DE-ENERGIZED TAP CHANGERS & MULTI-VOLTAGE SWITCHES

“HIGHEST QUALITY...IT’S UP TO US”

SINCE 1974
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INTRODUCTION

Quality Switch, Inc. manufactures a broad range of custom and standard switches for the electrical industry. Our switches can range from 125 amps to 2500 amps per deck with BIL ratings from 10 kV BIL to 1050 kV BIL. Also, switches are designed for use in Air, Transformer Oil, Natural Ester Fluids, Silicone, and other refined hydrocarbons. Quality Switch, Inc. is an ISO 9001:2015 certified company with a certification for the design and manufacture of the product. Quality Switch, Inc. is staffed with electrical and mechanical engineers with over 100 years of combined industry experience. Engineering is actively involved in industry standards, including the IEEE Transformer Committee and the IEC 60214 standards. Engineering is involved in supporting customers with the design of switches which are modeled using SolidWorks 3D CAD system. We also have ANSYS finite element analysis tools to aide in the verification of designs. Many designs are verified through testing in accordance with specific industry standards for the product. In 2016, Quality Switch unveiled the Horace H. Sewell High Voltage Test Lab dedicated to product development and R&D. The new lab is equipped with a 1.2 MV Impulse Generator (High Volt) and a 700 kV Hi-Pot transformer (Phenix Tech) that is rated for continuous operation. Omicron partial discharge equipment is used for design testing and the background PD levels at 700kV were 2pC.

- Quality Switch has the history, resources, expertise, and abilities to be your partner.
- We can bring resources to assist in solutions tailor made for integrating our product with your product.
- We are a third generation company that is in it for the long haul. We will be here tomorrow.

This brochure is an overview of the product range manufactured by Quality Switch, Inc. The brochure contains general details of several of our standard switch families, but by no means is all-inclusive. A significant percentage of our products are custom built to meet customer specifications. If something to meet your needs cannot be found in our brochure, engineering will work with you to customize a switch to work for your application.

See the Customer Inquiry form contained in this brochure and submit your request for information.
YOUR TAP CHANGER OR MULTI-VOLTAGE SWITCH

The switch supplied to you by Quality Switch has been designed, tested, and manufactured to all applicable standards. During the design process we have selected materials that should allow the switch to provide long life and reliable operation. There are, however, three factors that you, our customer control. These factors are nothing more than ones you presently concern yourself with when manufacturing your electrical equipment. This section merely outlines them for your consideration as applied to our switch. We also provide guidelines for meeting these requirements. In all cases, should you have any questions, please do not hesitate to contact Quality Switch.

CLEANLINESS

The first factor is cleanliness. You must make sure that no contamination is present on the switch. Dirt, debris, grease, metal filings, and any of the things you do not want in your transformer or electrical equipment, you do not want on the switch. If you notice something on the switch, you can clean it with a dry lint free cloth or a blast of clean dry air. Should more effort be required (grease or a smudge) we recommend denatured alcohol or an environmentally safe cleaner like a citrus solvent.

MOISTURE REMOVAL

The second factor is to insure your switch is dry. Obviously, water and electricity do not mix. The unit should be stored in a manner that minimizes the exposure of the switch to high humidity. Water on your switch should be wiped off immediately.

We recognize that during storage and even assembly of the switch into your electrical equipment, the unit will be exposed to environments that may introduce moisture into the switch components. For that reason, we require that the switches be processed through one of the many available drying procedures to remove moisture that may have migrated into the materials that make up our switch. During our design process we have selected materials with characteristics that minimize the amount of moisture they will absorb. However, in order to ensure that the units function dielectrically as designed a dry out process is required.

Whatever process you choose to use (oven, vacuum, hot oil, vapor phase), you must observe the following:

In general, the maximum temperature of the switch insulating materials must not exceed 140°C.

Switch should not be directly in the path of the incoming drying medium (kerosene or air). If necessary use a guide plate to deflect the incoming medium.

Minimum dry out period should be:

<table>
<thead>
<tr>
<th>Voltage Class of Switch</th>
<th>Minimum Dry-out Time in Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 kV and below</td>
<td>8 hours</td>
</tr>
<tr>
<td>25 kV</td>
<td>12 hours</td>
</tr>
<tr>
<td>35 kV</td>
<td>24 hours</td>
</tr>
<tr>
<td>Above 35 kV</td>
<td>48 hours</td>
</tr>
</tbody>
</table>
NON-METALLIC FASTENERS
After dry out it is recommended to re-tighten all non-metallic fasteners due to the expansion and contraction that is typically seen with some of the insulating materials used on switches. The same principles applied to framework and transformer superstructure non-metallic hardware should be applied to the non-metallic hardware on our switches. Typically after re-tightening of all the fasteners, an electrical insulating epoxy is applied to keep the fasteners from vibrating loose (i.e. Glyptal or equivalent).

CAUTION
DO NOT OPERATE THE SWITCH AFTER DRY OUT WITHOUT SOME LUBRICANT ON THE CONTACTS. FOR UNITS DESIGNED FOR USE IN DIELECTRIC FLUIDS WE RECOMMEND EITHER A LIGHT COAT OF THE SPECIFIC DIELECTRIC FLUID OR VASELINE BE APPLIED ON THE CONTACTS.

ENTRAPPED AIR
*Applicable only to switches in dielectric fluid filled units
We recommend that your dielectric fluid filled unit be filled with clean, dry, degassed fluid. On high BIL units, we recommend the units be filled under vacuum to minimize the possibility of entrapped air. On all units, whether filled under vacuum or not, we recommend a minimum of 24 hours of soak time before energized to allow any entrapped air to dissolve into the fluid. We also recommend that the switch be operated a minimum of 5 times after the unit is covered with fluid before any test voltages are applied to break free any bubbles that may be entrapped.

MAINTENANCE
Our de-energized tap changers and multi-voltage switches require little or no maintenance to ensure proper mechanical and electrical operation of the switch. The transformer must be de-energized before operating. The external operating mechanism should be inspected for any damage to ensure proper operation. If for any reason the position of the switch is to be changed, operate the switch across its full range of positions a minimum of two times to assure proper mechanical operation and cleaning (wiping) of the contacts.

STORAGE
The switch’s original packing protects the switch in a box or crate. This packaging typically includes plastic wrap with desiccant and a vapor corrosion inhibiting paper to help keep the switch dry and protect the contacts from excessive oxidation. The switch must be kept at room temperature and covered from outside exposure. Do not store any of the switches on concrete as concrete promotes moisture. A wooden or plastic pallet is preferred.

SUMMARY
Quality Switch has made every effort to provide you with a switch that will meet or exceed your needs. However, by following the above recommendations, you can ensure that the unit will perform as expected. Common sense applies in all cases. If it is bad for your electrical equipment, it is not good for our switch. If you have any questions, please do not hesitate to call.
Type QS-DGR™ Small Distribution
- Rotary 5 position DETC.
- Current rating 125 amps, voltages 125 kV BIL thru 250 kV BIL. Plain copper contact ring with brass threaded stationary post for cable connections (1/4"-20 threads). Ring terminal is connected under lock washer and brass nut.

LENGTH WILL VARY BASED ON kV BIL RATING
Type QS-DRR™ Small Distribution DETC

- Rotary 5 position DETC.
- Current rating 200 or 500 amps, voltages 125 kV BIL thru 250 kV BIL. Silver plated rolling contact ring and silver plated stationary contacts (5/16”-18 threaded posts, connections are made on top of brass nut).

Length will vary based on kV BIL rating (200 AMP, 150 kV BIL SHOWN)
Type QS-DRR™ Small Distribution DETC

(500 AMP, 150 kV BIL SHOWN)

LENGTH WILL VARY BASED ON kV BIL RATING
(500 AMP, 150 kV BIL SHOWN)

5/16"-18 Threaded Connection (TYP)
Type QS-DRD™ Small Distribution DETC
-Rotary 5 position DETC (available up to 9 positions).
-Current rating 200 amps, voltages up to 350 kV BIL. Silver plated rolling contact disc and silver plated stationary contacts (5/16"-18 threaded posts for 200 amps, connections are made on top of brass nut). The switch is positive positioning, with a snap action type operating feel. See QSD-32 for more information.
Type QS-DRD™ Small Distribution DETC

- Rotary position DETC (available up to 9 positions).
- Current rating 400 amps, voltages up to 350 kV BIL. Silver plated rolling contact disc and silver plated stationary contacts (3/8"-16 threaded posts for 400 amps, connections are made on top of brass nut). The switch is positive positioning, with a snap action type operating feel. See QSD-32 for more information.

![Diagram of the switch components](image)
Type QS-DRD™ Distribution, Small Power DETC

- Rotary 5 position DETC (available up to 9 positions). This arrangement is typically mounted alongside the core and coil assembly spaced out to center the tap decks with the coil centerlines.
- Current rating 400 amps, voltages up to 350 kV BIL. Silver plated rolling contact disc and silver plated stationary contacts (3/8"-16 threaded posts for 400 amps, connections are made on top of brass nut). The switch is positive positioning, with a snap action type operating feel. See QSD-32 for more information.
Type QS-DRS™ Distribution DETC

- Rotary 5 position DETC (available up to 9 positions). This arrangement is typically mounted on the tank wall.
- Current rating 800 amps, voltages up to 250 kV BIL. Silver plated sliding shoe contact and plain copper stationary contacts (1/2”-13 threaded posts for 800 amps, connections are made on top of brass nut). Silver plated stationary contacts are available on request (silver shown).
Type QS-DLS™ Small/Medium Power DETC

- Rack Type 5 position DETC. This arrangement is typically mounted alongside the core and coil assembly spaced out to center the tap decks with the coil centerlines.
- Current rating 400 amps, voltages up to 650 kV BIL. Copper sliding shoe contact and plain copper stationary contacts (single-hole lug). Silver plated contacts are available on request. See QSD-31A for more information.

Mounting Flange supplied with sealing mechanism installed (to bolt to a header flange after switch is tanked).

Spring loaded coupling that will couple with drive shaft pin after the core and coil assembly is tanked.

Mounting holes (top or bottom) attach switch to transformer superstructure.

All non-metallic gearing and drive shafts connecting the tap decks.

Mounting Flange supplied with sealing mechanism installed (to bolt to a header flange after switch is tanked).

Spring loaded coupling that will couple with drive shaft pin after the core and coil assembly is tanked.

Mounting holes (top or bottom) attach switch to transformer superstructure.

All non-metallic gearing and drive shafts connecting the tap decks.

Mounting Flange supplied with sealing mechanism installed (to bolt to a header flange after switch is tanked).

Spring loaded coupling that will couple with drive shaft pin after the core and coil assembly is tanked.

Mounting holes (top or bottom) attach switch to transformer superstructure.

All non-metallic gearing and drive shafts connecting the tap decks.
Type QS-DLS™ Small Power DETC

- Rack Type 5 position DETC. This arrangement is typically mounted alongside the core and coil assembly spaced out to center the tap decks with the coil centerlines.

- Current rating 1000 amps, voltages up to 350 kV BIL. Copper sliding shoe contact and plain copper stationary contacts (two-hole NEMA lug). Silver plated contacts are available on request.
Type QS-DGR™ Small/Medium Power DETC

- Rotary Type 5 position DETC (available up to 7 positions). This arrangement is typically mounted alongside the core and coil assembly spaced out to center the tap decks with the coil centerlines.
- Current rating 300 or 500 amps, voltages up to 750 kV BIL. Silver Plated copper ring and plain copper stationary contacts (crimp or threaded terminals available). Silver plated contacts are available on request. See QSD-25 & QSD-25A for additional information.

Mounting holes (top or bottom) attach switch to transformer superstructure.

Flexible drive coupling that will couple with drive shaft pin after the core and coil assembly is tanked.

Brass drive shaft is inserted thru gland before unit is tanked and then pushed into slot to operate switch.

Various crimp or threaded terminal available on request.

Roll Pin

Brass drive shaft is inserted thru gland before unit is tanked and then pushed into slot to operate switch.

Flexible drive coupling that will couple with drive shaft pin after the core and coil assembly is tanked.

Brass drive shaft is inserted thru gland before unit is tanked and then pushed into slot to operate switch.
Type QS-DRB™ Custom Non-Bridging (Linear) DETC

-Rotary Type non-bridging (linear) DETC (available up to 12 positions). This is currently the only style available for non-bridging switches.

-Current rating 200 up to 2500 amps per deck, voltages up to 200 kV BIL. Silver Plated copper rotating blades and silver plated stationary contact clips (customer connections vary based on current & customer preference). Switches are typically custom made to fit your application and are capable for dry-type or liquid filled applications.

![Diagram of Type QS-DRB™ Custom Non-Bridging (Linear) DETC]

- Silver Plated Stationary & rotating contacts
- Steel Gland (to be welded into tank thru 1.53 cut-out)
- Cotter Pin installed behind Index plate to prevent pin from disengaging the slot
- Common connection: varies NEMA 1.75” pattern shown
- Pad lockable Handle
- Brass Spacer
- Index Plate
- Gland Nut
- O-ring
- Handle Pin
Type QS-DLS™ Medium/Large Power DETC

- Rack Type 5 position DETC. This arrangement is typically mounted alongside the core and coil assembly spaced out to center the tap decks with the coil centerlines.
- Current rating 1000 amps, voltages up to 1050 kV BIL (possibly higher dependent on tap voltage range). Silver plated copper sliding shoe contact and silver plated copper stationary contacts are standard (crimp type connectors, single hole, or two-hole NEMA lug available for customer coil lead connections).

(1000 AMP, 1050 kV BIL, 3 PHASE, 5 POSITION SHOWN)

- Non-Metallic Geneva drive mechanism.
- Mounting holes attach switch to transformer superstructure.
- Mounting Flange supplied with sealing mechanism installed (to bolt to a header flange after switch is tanked).
- Spring loaded coupling mates with switch drive pin.
- Customer connection: varies (Crimp barrel shown).
- Silver Plated Stationary & sliding contacts.
- Note: other front end couplings are available on request.

Side view of handle mounting flange assembled.
Type QS-DRS™ Distribution Multi-Voltage
-Rotary multi-voltage switch. This arrangement is typically mounted on the tank wall.
-Current rating 200 or 300 amps, voltages up to 95 kV BIL. Silver plated sliding shoe contact and plain copper stationary contacts (silver available on request). Connections are made on top of brass nuts with cable terminals (not supplied by QS). Connection schemes will vary depending on the application.

(200 AMP, 95 kV BIL, 3 PHASE, 2 POSITION SHOWN)

Figure 1: Example of different connection schemes (others available on request).
Type QS-DRS™ Distribution/Power Multi-Voltage

-Rotary multi-voltage switch. This arrangement is typically mounted on top of core and coil assembly or spaced alongside the core and coil assembly.

-Current rating 500 up to 2500 amps, voltages up to 200 kV BIL. Silver plated sliding shoe contact and plain copper stationary contacts (silver available on request). Connections are made on top of brass nuts with cable terminals (not supplied by QS). Connection schemes will vary depending on the application (See Figure 1 on page 18 for examples of connections). See QSD-26 for additional information.
**Type QS-DLS™ Small/Medium Power Multi-Voltage**

-Rack type multi-voltage switch. This arrangement is typically mounted on top of core and coil assembly or alongside the core and coil assembly.
-Current rating 550 up to 1200 amps per group, voltages up to 200 kV BIL. Plain copper sliding shoe contact and plain copper stationary contacts (silver available on request). Connections are made to NEMA two-hole lug or four-hole spade.

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(1200 AMP, 150 kV BIL, 3 PHASE, 2 POSITION SHOWN)

- Flexible drive coupling that will couple with drive shaft pin after the core and coil assembly is tanked.
- Mounting holes (top or bottom) attach switch to transformer superstructure.

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(1200 AMP, 150 kV BIL, 3 PHASE (2 GROUPS GANGED), 2 POSITION SHOWN)

- 563° DIA. HOLES IN CONNECTION LUG: NEMA 1.75° PATTERN.
Type QS-DLS™ Medium Power Multi-Voltage

-Rack type multi-voltage switch. This arrangement is typically mounted on top of core and coil assembly or alongside the core and coil assembly.

-Current rating 1000 amps per group, voltages up to 550 kV BIL between contacts & 650 kV BIL phase to phase. Silver plated copper sliding shoe contact and silver plated copper stationary contacts are standard. (Crimp type connectors, single hole, or two-hole NEMA lug available for customer coil lead connections).

Front contacts slide in the opposite direction of the back contacts to make connections.

Silver Plated Stationary & sliding contacts

Non-Metallic drive mechanism.

Cable connection: NEMA 2-hole pattern shown (single hole or crimp type available)

Mounting holes (top & bottom) attach switch to transformer superstructure

(1000 AMP, 138kV X 69KV RECONNECTABLE 3 PHASE SWITCH SHOWN)

<table>
<thead>
<tr>
<th>CONNECTION DIAGRAM</th>
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</thead>
<tbody>
<tr>
<td>POSITION</td>
</tr>
<tr>
<td>1/A (PARALLEL)</td>
</tr>
<tr>
<td>2/B (SERIES)</td>
</tr>
<tr>
<td>FOR ALL 3 PHASES</td>
</tr>
</tbody>
</table>

Print Date 4/21/2018       Revision 01  4/1/18

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QS Document No. QSD-30
Type QS-GBN™ (Patented) Submersible/Network Application

- Rotary non-bridging 3 position HV Disconnect/Ground Switch. This arrangement is typically mounted in a chamber that is attached to the end of the network transformer.

Type QS-DGR™ Submersible/Network Application

- Rotary 5 position DETC.
- Pipe Cap & Drive components meet IEEE C57.12.40-2017 requirements for corrosion.
- Current rating 125 amps or 200 amps, voltages 125 kV BIL thru 250 kV BIL. Plain copper contact ring with brass threaded stationary post for cable connections (1/4"-20 threads for 125 amps). Ring terminal is connected under lock washer and brass nut. 200 amp versions are silver plated copper ring and 5/16"-18 silver plated threaded posts for connections.
CUSTOMER INQUIRY

Name : 
Country : 
Company Name : 
Phone Number : 
Email : 

TRANSFORMER DATA

Year of Manuf. : 
Name of End user : 
Transformer Rating : 
Type of Cooling : Oil  Air
Quantity of Transformers : 
Quantity of DETC/Transformer : 
Type of Transformer : Distribution  Power  Furnace  Special Type
Rated Voltage HV : 
Rated Voltage LV : 
Frequency : 

DE-ENERGIZED TAP CHANGER DATA

System Voltage (kV) : 
Maximum Current thru DETC (Amps) : 
Tap Range & Steps : 
No. of Positions : 
No. of Phases : 
No. of Decks / Phase : 
Location of DETC : Line End  Middle of HV Winding  Middle of LV Winding  Neutral End
## Insulation Levels

<table>
<thead>
<tr>
<th></th>
<th>Lightning Impulse - BIL (1.2 x 50 μs)</th>
<th>Applied Voltage for 1Min (kV RMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DETC Phase to Ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Phases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between adjacent tap contacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between tap groups (if more than 1 per phase)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Type of Connection
- Bridge
- Electrically linear (selector)
- 2:1 Dual Voltage
- Uneven multi-voltage

### Type of Construction
- QS-DLS (mech. Linear)
- QS-DRS (shoe-type)
- QS-DGR & QS-DRR (Ring)
- QS-DRD (disc snap-action)

### Type of Mounting
- Horizontal
- Vertical

### Drive Mechanism
- Manual
- Motorized

### Location of Drive Mechanism:

- On Side wall (ANSI segment 2 or 4)
- On front or back wall (ANSI segment 1 or 3)
- On Top cover
- On Top with External Drive to drop to ground
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