting bracket. (See Figure 192.)

14. Using a 5/32 Allen wrench, loosen and remove the pan head Allen screws fastening the front drive assembly section and the contact panel assembly section together. (See Figure 193.)

15. Lift the front drive assembly off of the contact assembly and set aside. (See Figure 194.)

Reversing Moveable and Neutral Stationary Contact Removal and Re-assembly

1. Use a 9/16 wrench or a deep well 9/16 socket and ratchet, loosen and remove the brass nut on stationary contact one, remove the external tooth lock washer and flat washer. (See Figure 195.)
2. Push the contact stud through the mounting hole in the contact panel. (See Figure 196.)

3. By hand, rotate the main moveable contact and Geneva gear assembly so that the moveable contact is in the stationary one contact position. (See Figure 197.)

4. Use a 9/16 wrench or deep well 9/16 socket and ratchet to remove the six nuts, lock washer, and flat washer fastening the P1 and P2 slip ring studs to the contact panel located in the center back of the stationary contact panel. (See Figure 196.)

5. Facing the main moveable contacts and Geneva gear assembly, pull forward removing the main contact assembly and P1 and P2 slip ring assemblies from the contact board assembly. (See Figure 199.)
6. Rotate the reversing switch assembly, if not already rotated, so that the contact buttons are in the center space between the VR and VL stationary contacts as though in the neutral position. (See Figure 200.)

7. Using a 9/16 wrench, or 9/16 socket and ratchet loosen and remove the mounting nut on the stud of the reversing switch assembly. The reversing switch assembly stud is located between the reversing stationary contacts VR and VL on the stationary contact assembly on the contact panel. (See Figure 201.)

8. Pull out on the reversing moveable contact assembly removing form the contact panel. (See Figure 202.)

9. Install the reversing switch assembly with the contact buttons located between the VR and VL stationary contacts. (See Figure 200.)

10. Place the brass flat washer, external tooth lock washer and nut onto the reversing switch assembly stud. Tighten and torque the hardware to 60-70 pound-inch torque (6.779-7.908 Nm).

11. Rotate the reversing switch assembly so that the button contacts are on the VR reversing stationary contact. (See Figure 203.) To identify the VR stationary contact look for the ID marking on the contact panel.
12. Align the Moveable Contact and Geneva Gear Assembly so that the moveable contacts align to where the number one stationary contact has been removed. (See Figure 204.)

![Figure 204. Moveable contact re-assembly.](image)

13. Align the studs of the slip rings with the mounting holes in the contact panel. The studs on the slip ring that is between the left hand lower button contact will go into the holes that have the high shoulder spacer as part of the contact panel. (See Figures 205 and 206.)

![Figure 205. Slip ring P1 and P2 studs.](image)

14. You may need to rotate the slip ring assemblies in the button contact to make the proper alignment.

15. Press on the moveable and Geneva contact assembly to insert the studs.

16. You may find that after starting the studs, the moveable and Geneva contact assembly will need to be rotated to position the moveable contact so that the contacts are not interfering with other stationary contacts during the installation.

17. Rotate the main moveable contact Geneva gear assembly onto the neutral stationary contact, located under the reversing switch assembly, locating the reversing moveable so that the button contact is between VR &VL stationaries. (See Figure 207.)

![Figure 207. Positioning of reversing moveable contacts.](image)

18. Place a flat brass flat washer, external tooth lock washer, and 3/8 nut on each of the P1 and P2 slip ring studs and tighten with a 9/16 wrench or socket and ratchet. Torque the nut on the studs to 60-70 pounds-inch (6.779-7.908 Nm).
19. Replace the number 1 stationary contact by inserting the contact stud into the contact-mounting hole in the contact panel. The contact position number is located on the contact panel. (See Figure 208.)

20. Place a brass flat washer, external tooth lock washer, and nut on the number 1 stationary contact stud. Tighten and torque the hardware 60-70 pound-inch (6.779-7.908 Nm).

**Tap-changer Re-assembly**

1. Lay the contact panel assembly section flat on a table surface. (See Figure 209.)

2. Place and align the tap-changer drive assembly section on top of the contact panel assembly. (See Figure 210.)

3. Align the center hub of the main moveable contact assembly with the center hole in the tap-changer drive assembly. (See Figures 211 and 212.)
5. Insert four pan head Allen screws into the tap-changer assemblies. Two screws will mount the two tap-changer assemblies and the terminal block bracket at the top of the tap-changer. The other two screws are inserted in the mounting holes along both side centers of the tap-changer. (See Figure 214.)

6. Place the mounting bracket, (see Figure 215), to the base of the tap-changer assembly and fasten with two pan head hex screw and tighten with a 5/32 Allen Wrench. (See Figure 216.)
7. Place the neutral position pointer lob, (see Figure 217), into the main moveable contact hub located in the lower front center of the drive assembly panel. (See Figure 218.)

8. Fasten the tap-position switch assembly to the front of the drive panel assembly with three pan head Phillip screws. (See Figure 219.)

9. Position the position actuator arm between the center position and L by rotating the pinion counter clockwise. (See Figure 220.) This will allow for mounting the micro switches without interference with the micro switch arms.

Figure 216.
Bracket fastening.

Figure 217.
Position indicator lob.

Figure 218.
Lob placement.

Figure 219.
Position switch assembly.

Figure 220.
Lob placement.
10. Place and fasten the reversing logic and neutral logic micro switches on the upper left of the drive assembly panel. The micro switch with a blue white striped wire and blue black striped wire is located on the R position. The micro switch with a red white striped wire and red black striped wire is located on the L position. The micro switch with an orange wire and a white wire is located on the center position between the R and L position. (See Figure 221.)

11. Rotate the pinion back clockwise until the arm in Figure 221 is in the center and the neutral switch is depressed.

12. Connect the blue wires with red strips to the 40-ohm resistor by pushing the female connector onto the resistor terminals. (See Figure 222.)

13. Check and set the tap-changer for neutral position. The tap-changer can be set for any tap position by rotating the pinion cam in either the clockwise or counter clockwise direction. For rotating to the neutral position, the reversing logic switch actuator must be in the center with the neutral switch arm depressed. The tap position lob must have the pointer pointing at N. The pinion cam point is pointing at the three o’clock position over the holding switch lever arm. The holding switch is open. (See Figure 223.)

Re-assembly of Tap-changer to Voltage Regulator Assembly

1. Once the tap-changer has been re-assembled, reverse the process in the procedure titled “Tap-changer Removal from Voltage Regulator” at the beginning of these installation instructions.
QD3/T350 TC-LTC P.I. DRIVE FACE GEAR KIT
Kit Number 5740787B11

Refer to Service Information S225-50-45

GENERAL

The purpose of this replacement kit is to provide the parts and installation instructions for replacing the P.I. Drive Face Gear on a QD3 Quik Drive Tap-changer.

<table>
<thead>
<tr>
<th>TABLE 23</th>
<th>Parts Supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>Part Number</td>
</tr>
<tr>
<td>1</td>
<td>2240787B11</td>
</tr>
<tr>
<td>2</td>
<td>0800073184Z</td>
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<table>
<thead>
<tr>
<th>TABLE 24</th>
<th>Tools Required</th>
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</thead>
<tbody>
<tr>
<td>Description</td>
<td>Qty</td>
</tr>
<tr>
<td>Standard Narrow Blade Screw Drive</td>
<td>1</td>
</tr>
<tr>
<td>Needle Nose Pliers</td>
<td>1</td>
</tr>
<tr>
<td>Standard Wireman Pliers</td>
<td>1</td>
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</tbody>
</table>

INSTALLATION PROCEDURE

PI Gear Removal

1. Place a narrow blade standard screwdriver in the slots of the retainer ring allowing the retainer ring to be pried off the shaft. (See Figure 226.)

   Figure 226. Retainer ring removal.

2. Remove the retainer ring.

3. Slide the P.I. Drive Gear off of the shaft. (See Figure 227.)

   Figure 227. P.I. drive gear and shaft.
4. Slide the new P.I. Drive Gear onto the shaft matching up the gear teeth of the P.I. Drive Gear and the teeth of the miter gear. (See Figure 228.)

![Figure 228. Gear teeth.](image)

5. Use a pair of pliers, either needle nose or wireman pliers, and press the retainer ring over the shaft with the retainer ring located in the shaft groove. (See Figures 229 and 230.)

![Figure 229. Retainer ring fastening.](image)

![Figure 230. Retainer ring in place.](image)
INSTRUCTIONS

Removing Holding Switch

1. Using a pair of pliers remove the four leads from the holding switch assembly. Facing the holding switch you will find the wires by color. (See Figure 232.)

   **Top Micro Switch**
   - Black wire on top terminal post (com post)
   - Blue wire on center terminal post (No. 2 post)
   - Bottom terminal post, vacant (No. 3 post)

   **Bottom Micro Switch**
   - Top terminal post, vacant (No. 3 post)
   - Red wire on center terminal post (No. 2 post)
   - Black wire on bottom terminal post (com post)

2. Use either a Phillips screwdriver, standard flat blade screwdriver or an Allen wrench and remove the four screws fasten the holding switch in place. Earlier Quik-Drive tap-changers were built using pan head and Phillip screws. (See Figure 232.)

---

GENERAL

The purpose of this installation instruction is for replacing the holding switch on a QD3 Quik Drive Tap-changer.

**TABLE 25**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
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<th>Qty</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>2240794B04</td>
<td>Holding Switch</td>
<td>1</td>
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<tr>
<td>2</td>
<td>0800073409Z</td>
<td>#8-32 Machine Screw</td>
<td>4</td>
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</table>

**TABLE 26**

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
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<tbody>
<tr>
<td>Pliers</td>
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<tr>
<td>Phillips Screwdriver</td>
<td>1</td>
</tr>
<tr>
<td>Standard Flat Blade Screwdriver</td>
<td>1</td>
</tr>
<tr>
<td>Allen Wrench 9/64 inch</td>
<td>1</td>
</tr>
</tbody>
</table>

---

Figure 231.
Kit part.

Figure 232.
Holding switch connections.
Installation of Holding Switch

3. Place the holding switch assembly on to the QD3 tap-changer with the nylon actuator located at the 3 o’clock position or just to the right of the pinion cam. (See Figure 233.)

Figure 233.
Pinion and actuator location.

4. Using a 9/64 Allen wrench place and tighten the four mounting screws. (See Figure 232.)

5. Connect the wires on to the holding switch assembly. (See Figure 232.)

Top Micro Switch
- Black wire on top terminal post (com post)
- Blue wire on center terminal post (No. 2 post)
- Bottom terminal post, vacant (No. 3 post)

Bottom Micro Switch
- Top terminal post, vacant (No. 3 post)
- Red wire on center terminal post (No. 2 post)
- Black wire on bottom terminal post (com post)