

Title: Ames Yellow Alert: Improper Modification of Electrical Power Strip Receptacle

Lessons Learned Statement: Only trained and qualified workers are to assemble electrical/electronic devices, and all assembly must be to National Electrical Code standards, or approved by the Ames Laboratory Electrical Safety Committee.

Event Specifics: An annual Program Walk Through was performed October 20, 1998. As a result of that Walk Through, two setups were identified which had electrical power strip receptacles that had been modified with sub-standard wiring practices. The power strip receptacles are the types that have 6 to 8 female receptacles, surge protection, 15 amp breaker and a 6 foot electrical cord.

The following findings were observed:

Finding 1: The user that modified the equipment had previously attended the electrical safety and high voltage modules administered by Ames Lab.

Corrective Action Taken: The Electrical Inspector discussed the findings with the user to ensure understanding of the safety implications and violations.

Finding 2: One of the receptacles was rated by Underwriters Laboratory (UL) and the other was not. All electrical equipment is required to be rated by UL unless inspected by the Ames Laboratory Electrical Safety Inspector and determined to be safe. If verified to be safe, it will receive an inspection sticker of approval.

Corrective Action Taken: The power strips were removed from operation.

Finding 3: The user had disassembled the fixtures, drilled holes in the housing of the fixtures, inserted the wires through the holes and tapped hot and neutral 22 gauge wires to the internal connections. The original power cord is 14/3.

- The wire and the insulation was undersized for the voltage being used.
- The wire was not protected from sharp edges from the drilled hole.
- Modification of the power strip destroys the UL approval.

Corrective Action Taken: The power strips were removed from operation. Engineering Services Group re-wired the equipment meeting National Electric Code Requirements.

Finding 4: A grounding wire was not used with the 22 gauge wires.

Corrective Action Taken: The power strips were removed from operation. Engineering Services Group re-wired the equipment meeting National Electric Code Requirements.

Finding 5: Each 22 gauge wire was then spliced with electrical tape for additional wire length.

- Conductors must be spliced using devices suitable for the use or by brazing, welding or soldering.

- Flexible cords must be used only in continuous lengths with out splice. Hard service flexible cords No. 12 or larger may be spliced if the insulation properties are retained.

Corrective Action Taken: The power strips were removed from operation. Engineering Services Group re-wired the equipment meeting National Electric Code Requirements.

Finding 6: The 22 gauge wires were then connected to male plug ends designed to accept larger gauge wire, preventing adequate strain relief.

- Strain relief prevents a pull from being transmitted to the wire or terminal screws.

Corrective Action Taken: The power strips were removed from operation. Engineering Services Group re-wired the equipment meeting National Electric Code Requirements.

Finding 7: Two hair dryers used in conjunction with the system had the male plug ends cut, insulation stripped back from the wire and the bare wires pushed into the female receptacles of the power strip.

Corrective Action Taken: The power strips were removed from operation. Engineering Services Group re-wired the equipment meeting National Electric Code Requirements.

Finding 8: The receptacle boxes had been labeled with Blk = H and Red = Lo. Assuming the Black is Hot and Red is Neutral, the markings could be misleading, as they do not reflect the nationally standardized color coding.

Corrective Action Taken: The power strips were removed from operation. Engineering Services Group re-wired the equipment meeting National Electric Code Requirements.

Results: As a result of these findings, ESH&A locked out both pieces of equipment. The equipment was remediated by Engineering Services Group in approximately one week. A Readiness Review was performed of both set-ups before going back into service. The two strip receptacles are located at ESH&A, 40 TASF, if you would like to examine them.

Recommendations: All electrical wiring and electronic equipment shall meet the requirements of the National Electrical Code and the Ames Laboratory Electrical Safety Manual. Substandard modifications that pose a risk to the safety of employees and visitors, and increase the likelihood of fire are unacceptable. If you are not sure that changes or additions to a system are compliant, an evaluation by Engineering Services before putting the system on-line may be more expedient than the delays of a lock-out and subsequent Readiness Review.

For more information, please contact Shawn Nelson at 515/294-4161.