

# **SANYO DENKI *America, Inc.***

**Cooling Systems Division**

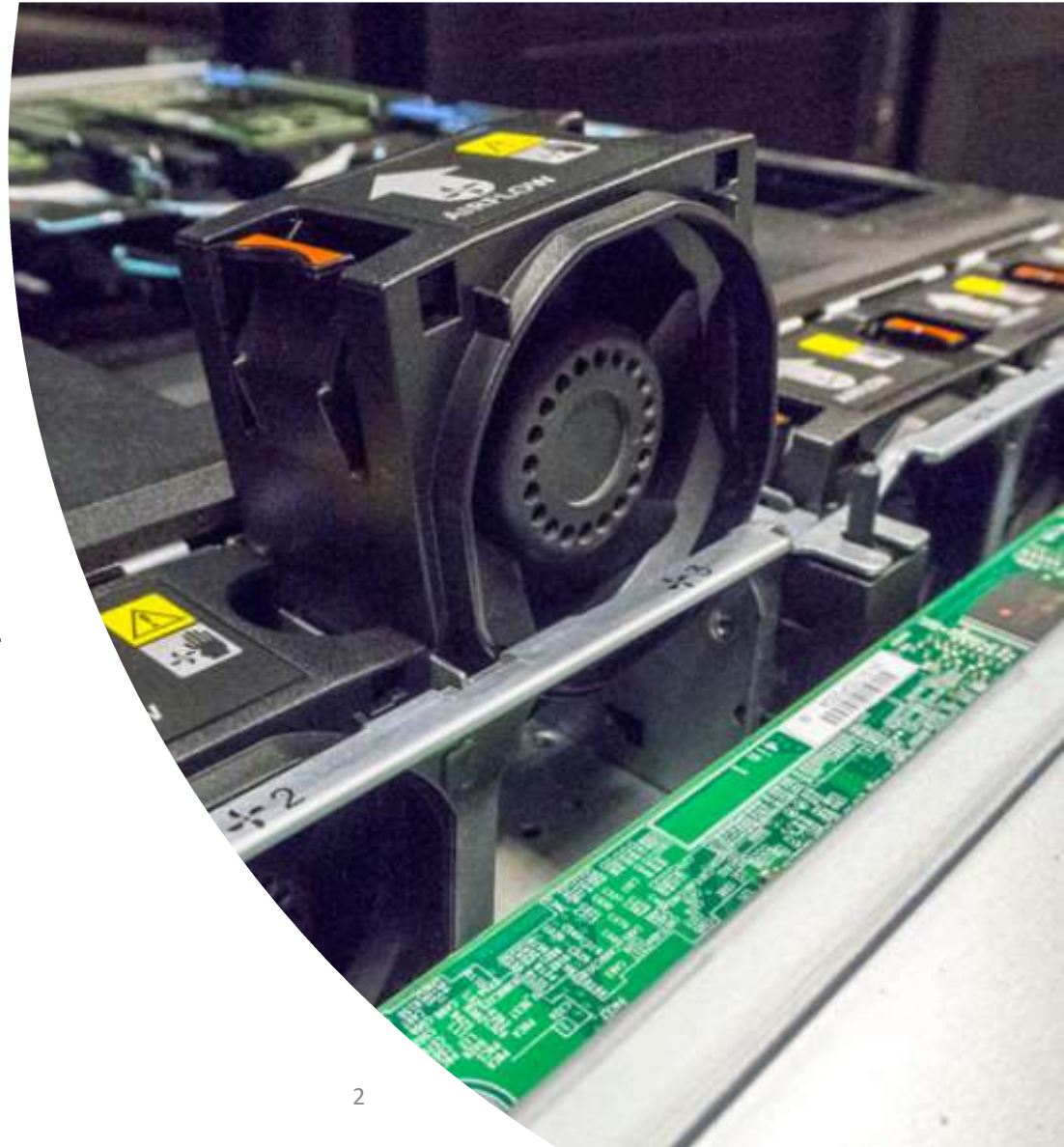
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## **Precautions for Reverse Rotation in Fans**

# HOT SWAPPING

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- Hot swapping is also known as “hot plugging”.
- Hot swapping occurs when the user is replacing/adding components to a system without stopping or shutting down its operation.
- This allows the user to replace defective parts without experiencing system down time.
- One major issue with hot swapping fans is that it can cause **Reverse Rotation** in fans



# WHAT IS REVERSE ROTATION?

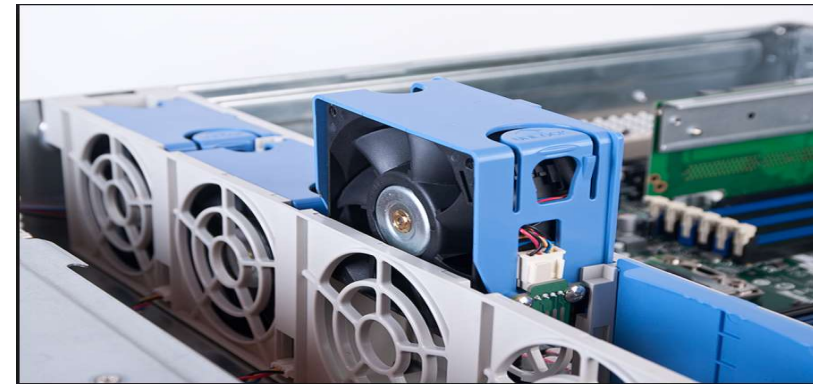
## What is Reverse Rotation?

When a fan is spinning in the opposite direction to normal operation which can't be corrected by the fan motor.

## What causes Reverse Rotation?

- When multiple fans are used in a system, high system pressure generated by the other fans causes air to circulate back through the replacement fan before it is powered up.
- In some instances, systems with multiple fans can have reverse rotation faults at startup. This can be caused by fans starting up at different times or larger size fans overpowering smaller fans.
- Some fans have 3-phase motors for improved efficiency, but these are easily susceptible to reverse rotation due to the low cogging torque needed to spin the fan impeller.

Sanyo Denki fans have an electrical safety circuit to prevent over heating. This prevents the fans from starting up during a backflow of air.



# Reverse Rotation Conditions

The image to the right is comparison between what a normal and a reverse rotation waveform looks like. In the normal rotation, the current is at normal specification range while the reverse rotation is nearly 3 times the normal current. **This abnormal wave form will have long-term negative affects to the fan.**

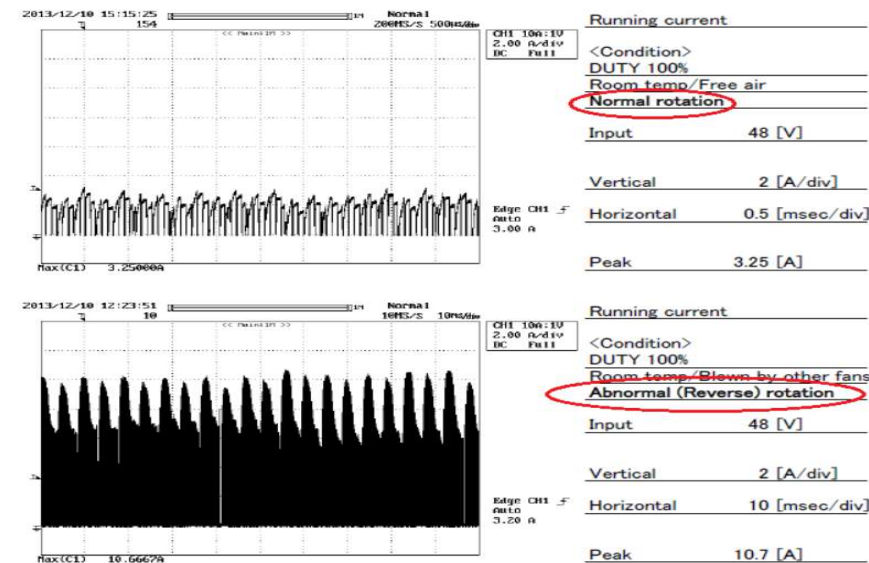
## Warning

### Handling

- Installation, placement, connections, wiring, or relocation of the product should be performed by knowledgeable or correctly licensed person. This might lead to injury, electrical shock, burns, or fire.
- Do not use the fan if not fixed or stand in hand.
- Never allow yourself to come into contact with the ends of wires or plugs when measuring the insulation resistance or dielectric strength.
- Never attempt to disassemble or alter this product in any way. Doing so might invalidate any warranties concerning the functions or bodily injury, or electrical shock.

### Instruction

- If the fan stops during operation, give proper consideration to the device for its protection.
- Never use the product at voltages, temperatures, or any other settings which exceed those given in the product specifications. This might lead to injury, electrical shock, burns, or fire.
- The fan may fail to operate properly if there is insufficient power capacity, because the starting current is several times larger than the rated current of the fan. Be sure to inquire about startup current levels for individual models.
- Do not control the speed of the fan by changing power voltage. It may cause fan failure.
- Start up all fans at the same possible timing if two or more fans which wind interferes with each other are installed in the device. If the fan is exposed to wind from other fans at start up, it may cause fan failure or the fan may not start up correctly.
- Never insert or remove any lead wires or connectors while the power is turned on. When inserting or removing plugs or connections, always hold the housing of the plug or connector when doing so. Failure to do so might result in damage or exposure to electrical shock.
- Do not remove the lead wire from the frame hook. It may scratch and damage the surface of the lead wire.
- Never remove the product identification plate or install the product so that the identification cannot be seen after installation. This could result in fires.
- Do not push the nameplate of the DC fan with strong force. The nameplate may break and touch the shaft.
- The product might become damaged if foreign objects or external forces are allowed to interfere with normal fan operation.
- Do not implement ON-OFF of power supply in negative line. That might cause damage of the fan.

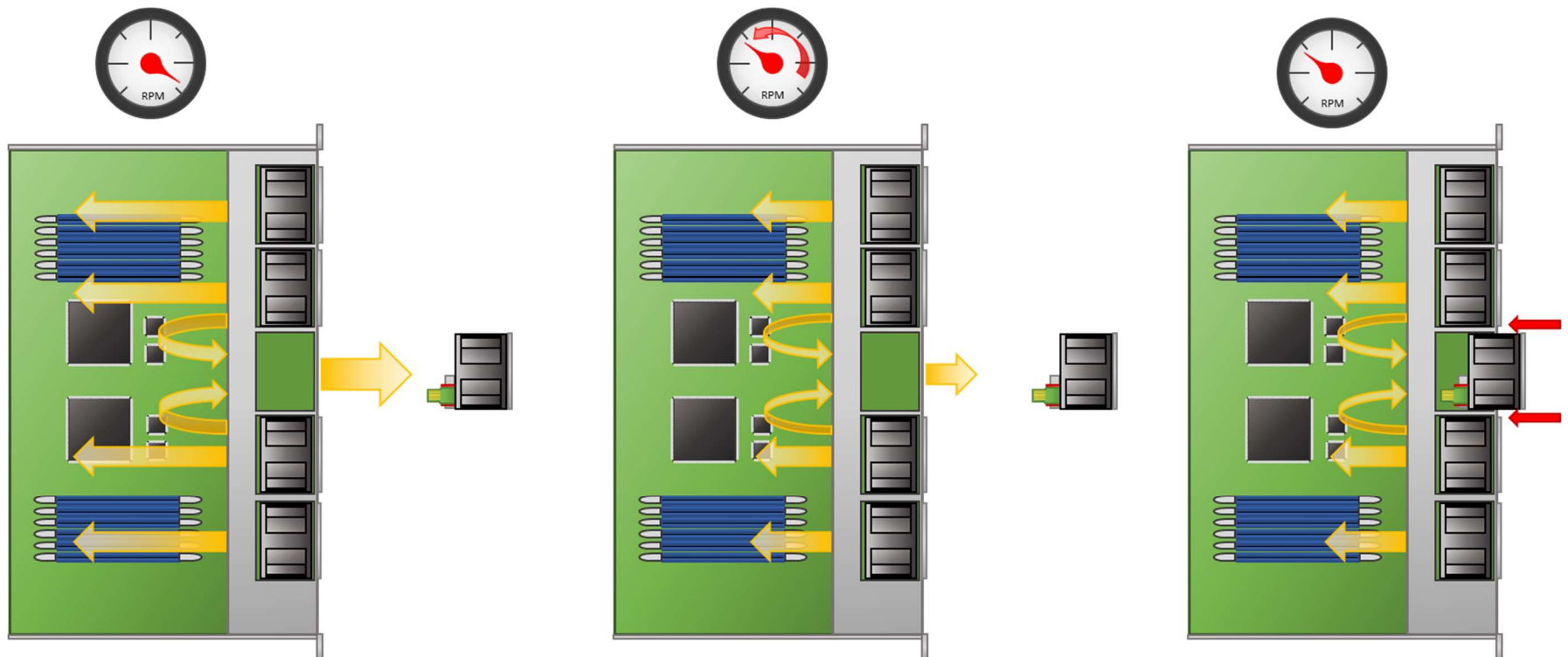


Airflow from other fans in a system can cause a hot swapped fan to reverse rotate due to high pressure. **It is recommended to start all fans at the same time to prevent fan failure or reverse rotations.**



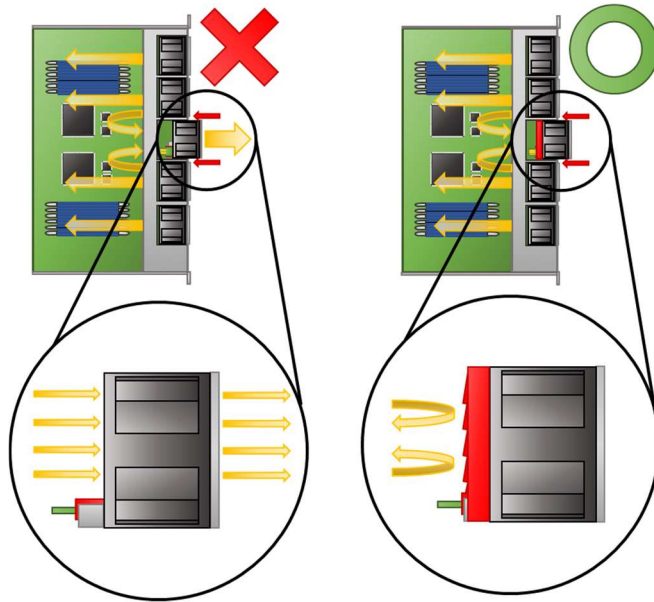
# SOLUTIONS TO PREVENT REVERSE ROTATION

- Lower the speed of the other fans during installation to reduce backflow through the hot plug location. Nominal speed can be resumed after the replacement fan is installed.

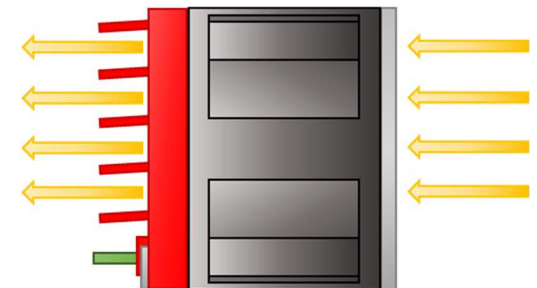
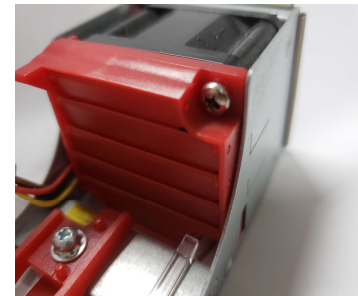


# SOLUTIONS TO PREVENT REVERSE ROTATION

- Obstruct the reverse airflow through the affected fan, in order for that fan start spinning when hot plugged.
  - This can be done by installing a louver. Louvers should be properly designed to shut when there is a backflow of air.
  - This can be done manually. The user can use an object to block off backflow to the hot plug location, in order for the fan to start spinning without impedance.

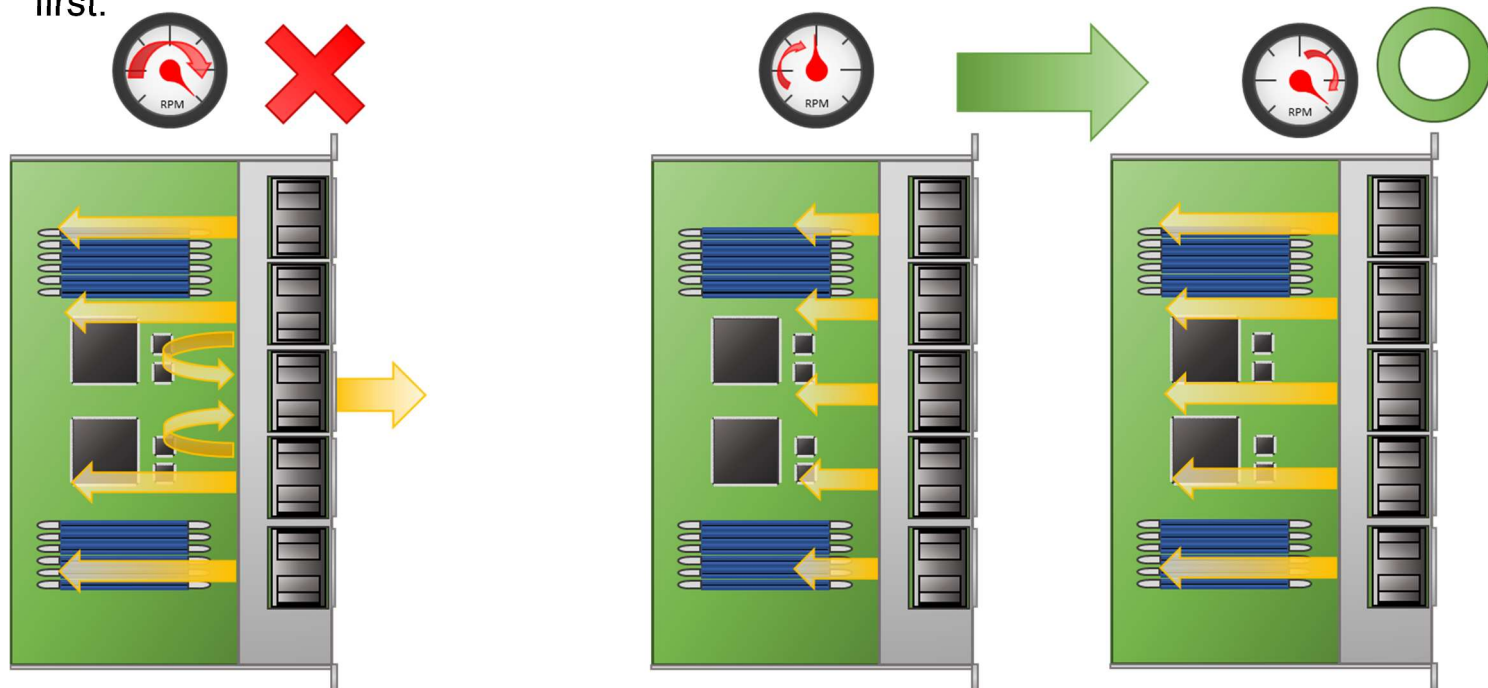


**An example of a louver**



# PREVENT REVERSE ROTATION AT STARTUP

- Start all fans in a system simultaneously. If some fans start at different times, there is risk of reverse rotation in the fans starting later
- Start all fans at lower speed then increase speed once all fans have begun rotating.
- If multiple size or performance fans are used in a system, start up the lower performance fans first.



# RECAP

- **Reverse Rotation** is when a fan is spinning in the opposite direction to normal operation.
- Reverse rotation can happen due to:
  - **Hot swapping** a fan in an application with multiple fans
  - Startup of fans at different times
  - Startup of fans with multiple sizes or performances in a system
- Reverse rotation can be prevented when hot swapping by:
  - **Reducing Speed** of all fans currently in a system while the new fan is installed
  - Installing **Louver System** on fans to prevent airflow backwards through the fan
- Reverse rotation can be prevented at startup by:
  - Starting all fans **simultaneously**
  - Starting all fans at **reduced speed** and then increasing after all fans are rotating
  - Starting **lower performance or smaller fans first** and then starting up larger fans after.