

Kell Systems PSE air-cooled acoustic server rack enclosures v7.6

Thermal performance of Kell Systems PSEs

The effect to server operating conditions, provided that Kell Systems thermal loading and installation guidelines are adhered to, is so slight as to be insignificant.

To understand how effective the PSE's thermal management system is, please consider the following example of a Kell v7.6 PSE18 enclosure's impact to server CPU temperatures, under normal "office" environmental conditions, compared to operation of those same servers in free space.

Test conditions:

Equipment used:

- Kell PSE:** Model PSE18 v7.6, maximum recommended thermal load 1.2 kW
- Server 1:** HP Proliant DL380 G4 2U rack-mount server with 2 x 3.2 GHz Intel Xeon processors
- Server 2:** HP Proliant DL380 G4 2U rack-mount server with 2 x 3.2 GHz Intel Xeon processors
- Server 3:** HP Proliant ML370 G4 5U rack-converted server with 2 x 3.2 Intel Xeon GHz processors

Incidental hardware also present in PSE during example test:

APC Smart-UPS 3000 VA 3U rack-mount UPS

3 x Netgear network switches

2 x 1U climate monitoring devices

Test and measurement method

CPU temperature measurements were taken using HP Systems Insight Manager software

Continuous CPU loads were generated using BurnInTest software by Passmark

Room ambient temperature measurements were taken by recording the average reading of 2 x digital thermometers

Room ambient air temperature

The test room air temperature was maintained at a constant 24°C / 75°F (+/- 0.5°C) throughout the test period (equivalent to a moderately warm office).

Procedure used in example tests

- 1) In the first instance the entire outer shell of the PSE was removed, and the CPU temperatures were recorded at "idle" (running but not processing client tasks) in free air space. Removing the PSE's casing created thermal conditions identical to those in a conventional open-frame rack, or with servers not rack-mounted but resting on surfaces.
- 2) Identical and continuous processing loads, generated by the test software, were applied to all six CPUs simultaneously, such that utilisation in all CPUs was increased in steps from "idle" to 20%, 40%, 60%, 80% and 100%. After each step change in CPU loading, CPU temperatures were allowed to stabilize for one hour, and then the operating temperature of each of the six CPUs was measured/recorded using the server manufacturer's own software.
- 3) The outer shell of the PSE was then fully reinstated, and the above test procedure was replicated.

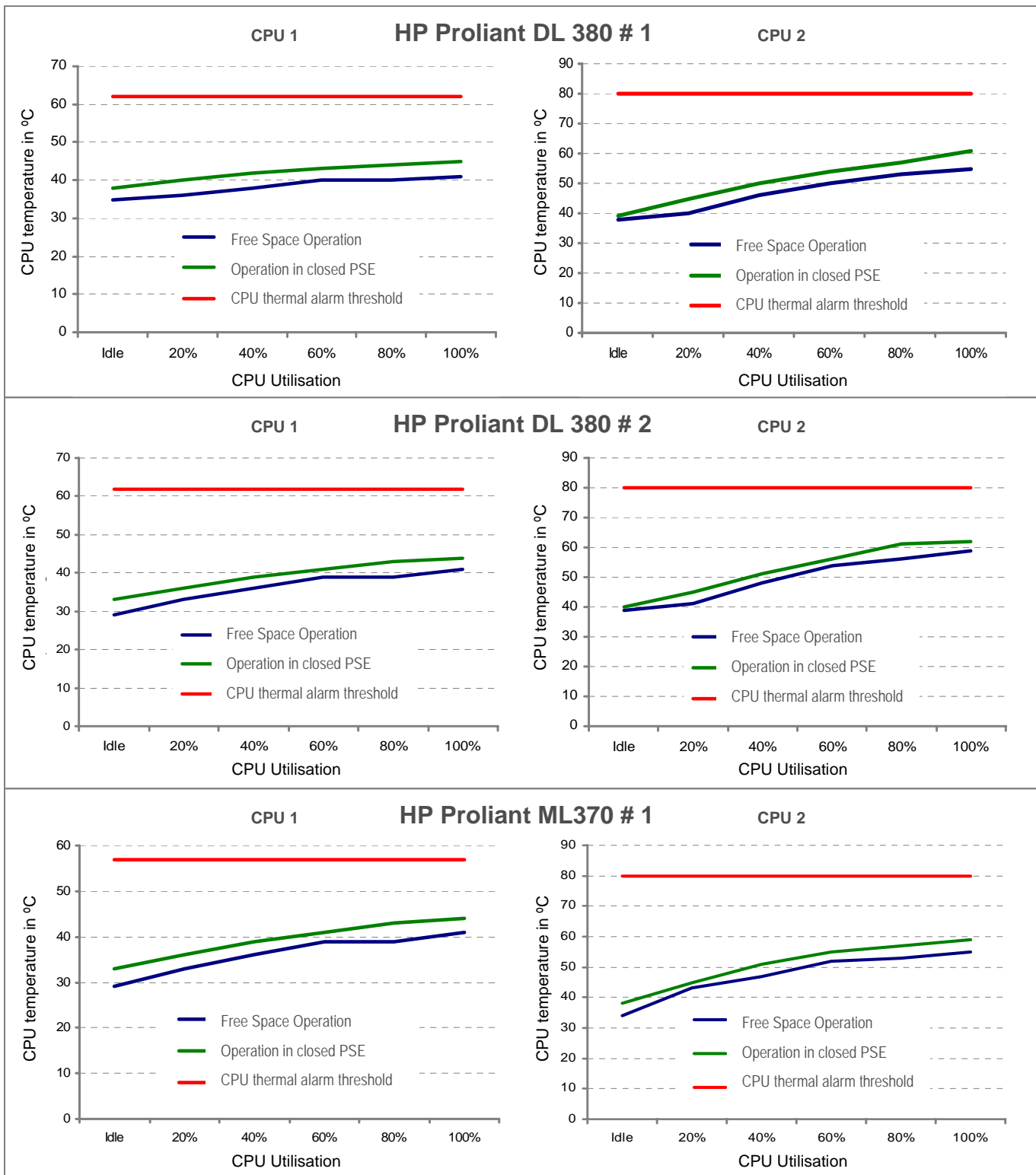
The following results were recorded (please see graphical records on page 16 of this document):

The average increase in CPU temperature attributable to the PSE, versus free space operation, was +3.2° Celsius

The electrical consumption of the combined systems, with all CPUs at 100% utilisation continuously, was 1.076 kW.

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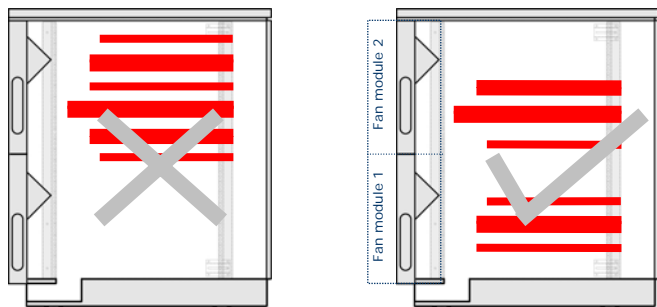
Thermal capacity (measurements from example scenario detailed on page 15 of this document)



Kell Systems PSE rack planning guidelines

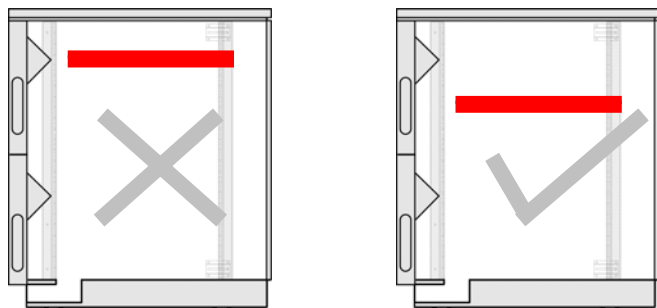
Please note the following guidelines for best installation and operation of hardware in a Kell PSE. Specific cabinet sizes are shown for illustration purposes below, but the principles extend to all PSE sizes.

Figure 1: distribution of thermal load



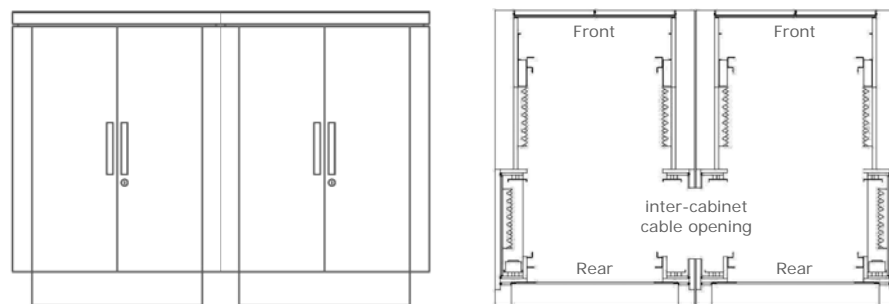
Avoid clustering **hot-running devices** such as servers, dense RAID arrays and large VoIP switches in one part of the rack. Distribute the thermal load evenly up and down the rack such that each Kell PSE fan module supports an equal amount of the thermal load, or as close to it as possible. The cabinet shown in this example is the model PSE24, which has 2 x fan modules. Models PSE12 and PSE18 each have 1 x fan module, and model PSE38 has 3 x fan modules.

Figure 2: selecting the best location for very deep servers



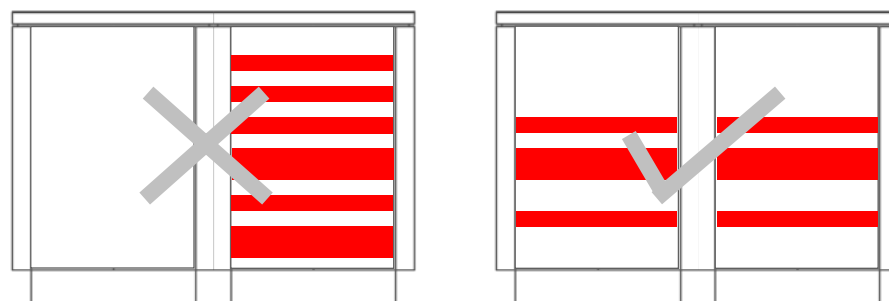
Each PSE fan module has a triangular metal section protruding slightly into the cabinet (please also see side section drawings on page 17 of this document). This does not create an issue for installation of most equipment, but to allow for ample cabling space to the rear, deep servers are generally best installed in the rack spaces above and below these triangular metal protrusions.

Figure 3: baying cabinets together



When the optional baying kit is used to link PSEs together, the rear sections of the cabinets are open to each other as shown here.

Figure 4: distribution of thermal load in bayed cabinets



When installing hardware in bayed PSEs, distribute **hot-running devices** evenly between the cabinets as shown. Also see notes in figure 1 above.

About Kell Systems

Kell Systems has pioneered the design and manufacture of Portable Server Environments (PSEs), the first complete solution for deployment of servers and network hardware directly in the office workplace. Kell PSEs are an award-winning new concept and a very real, self-contained alternative to building computer rooms. Kell PSEs are exported throughout the world and are installed in locations from Bali to Bratislava and from Hawaii to Hong Kong.

Kell Systems Ltd. is a privately-held English company founded in 2003, headquartered in Marlow, Buckinghamshire, with its manufacturing and distribution facility in Frome, Somerset.

Kell Systems Inc. is a subsidiary company of Kell Systems Ltd, with offices and showrooms in Chantilly, Virginia (Washington D.C. area). Kell Systems Inc. warehouses inventory and manages its own distribution operations in the USA.

Kell Systems (Vertrieb Deutschland) is Kell Systems' sales office in Germany and Kell Systems (Ventas España) is Kell Systems' sales office in Spain.

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