**Critical Item:** Relay, Main Hoist (4 Total, 2/Crane)

**Find Number:** 1HCR, 1LCR (1 ea./Crane)

**Criticality Category:** 2

| | | | |
|---|---|---|---|
| **SAA No:** | 09FY12-005 | **System/Area:** | 250-Ton Bridge Crane (#1 & #2)/VAB |
| **NASA Part No:** | NA | **PMN/ Name:** | K60-0533, K60-0534/ 250-Ton Bridge Crane (#1 & #2)/VAB |
| **Mfg/ Part No:** | General Electric/ CR120A06002AA | **Drawing/ Sheet No:** | 59-K-L-11388/ 13 |

**Function:** Provides power to the brake relays to release brakes during hoisting, lowering and float operations, and provides power to start the sequence that energizes the generator field winding.

a. N.O. contact closes to energize HCR RUN (1HCR) or LCR RUN (1LCR) which energizes relay 1RUN.

b. N.O. contact closes to energize relay 1XR, which releases the brakes, and relay 1XR1, which enables the generator field DC input controller.

**Critical Failure Mode/Failure Mode No:**

a. N.O. contact fails open/

- 09FY12-005.006 (1HCR)
- 09FY12-005.008 (1LCR)

b. N.O. contact fails closed or relay fails activated (contacts remain in the energized position)/

- 09FY12-005.007 (1HCR)
- 09FY12-005.009 (1LCR)

**Failure Cause:**

a. Corrosion, binding mechanism.

b. Welded contacts, binding mechanism.

**Failure Effect:**

a. Relay 1RUN N.O. contact will not close and generator field will not be energized. No output from the generator. No hoist motor torque while the command is being given to raise, lower or float the load and the brakes are released. The load will descend with regenerative braking at 0.25 ft/min (0.05 in/sec) max (based on maximum load capacity of the hoist. in reality this would descend slower). The worst case would be attempting to lift or float a critical load (SRB segment, Orbiter, or ET) from the stop position, releasing the brakes, the failure occurring, and the effect being the critical load descending and striking the VAB floor, transporter, work platforms, MLP, or Shuttle Stack resulting in possible damage to a vehicle system. Time to effect: seconds.

b. Brake relays will remain energized and the brakes will not set when the hoist motors are commanded to stop (in normal operation). The load will descend with regenerative braking at 0.25 ft/min (0.05 in/sec) max (based on maximum load capacity of the hoist, in reality this would descend slower). The worst case would be attempting to bring a critical load (SRB segment, Orbiter, or ET) to a stop while lowering, the failure occurring, and the effect being the critical load continuing to lower and striking the VAB floor, transporter, work platforms, MLP, or Shuttle Stack resulting in possible damage to a vehicle system. Time to effect: seconds.

## ACCEPTANCE RATIONALE

**Design:**

| Contact Ratings | Actual |
|---|---|
| 300 volts | 120 volts |
| 10 amps | Testing required |

- Contact Material: Silver Cadmium Oxide, Self-cleaning
- Mechanical life expectancy is 10 million operations.
- This relay was off-the-shelf hardware selected by the crane manufacturer for this application.

**Test:**

- OMRSD file VI requires verification of proper performance of hoist operational test annually.
- OMI Q3008, Operating Instructions, requires all crane systems be operated briefly in all speeds to verify satisfactory operation before lifting operations.

**Inspection:**

- OMI Q6003 Maintenance Instructions, requires annual inspection of contacts and contact members for burning, pitting, proper alignment, and discoloration caused by overheating; visual check of closing coils for deterioration insulation and evidence of overheating or burning.

**Failure History:**

- The PRACA database was researched and no failure data was found on this component in the critical failure mode.
- The GIDEP failure data interchange system was researched and no failure data was found on this component in the critical failure mode.

**Operational Use:**

- Correcting Action:
  1) The failure can be recognized via the ammeter (lack of current) and the Selsyn (positions change) (for both failures), or the failure of the brake set light to illuminate (for the N.O. contact fails closed failure only). that are in view of both operators.
  2) When the failure indication is noticed, the operator can stop all crane operations by pressing the E-Stop button (for both failures), returning the Master Control Switch to neutral, or releasing the brake switch if in the float mode (for the N.O. contact fails open failure only).
  3) Operators are trained and certified to operate these cranes and know and understand what to do if a failure indication is present.
  4) During all critical lifts, there is at least one remote Emergency Stop (E-Stop) operator observing the load lift, and can stop the crane if a failure indication is noticed.
  5) Operationally, the crane must be operated in the fine or float speed mode if a critical load is within 10 feet of any structure in the direction of travel.
  6) During final SRB mate, all crane operations are ceased and final mate is accomplished by use of the 250-Ton Hydra-Set.
- Timeframe:
  - Estimated operator reaction time is 3 to 10 seconds.