361 AS
SERVICE BULLETIN

Troubleshooting and Maintenance of Square D Motor Control Equipment

• DANGER: Hazard of electrical shock or burn. Be sure to turn off power supplying this equipment before working on it.

MOTOR CONTROL TROUBLE — REMEDY TABLE

The following table lists troubles encountered with motor control, their causes and remedies. This table is of a general nature and covers only the main causes of trouble.

Misapplication of a device can be a cause of serious trouble, however rather than list this cause repeatedly it should be noted here that **misapplication is a major cause of motor control trouble and should always be questioned when a device is not functioning properly.**

Actual physical damage or broken parts can usually be found quickly and replaced. Damage due to water or flood conditions require special treatment. See page 3 for recommendations for renovating water soaked motor control.

TROUBLE	CAUSE	REMEDY
	Magnetic Contactors, Starters and Control Relays	
CONTACTS ▲		
Contact Chatter (Also see "Noisy Magnet")	1. Poor contact in control circuit.	1. Replace the contact device or use holding circuit interlock (3 wire control).
	2. Low voltage.	2. Check coil supply voltage and voltage dips during starting.
Welding or Freezing	1. Abnormal inrush of current.	1. Check for grounds, shorts or excessive motor load current or use larger contactor.
	2. Rapid jogging.	2. Install larger device rated for jogging service.
	3. Insufficient tip pressure.	3. Replace contacts and springs, check contact carrier for deformation or damage.
	4. Low voltage preventing magnet from sealing.	4. Check coil supply voltage and voltage dips during starting.
	5. Foreign matter preventing contacts from closing.	5. Clean contacts with Freon. Contacts, starters, and control accessories used with very small current or low voltage, should be cleaned with Freon.
	6. Short circuit or ground fault.	6. Remove fault and check to be sure fuse or breaker size is correct.
Short Tip Life or Overheating of Tips	1. Filing or dressing.	1. Do not file silver tips. Rough spots or discoloration will not harm tips or impair their efficiency.
	2. Interrupting excessively high currents.	2. Install larger device or check for grounds, shorts or excessive motor currents.
	3. Excessive jogging.	3. Install larger device rated for jogging service.
	4. Weak tip pressure.	4. Replace contacts and springs, check contact carrier for deformation or damage.
	5. Dirt or foreign matter on contact surface.	5. Clean contacts with Freon. Take steps to reduce entry of foreign matter into enclosure.
	6. Short circuits or ground fault.	6. Remove fault and check to be sure fuse or breaker size is correct.
	7. Loose connection in power circuit.	7. Clear and tighten.
	8. Sustained overload.	8. Check for excessive motor load current or install larger device.
COILS		
Open Circuit	1. Mechanical damage.	1. Handle and store coils carefully.
Overheated Coil	1. Over voltage or high ambient temperature.	1. Check application, circuit, and correct. Voltage should not exceed 110% of coil rating.
	2. Incorrect coil.	2. Install correct coil.
	3. Shorted turns caused by mechanical damage or corrosion.	3. Replace coil.
	4. Under voltage, failure of magnet to seal in.	4. Check coil supply voltage, which should be at least 85% of coil rating.
	5. Dirt or rust on pole faces.	5. Clean pole faces.
	6. Mechanical obstruction.	6. WITH POWER OFF check for free movement of contact and armature assembly.

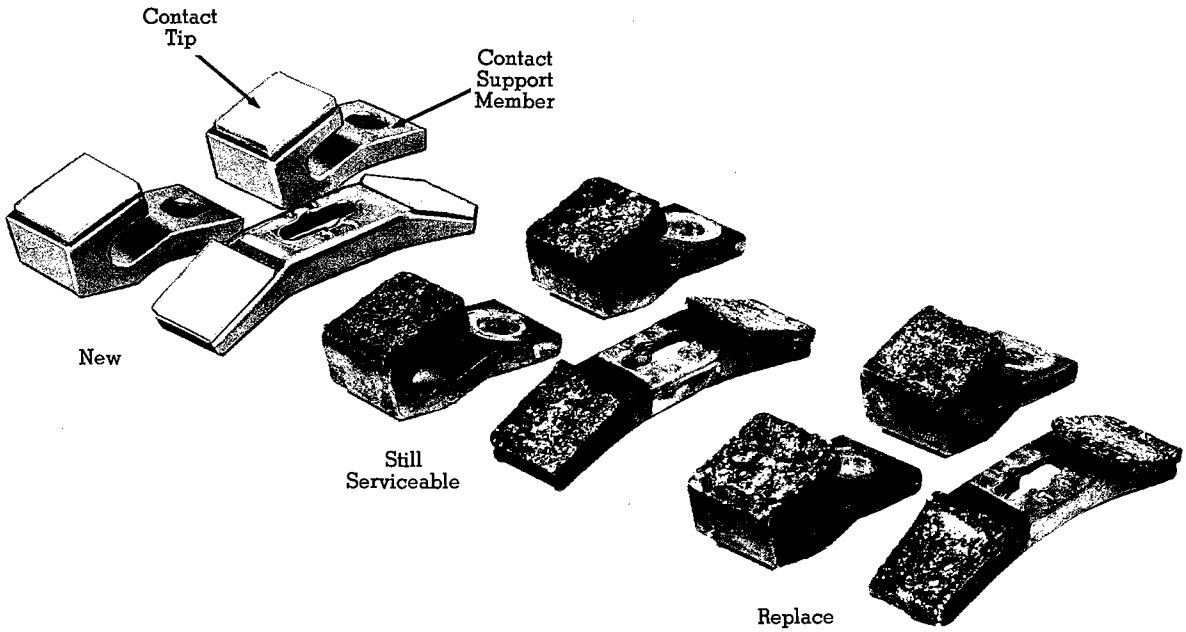
▲ More detailed information provided on page 2.

361 AS
SERVICE BULLETIN

TROUBLE	CAUSE	REMEDY
	Magnetic Contactors, Starters and Control Relays	
OVERLOAD RELAYS	1. Sustained overload.	1. Check for excessive motor currents or current unbalance, and correct cause.
Tripping	2. Loose or corroded connection in power circuit.	2. Clean and tighten.
	3. Incorrect thermal units.	3. Thermal units should be replaced with correct size for the application conditions.
	4. Excessive coil voltage.	4. Voltage should not exceed 110% of coil rating.
Failure To Trip	1. Incorrect thermal units.	1. Check thermal unit selection table. Apply proper thermal units.
	2. Mechanical binding, dirt, corrosion, etc.	2. Replace relay and thermal units.
	3. Relay previously damaged by short circuit.	3. Replace relay and thermal units.
	4. Relay contact welded or not in series with contactor coil.	4. Check circuit for a fault and correct condition. Replace contact or entire relay as necessary.
MAGNETIC & MECHANICAL PARTS		
Noisy Magnet	1. Broken shading coil.	1. Replace magnet and armature.
	2. Dirt or rust on magnet faces.	2. Clean.
	3. Low voltage.	3. Check system voltage and voltage dips during starting.
Failure to Pick-up and Seal	1. No control voltage.	1. Check coil circuit for loose connection or poor continuity of contacts.
	2. Low voltage.	2. Check system voltage and voltage dips during starting.
	3. Mechanical obstruction.	3. WITH POWER OFF check for free movement of contact and armature assembly.
	4. Coil open or overheated.	4. Replace.
	5. Wrong coil.	5. Replace.
Failure to Drop-Out	1. Gummy substance on pole faces.	1. Clean pole faces.
	2. Voltage not removed.	2. Check coil circuit.
	3. Worn or corroded parts causing binding.	3. Replace parts.
	4. Residual magnetism due to lack of air gap in magnet path.	4. Replace magnet and armature.
	5. Contacts welded.	5. See "Welding" under "Contacts".
PNEUMATIC TIMERS		
Erratic Timing	1. Foreign matter in valve.	1. Replace timing head complete or return timer to factory for repair and adjustment.
Contacts Do Not Operate	1. Maladjustment of actuating screw.	1. Adjust per instruction in service bulletin.
	2. Worn or broken parts in snap switch.	2. Replace snap switch.
LIMIT SWITCHES		
Broken Parts	1. Overtravel of actuator.	1. Use resilient actuator or operate within tolerances of the device.
MANUAL STARTERS		
Failure to Reset	1. Latching mechanism worn or broken.	1. Replace starter.

361 AS
SERVICE
BULLETIN

REPLACEMENT GUIDE FOR MAXIMUM LIFE OF CONTACT TIPS



There are two types of contact wear — Electrical and Mechanical. The majority of wear to contact tips is due to electrical wear. The mechanical wear is insignificant and requires no further mention.

Arcing causes the electrical wear by erroding the contacts. During arcing, a small part of each contact melts, then vaporizes and is blown away.

When a device is new, the contacts are smooth and have a uniform silver color. As the device is used, the contacts become pitted and the color may change to blue, brown and black. These colors result from the normal formation of metal oxide on the contact's surface and are not detrimental to contact life and performance. Therefore, DO NOT FILE contacts. This practice only shortens contact life and may cause welding.

The contacts should be replaced under the following conditions:

1. **Insufficient Contact Material.** This is when the amount of contact material remaining is inadequate. When less than $\frac{1}{64}$ inch remains, replace the contacts. (A measurement procedure is described in the following paragraph).

2. **Irregular Surface Wear.** This type of wear is normal. But if a corner of the contact material is worn away and a contact may mate with the opposing contact support member, the contacts should be replaced. This condition can result in contact welding.

3. **Pitting.** Under normal wear, contact pitting should be uniform. This condition occurs during arcing, as described above. The contacts should be replaced if the pitting becomes excessive and little contact material remains (see 1 above).

4. **Curling of Contact Surface.** This condition results from severe service producing high contact temperatures (i.e., severe inching or jogging, overcurrent or contamination) and causes separation of the contact material from the contact support member.

The measurement procedure for checking the contact tip material requires a continuity checker and a $\frac{1}{32}$ inch feeler gauge. The procedure is as follows:

1. Place feeler gauge between the armature and magnet frame, with armature held tight against the magnet frame.

2. Check continuity of each phase.

If there is continuity in all phases, the contacts are in good condition, if not, ALL CONTACTS (both stationary and movable) SHOULD BE REPLACED. Even though the contacts pass condition #1, any of the other conditions would necessitate the replacement of the contacts. Contacts should only be replaced when necessary; too frequent replacement is a waste of money and natural resources.

361 AS
SERVICE
BULLETIN

WATER-SOAKED MOTOR CONTROL

GENERAL RECOMMENDATIONS

1. **CLEANING** — All equipment should be hosed down and scrubbed with a stiff brush. Water pressure should be limited to 25 pounds per square inch maximum on insulating parts. Water temperature should not exceed 90° C., 194° F. maximum. Freon or any approved solvent should be used for a final cleaning of insulating surfaces, contact tips, and magnet pole faces. Steam cleaning should not be used except on cabinets and enclosures from which the interiors have been removed.
2. **DRYING** — Drying in the sun or in a warm, dry room will take about 2 to 4 days. If heat is used for drying, it should be limited to about 212° F., preferably starting at about 150° or lower and gradually building up to 212° F. Plaster drying equipment, electric heaters, or baking ovens may be used. Approximately 24 hours drying by this method should generally be sufficient. For equipment operating at voltages above 250, greater caution in drying and cleaning should be taken, because of the greater susceptibility to insulation breakdown.
3. **FINAL CHECK** — Test insulation resistance with megger or ohmmeter. A 500 volt or 1000 volt megger is recommended; higher voltages are not suitable for testing controls rated at 600 volts. One megohm is recommended as minimum resistance but equipment may operate satisfactorily with less. In operation, normal drying will cause this resistance value to increase. Restore power to one device at a time, watching for evidence of leakage, spitting, or smoking. For all equipment passing up to this point, load may then be restored, watching for spitting or smoking at contacts. Check to be sure that no open circuit conditions exist.

SPECIFIC RECOMMENDATIONS

1. **COILS AND TRANSFORMERS** — Wash with clean hot water and dry by any of methods listed above, or by applying a low voltage (about 10% of rated voltage) to the coil for 2 or 3 hours. Magnet armature should be in open position or coil should be removed from magnet. For drying dc coils by this method, a resistor in parallel with the coil is recommended to provide a discharge path for the kick voltage induced when the circuit is opened. Special care should be taken to dry out dc coils, since in operation, the inductive voltage may be several times larger than the normal voltage. Check with megger for insulation resistance (one megohm).
2. **MAGNETS** — Wash, clean, and dry with cloth or air hose. Clean magnet pole faces with Freon to remove oil film and surface dirt which might cause the armature to stick.
3. **CONTACT SURFACES** — . Filing the tips is not recommended, but may be used if the surface is very difficult to clean. Do not use sandpaper or emery-cloth which would deposit grit on the tips. Small contacts can be "filed" by rubbing Kraft paper over the surface. Particular care should be taken with small contacts such as electrical interlocks, overload relays, and push buttons.
4. **INSULATING PARTS** — All surfaces of contact blocks, arc chamber covers, movable contact carriers, over-load relay blocks, etc., should be cleaned with Freon, particularly between poles, and dried carefully. Surface drying is generally sufficient for glazed porcelain, melamine, and non-absorbent plastics. Unglazed porcelain, bakelite, and Rostone absorb water and should be baked to dry thoroughly. (Rostone is the cold molded material used for contact blocks on Types B-G contactors and starters.) Check with megger from pole to pole and from each pole to ground, for one megohm minimum insulation resistance.
5. **THERMAL OVERLOAD RELAYS** — Replace Type S thermal overload relay. Melting alloy type relays should be partially disassembled to permit cleaning contacts and moving parts. Clean heater surfaces to permit normal heat radiation. Bimetallic type overloads should not be taken apart, because of their intricate assembly. For emergency service, they can be used if they check satisfactorily, mechanically and electrically. To check mechanically, remove heater unit and press downward on lower end of bimetal strip with a screwdriver; this should trip the relay and open control circuit contacts. Ultimately, bimetal overload relays should be replaced.
6. **SNAP SWITCHES** — (Class 9007, Type AO) snap switches should generally be replaced as soon as possible. For temporary use, shake out any water trapped inside, blow out with an air hose, and bake to dry. Check circuit continuity. Dirt inside the case may prevent contacts from closing properly and cause excessive wear on the toggle mechanism. It is generally impractical to attempt opening the case to clean it out.
7. **PNEUMATIC TIMERS** — Timer heads should not be taken apart. It is recommended that the timer be replaced or returned to the factory for repair. For temporary use, dry timer thoroughly and treat coil, magnet, and snap switch as recommended. Check timing operation. Timer should be suitable for limited use, but will probably not be very accurate, due to dirt in the valves.