SAA09FY12-006
REV. B

B/L: 389.00
SYS: 175-TON
BRIDGE
CRANE, VAB

AUG 2 0 1993

Critical Item: Generator Field DC Input Controller, Main Hoist

Find Number: 1FC

Criticality Category: 2

SAA No:	09FY12-006	**System/Area:**	175-Ton Bridge Crane/VAB
NASA Part No:	NA	**PMN/ Name:**	K60-0528/ 175-Ton Bridge Crane/VAB
Mfg/ Part No:	Reflex/ URRK-VIII	**Drawing/ Sheet No:**	67-K-L-11348/ 15

Function: A solid state assembly which provides DC excitation to the generator field of the motor-generator set (M12-G4). The excitation is proportional to the input supplied from the control potentiometers (R POT, F POT) and is used to drive the DC motors which control the main hoist.

Critical Failure Mode/Failure Mode No:

a. No output/09FY12-006.067

b. High output (not inverted)/09FY12-006.072

c. High output (inverted)/09FY12-006.073

Failure Cause:

a. Contamination, corrosion, board component open.

b. Board component short, board component open, loss of voltage feedback from the DC drive motor loop.

c. Board component short.

Failure Effect:

a. No DC excitation voltage to the generator field winding. No output from the generator. No hoist motor torque when the command is given to raise, lower, or float the load while 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 an External Tank (ET) or the aft end of the orbiter from the stop position, releasing the brakes, the failure occurring, and the effect being the ET or the aft end of the orbiter descending and striking the VAB floor or transporter, resulting in possible damage to a vehicle system. Time to effect: seconds.

b. Increasing speed of the DC motors controlling the main hoist. The worst case would be attempting to lower an ET or the aft end of the orbiter in the slow coarse mode of operation, the failure occurring causing a sudden increase to full coarse speed resulting the ET or the orbiter striking the VAB floor or transporter at a velocity of 10 ft/min causing possible damage to a vehicle system. Time to effect: seconds.

c. Increasing speed, in the opposite direction than commanded, of the DC motors controlling the main hoist. The worst case would be attempting to lift an ET or the aft end of the orbiter in the slow coarse mode of operation, the failure occurring causing a sudden increase to full coarse speed downward resulting the ET or the orbiter striking the VAB floor or transporter at a velocity of 10 ft/min causing possible damage to a vehicle system. Time to effect: seconds.

ACCEPTANCE RATIONALE

Design:

- Voltage feedback from the DC motor armature loop maintains a constant output to the drive motors at +/- 2%. This prevents an overvoltage condition from driving the crane faster than is commanded by the operator.
- Current feedback from the DC motor armature loop prevents the crane from being driven faster than is allowable in maximum coarse speed.
- Current feedback from the generator field winding maintains the proper gating for output to the generator field.
- Output can be regulated and will remain constant each time the crane is being used. This allows for uniformity in expected crane reactions to inputs from the operator.
- Output to the generator field is supplied up to positive or negative 109 volts in response to an input of positive or negative 6 volts.
- Rated power: 4K watts
- Actual power: 2K watts
- Rated temperature: 0 to 50° C.
- Actual temperature: Ambient.

Test:

a. OMRSD file VI requires verification of proper performance of hoist operational test annually.

b. OMI Q3009, Operating Instructions, requires all crane systems be operated briefly in all speeds to verify satisfactory operation before lifting operations.

c. OMI Q3008, Pre-Operation Setup Instructions, requires current limit checks prior to all major lifts of flight hardware (verifies motor, generator, generator field DC input controller, float control loop and DC power loop components are operational).

d. OMI Q3008, Pre-Operation Setup Instructions, requires a verification of proper operation of the overvoltage protection relays prior to all critical lifts.

Inspection:

- OMI Q6003, Maintenance Instructions, will require an annual visual inspection of the solid state circuit board assemblies for evidence of burning, discoloration caused by overheating, contamination or corrosion.

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 Selsyn (positions change) that is in view of both operators.
  2) When the failure indication is noticed, the operator can stop all crane operations by returning the Master Control Switch to neutral or pressing the E-Stop button (releasing the brake switch in float mode).
  3) When the high output failure occurs in the fine speed or float mode, the motor generator set will be shut down by an overvoltage protection relay when the voltage in the DC motor loop reaches 115% of full float voltage in the float mode, or 115% of full fine voltage in the fine mode (see Test item d for operational verification information).
  4) Operationally, the crane must be operated in the fine or float speed mode if a critical load is within 10 feet of any structure.
  5) Operators are trained and certified to operate these cranes and know and understand what to do if a failure indication is present.
  6) 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.
- Timeframe:
  - Estimated operator reaction time is 3 to 10 seconds.