

EVC 80 RELAY

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Revision History

REVISION	DATE	SECTION	DESCRIPTION
Rev. A	4/1/2020	All	Initial Release

1. Abbreviations & Acronyms

1.1 Operating Time

- Time from when current is applied to the coil to when the contacts first touch.
- T1~T2 at figure.1

1.2 Operating Time + Bounce time

- T1~T3 at figure.1

1.3 Bounce time

- Time from when the contacts first touch to end of bounce
- T2~T3 at figure.1

1.4 Release time

- Time from when current is cut from the coil to when contacts lose continuity.
- Economizer type : T4~T5 at figure.2
- Non Economizer type : T6~T7 at figure.2

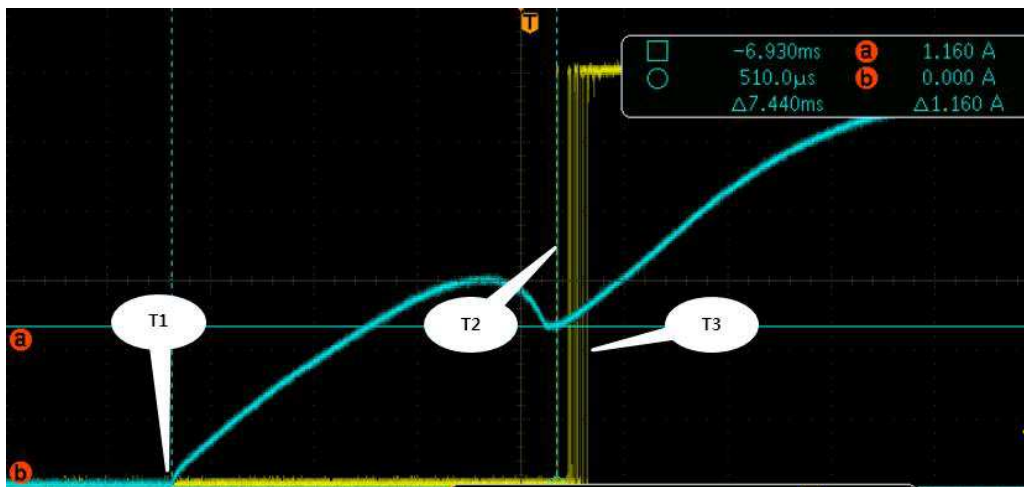


Figure.1

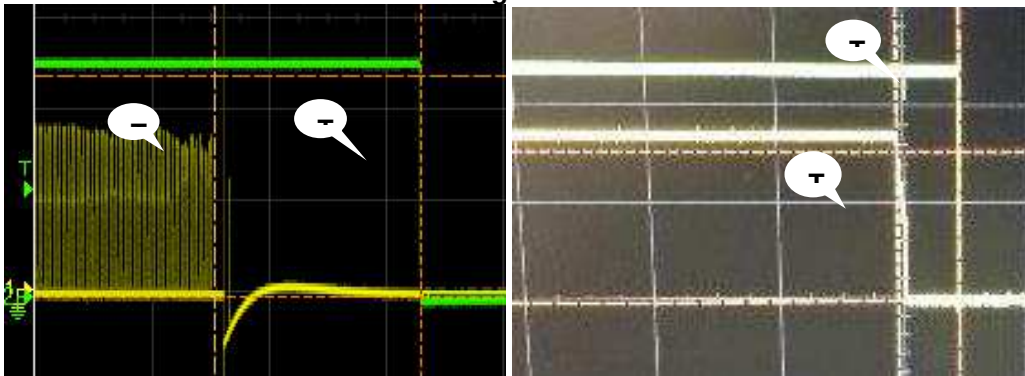


Figure.2

1.5 Pick up voltage & current

- The voltage and current that cause the contacts to close when slowly increasing coil voltage.

1.6 Drop out voltage & current

- The voltage & current that cause the contacts to open when slowly decreasing coil voltage.

2. Product Specification

General specification and Critical Characteristics are defined as table below

Table. 1 performance specification

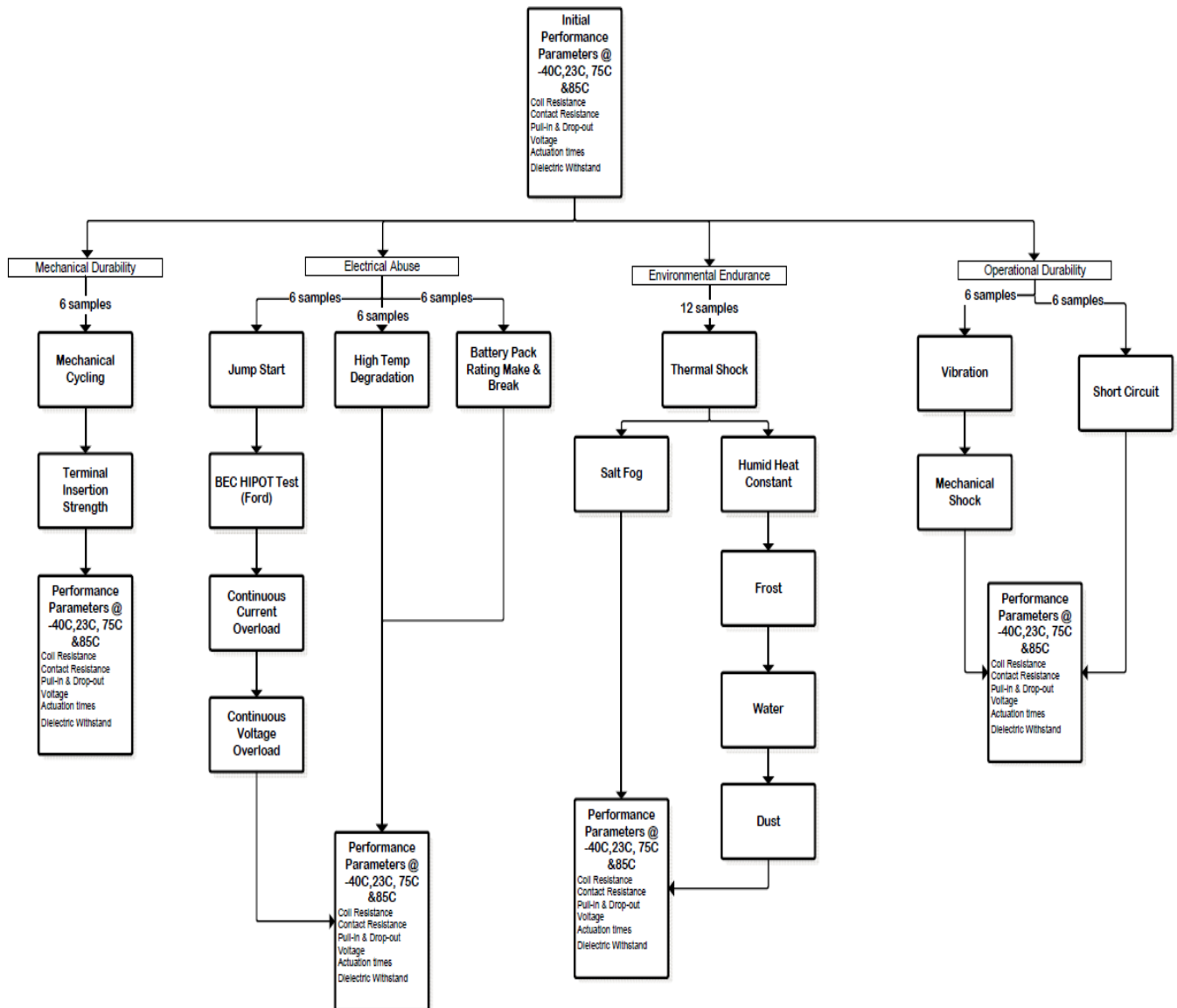
No.	function	EVC80
1	coil resistance @ 23°C	21.4 ohms +10%/-5%
2	operating time @23 °C	15ms (max)
3	bounce time	3ms (max)
4	release time	10ms (max)
5	Pull-in voltage @ 23°C	6.0 – 7.6 Vdc
6	pick up current @ 20°C	0.28 – 0.355A
7	Drop-out voltage @ 23°C	1.5 – 3.5 Vdc
8	drop out current @ 20°C	0.07 – 0.164A
9	contact resistance (beginning of life)	100A / 30sec / <0.8mΩ
10	Insulation resistance	Min 1GΩ @ DC 500Vdc
11	Dielectric Withstand	Max 1mA @ DC 2920Vdc, 10 sec

3. Qualification and Environmental Requirements

3.1 Test Requirements

EVC 80 shall comply with 2. Specification. Upon completion of the test, the results shall be submitted with reference to the test plan.

3.2 Test Flow



4. Validation

4.1 Mechanical Durability

4.1.1 Mechanical Cycling

Reference Standard:

Test Procedure

1. Cycle contactor 500,000 times for 1.0 sec “on” and 1.0 sec “off” using a coil voltage of 12Vdc with a load across the contacts for monitoring.
2. Perform performance checks
3. Perform extending testing for an additional 500,000 operations (1,000,000 Total)
4. Perform performance checks

Acceptance Criteria

Samples shall meet electrical performance requirements, no fail to open or operate misses, and have no damage.

4.1.2 Terminal Insertion Strength

Reference Standard:

Test Procedure

1. Place contactors in dead bug position and apply 500N force to HV terminals and 100N force to coil terminals.
2. Perform performance checks

Acceptance Criteria

No damage to contactor and samples shall meet electrical performance requirements.

4.2 Electrical Abuse

4.2.1 Jump Start

Reference Standard:

Test Procedure

1. Apply 24Vdc on coil for 5 minutes.
2. Perform performance checks

Acceptance Criteria

No damage to contactor and samples shall meet electrical performance requirements.

4.2.2 BEC HIPOT Test

Reference Standard:

Test Procedure

1. Ramp Rate: 0 to 500 Vdc in 5 seconds (100 Vdc/sec)
2. Maintain for 30 seconds and measure leakage current
3. Test between HV terminals and LV terminals and the coil
4. Perform performance checks

Acceptance Criteria

No damage to contactor, leakage current not to exceed 600 μ A and samples shall meet electrical performance requirements.

4.2.3 Continuous Current Overload

Reference Standard:**Test Procedure**

1. Energize coil with 14.1 Vdc
2. With the contact closed, apply 100A contact load for 15 minutes, remove load and then remove coil voltage (Load is carried only.)
3. Use 6 AWG wire for the load connection. Solder faston terminals (280756-4 or equivalent) to wire.
4. Perform performance checks

Acceptance Criteria

Contactors must carry 100A for 15 minutes without damage and samples shall meet electrical performance requirements.

4.2.4 Continuous Voltage Overload**Reference Standard:****Test Procedure**

1. Energize coil with 18.0 Vdc for 60 minutes
2. Perform performance checks

Acceptance Criteria

No damage to contactor and samples shall meet performance requirements

4.2.5 High Temperature Degradation**Reference Standard:****Test Procedure**

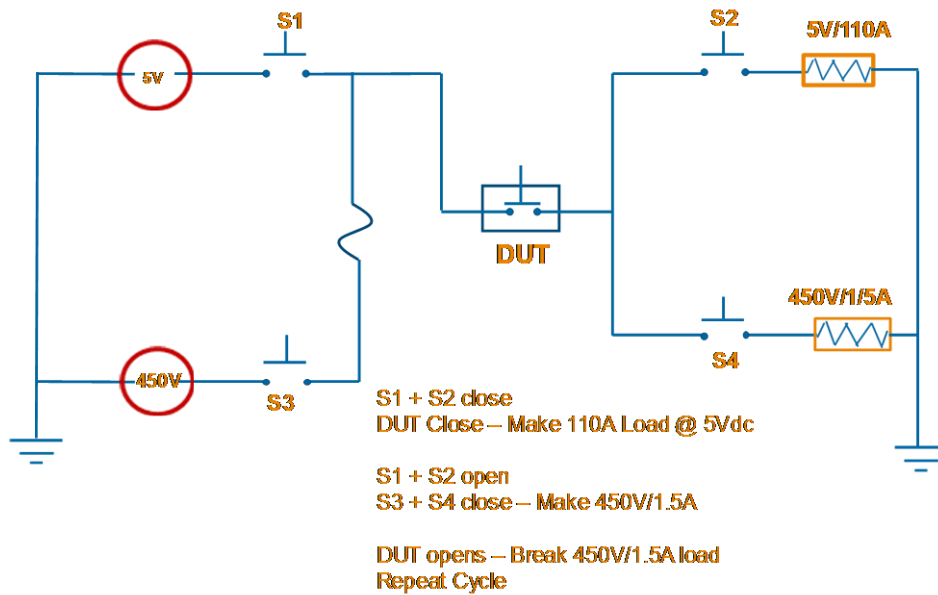
1. Energize coil with 12.0 Vdc continuously and apply 80A carry current for 504 hrs at 85 °C
2. Use 6 AWG wire for the load connection. Solder faston terminals (280756-4 or equivalent) to wire.
3. Monitor contacts for continuity throughout the test
4. Perform performance checks

Acceptance Criteria

No damage to contactor or loss of continuity and samples shall meet performance requirements

4.2.6 Battery Pack Rating Make and Break**Reference Standard:****Test Procedure**

1. Place 1N4007 or equivalent diode across coil
2. Make Load: 80A @ 10 Vdc
3. Break Load: 2A @ 420 Vdc
4. Cycles: 75,000 (forward polarity only)
5. Use 8 AWG cable for the 80A load and 16 AWG wire for the 2A load.
6. Monitor contacts
7. Perform performance checks and measure Insulation Resistance



Acceptance Criteria

No damage to contactor, contactor passes IR, and samples shall meet performance requirements

4.3 Environmental Endurance

4.3.1 Thermal Shock

Reference Standard:

Test Procedure

1. Expose the contactors (non-operating) to 6 thermal shock cycles where 1 cycle consists of 3 hours at -40 °C and 3 hours at 85 °C with a maximum transition time of 2 minutes.
2. Energize the contactors with 16V with 1A/12V on the contacts.
3. Monitor the contacts for any loss of continuity
4. Perform performance checks

Acceptance Criteria

No loss of continuity and samples shall meet electrical performance requirements and have no damage.

4.3.2 Salt Fog

Reference Standard:

Test Procedure

1. Test Temperature and salt solution: 35 ± 2 °C
2. Salt Solution: 5 parts by weight of salt dissolved into 95 parts by weight of water. The solution shall be adjusted and maintained at a specific gravity of 1.037 to 1.022. The pH of the salt solution shall be maintained between 6.5 and 7.2.
3. Energize the coils with 16Vdc
4. Condition contactor for 2 hours at 35 ± 2 °C prior to introducing the salt fog
5. Expose the contactor to the salt atmosphere for a duration of 24 hrs
6. Perform performance and insulation resistance checks. After completion of the test, the contactor can be functionally tested immediately or allowed to dry at ambient for 48 hours,

**Acceptance Criteria**

Samples shall meet electrical performance requirements and have no damage.

4.3.3 Humid Heat Constant**Reference Standard:****Test Procedure**

1. Test Temperature/humidity: 65 ± 30 °C/90% RH
2. Test Duration: 10 days
3. Cycle relays with 16 Vdc on coil and 80A/12V load.
4. Duty Cycle: 1 hr on and 1 hr off
5. Continuously monitor relays during test.
6. Perform performance checks

Acceptance Criteria

No loss of continuity, no product defects that would affect the functional performance of the contactor, and current shall not increase >50% from the initial values.

4.3.4 Frost**Reference Standard:****Test Procedure**

1. Soak contactor at -20 °C for 2 hrs
2. Monitor contacts for icing immediately after removal from -20 °C
3. Transfer to +45 °C, 95% RH for 2 hrs
4. Monitor contacts for moisture presence after +45 °C soak
5. Perform performance checks

Acceptance Criteria

No product defects that would affect the functional performance of the contactor during the monitoring phase and samples shall meet performance requirements

4.3.5 Dust**Reference Standard:****Test Procedure**

1. Test conditions: Reference ISO 20653
2. Test Temperature: Room with <35% RH
3. Test Contactors with terminals down
4. Test Duration: 8 hrs (20 cycles: 1 cycle = 6 second air blast followed by 15 minute pause)
5. Dust Concentration/Type: 0.1 to 0.3 gm/cu. m/ Arizona
6. Air Blast: 58 psi downward
7. Dispersion or suspension rate of dust: ~0.25 grams/m²
8. Perform performance checks

Acceptance Criteria

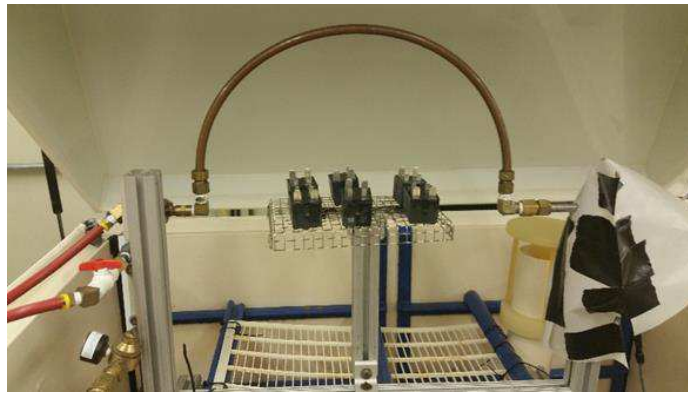
Samples shall meet performance requirements.

4.3.6 Water

Reference Standard:

Test Procedure

1. Test conditions: Reference ISO 20653
2. Test Temperature: Room
3. Test contactors with terminals up (see figure)
4. The contactors are to be unpowered
5. Apply water through a shower tube with aperture diameter of 0.4 mm at a rate of 0.1 l/min \pm 5% while swiveling the shower tube by \pm 60° with reference to vertical plane for a period of 5 min then a 2nd 5 min with swivel tune adjusted to spray 90° with reference to horizontal plane.
6. Total exposure time: 10 minutes
7. Perform performance checks



Acceptance Criteria

Samples shall meet performance requirements.

4.4 Operating Durability

4.4.1 Vibration

Reference Standard:

Test Procedure

1. Subject samples to a vibration sweep shown below.



Acceleration (m/s ²)	Frequency (Hz)
10 mm p-p Displacement Limited	5 – 15
44.1 (4.5g's)	15 – 25
19.6 (2g's)	25 – 100
4.9 (0.5g's)	100 - 200

2. Apply 12V to coil in order to pull contactor in and then reduce the coil voltage to 6.4V.
3. Perform 18 sweeps per axis, 3 axis for a total of 54 sweeps
4. Monitor for discontinuities greater than 100 microseconds.
5. Perform performance checks

Acceptance Criteria

Samples shall meet electrical performance requirements, no discontinuities greater than 100 microseconds, and have no damage

4.4.2 Mechanical Shock**Reference Standard:****Test Procedure**

1. Rigidly mount contactor to shock table.
2. Apply 12V to coil in order to pull contactor in and then reduce the coil voltage to 6.4V.
3. Apply a half sine shock impulse of 50Gs for a 10 msec duration in the $\pm X$, $\pm Y$, and $\pm Z$ axis.
4. 6 shocks per axis
5. Monitor for discontinuities greater than 100 microseconds.
6. Perform performance checks

Acceptance Criteria

Shall meet electrical performance requirements, no discontinuities greater than 100 microseconds, and have no damage.

4.3.3 Short Circuit**Reference Standard:****Test Procedure**

1. Subject contactors to a short circuit load of 1,879A for 25 ms.
2. Perform performance checks

Acceptance Criteria

No discontinuities or defects that would affect the functional performance of the contactor.