ACTION ITEM NO: 6-30

DATE SUBMITTED: 29 JUL 98

SUBMITTED BY: NAVSURFWCNTR CRANE, IN

PROBLEM:

When utilizing the Power Distribution Box (PDB) in extreme hot weather (120 degrees F +/-) and drawing a 50 Amp load through the 200 Amp Circuit Breaker, a thermal overload has occurred six (6) times, two (2) of the breakers would not reset.

We opened the maintenance access doors to allow the heat to escape. With the doors open, no further overloads have occurred. Safety hazard to keep the door open and allows excess dirt and sand to enter the unit.

RECOMMENDATION:

Add louvers to the maintenance access doors to allow heat to escape the unit, with the doors closed.

STATUS: 29 JUL 98

ACTION AGENCY:

NADEP NORTH ISLAND (Code 48701)

Open. NADEP North Island Code 48701 to provide louvers and analysis upon installation.

COMPLETION DATE:

16 NOV 98

STATUS: 14 SEP 98

Open. NADEP North Island, Code 48701, will conduct further investigation into the overheating and reduced circuit-breaker capacity.

COMPLETION DATE:

15 MAY 99

STATUS: 12 NOV 98

Open. Action Item 6-30 requests the addition of louvers to the Power Distribution Box (PDB), part number PWBX0101-1, to reduce overheating within the unit.

A PWBX0101-1 used in a very hot climate was reported to have reduced circuit-breaker capacity and increased circuit-breaker failures. Activities using the PWBX0101-1 only in cooler climates have not reported overheating and reduced circuit-breaker capacity.

MALS-13, MCAS Yuma utilizes PDB’s. To gather data for this Action Item, temperature measurements were performed on PDB012 at this location. The weather conditions at the time of the measurements were clear, with an outside temperature of 106 degrees F. The PDB was outside and not shaded during measurements. The measurements yielded the following results:

ACTION ITEM NO: 6-30 (CONTINUED)

- When the outside air-temperature was 106 degrees F, the interior air-temperature of the PDB was 116 degrees F.

- The temperature of the exterior aluminum metal covering the output circuit-breakers was 128.8 degrees F.

PDB012 contained a circuit-breaker that failed. It was removed for shipment to "Square-D" company and will be examined to determine if heat was the cause of the failure.

MALS-31, MCAS Beaufort also utilizes the PDB. One of their units, PDB038 has been modified to include (2) two louvers. The reason for the installation of louvers, which is specified in modification drawing PWBX0160, is to prevent condensation within the PDB. Temperature measurement data taken from PDB038 on 23 September 1998 showed that the interior of the PDB was only one degree higher than the outside temperature.

More significant than the interior temperature of the PDB is the temperature of the surface of the PDB. The PWC Norfolk PDB design specifies that the output power circuit-breakers be mounted inside of aluminum enclosures that put the circuit breakers next to the exterior skin of the PDB. When the sun heats the exterior metal surface, the circuit-breakers are likewise heated.

Louver installation will help keep the interior air-temperature of the PDB close to the air-temperature outside the PDB. However, more importantly, it may be necessary to block the PDB from direct sunlight in very hot climates to prevent the heated aluminum exterior surface from heating the circuit-breakers just beneath this surface.

Further testing is required to verify a solution before issuing a message or modification kit to PDB users. Data from "Square-D" company examination of the failed circuit-breaker is not yet available. It may be necessary to examine the PDB reported to have a failure in Action Item 6-30 to confirm circuit-breaker overheating is the cause of the problem. If overheating is determined to be the cause, a solution could be tested at the time and data could be gathered.

Further investigation will be conducted by NADEPNI Mobile Facilities Engineering Code 48701. A final report answering this Action Item will be issued within 180 days.

COMPLETION DATE:

15 MAY 99

STATUS: 11 MAR 99

Open. NADEP NORIS Code 48701 determined that in order to evaluate an overheating problem, there is a need to test a solution during the same conditions – the heat of the summer.

Last year a test was conducted at MALS-13 MCAS Yuma (see text below). The data gathered at that time indicated that the design of the PDB exposed the circuit breakers to solar heating which could reduce their capacity. In the Action Item response released to the MALS (see below), NADEPNI Code 48701 stated,

"Further testing is required to verify a solution before issuing a message or modification kit to PDB users…. It may be necessary to examine the PDB reported to have a failure in Action Item No. 6-30 to confirm circuit breaker overheating is the cause of the problem.

ACTION ITEM NO: 6-30 (CONTINUED)

A good reason for more careful examination of the problem claim in Action Item No. 6-30 is because of a similar PDB overheating problem reported on Action Item No. 6-19 during the summer of 1997. After NADEPNI Code 48701 contacted GySgt Stuckmeyer (Mals-13 in MCAS Yuma) and discussed Action Item No. 6-19 problem with him, his observation attributed the problem to overloading the circuit instead of overheating. After he had the power connections corrected, there was no further reports of overheating.

The PDB is NOT designed well and solar heating will affect the circuit breaker capacity more than an alternative design that NADEPNI Code 48701 proposed to COMNAVAIR Code 3.1B.4 in the past.

NAVSURFWCNTR, CRANE IND reported that an activity in Saudi Arabia was forced to open the PDB doors and introduce cooling air to the PDB to allow operation. From this, one could conclude that heat caused circuit breaker tripping. However, we need to verify whether design problems inherent in the PDB are actually causing the circuit breaker failures reported in Action Item 6-30. The following are two options to help determine the true problem:

1. The activity that reported the problem could change their cable connections to the PDB to reduce load on circuit breakers that have tripped, then report to engineering if circuit breakers are still tripping. (The tripping occurred during very hot weather. But that is also when the MF ECU's would be drawing more power too. So the tripping may not be directly attributed to heat on the PDB but to the additional ECU power draw resulting from higher temperatures.) Also, the activity could install louvers and suspend a tarp above the PDB that would block the sun completely and provide good shade.

2. Measure the power draw to individual connectors. This would require power shut down to the PDB. Then the wires to an individual connector would have to be identified. Then a meter would have to be attached to these wires to measure current. Then power would be applied and measurements taken during a normal workday. Temperature measurements, similar to the ones done at MALS-13, MCAS Yuma, should also be done to determine the temperature of the PDB skin that is in close proximity to the circuit breakers.

Option 1 should be tried first. If a problem still exists, then Option 2 may be tested. Option 2 may require that engineering go to the site to gather data.

Instructions outlined in Option 1 above should be communicated to the activity that reported the problem that generated Action Item 6-30 (NAVSURFWCNTR, CRANE IND). After the newer PDB louver prototype is finished, a set of louvers and instructions outlined in Option 1 could be included and shipped to the activity in Saudi Arabia. NADEPNI Code 48701 can then see if there are further problem reports from Saudi Arabia. If there are, then the steps outlined in Option 2 above would be required.

The newer PDB louver prototype is finished, installation scheduled to be installed at MALS-13, MCAS Yuma, during summer months and tests are to be conducted as per Option 1, results to be provided and analyzed by NADEPNI Code 48701.

COMPLETION DATE:

15 SEP 99

ACTION ITEM NO: 6-30 (CONTINUED)

STATUS: 09 SEP 99

Closed. Action item 6-30 requests the addition of louvers to the Power Distribution Box (PDB), part number PWBX0101-1, to reduce heat within PDB and reduce circuit breaker failure due to over heating within PDB.

Mobile Facilities Program Office has approved modification of PDBs to install two louvers (part number PWBX0160-1). However, PDB users must be aware that operation in high temperature conditions or climates will limit the capacity of the PDB. The output circuit breakers installed in the PDB are rated for use up to their full capacity at 104 degrees F (40 degrees C). Temperatures higher than 104 degrees F require that the circuit breakers be de-rated from their specified rating. Per the Square D circuit breaker application guide, a 200 amp circuit breaker that is heated to 140 degrees F is then rated for approximately 165 amps.

Louver installation, originally specified to prevent condensation within the PDB, may increase ventilation to reduce the buildup of heat within the PDB. However, in high-heat climates where temperature of the PDB may exceed 104 degrees F, other measures to reduce ambient and solar heating of the PDB will be necessary to maintain full electrical capacity of the PDB. If it is not possible to reduce ambient and solar heating of the PDB to 104 degrees F, the PDB electrical loading must be reduced. Due to the design of the PDB, direct sun exposure combined with high ambient temperatures may heat the output circuit breakers well above the ambient air temperature measured at the site. Operation at temperatures beyond the circuit breaker's maximum rated ambient temperatures of 140 degrees F (60 degrees C) may cause failure of the circuit breaker.