EXERTHERM LOADMAP™
24x7 Low Load Protection

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The Next Technology Step

QHi - Group
SYSTEMS DIVISION

QHiGroup.com/Exertherm

The Background...

- Compromised joints / terminations are recognised as the most common cause of serious electrical outages / ARC flash incidents. The current method of attempting to detect these critical issues is periodic thermal imaging inspections.

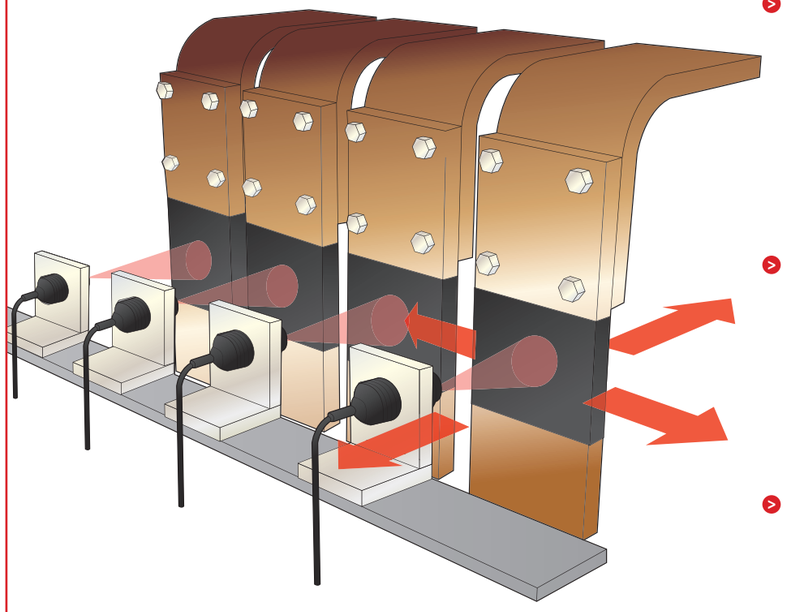
- Thermal imaging inspections either require the opening of electrical panels or external inspections which must be correlated to calculate the actual joint temperature inside the panel. In today's high uptime industry, it is increasingly being recognised that mission critical facilities must be continually monitored as a 'best practice' policy.

- New Exertherm™ IR technology provides 'The Next Technology Step' by delivering the ability to place small, non-contact, non-powered, lifetime calibrated IR sensors INSIDE electrical enclosures.

- This directly resolves two key issues with thermal imaging; firstly IR sensors provide a direct and continuous (therefore more accurate) view of critical joints / terminations. Secondly, as it provides a Delta T measurement from INSIDE the enclosure, no temperature correlation is required.

- In addition, Exertherm™ 24 x 7 Thermal Monitoring features and benefits also include:
  - Real-time data easily integrates to BMS / SCADA and can be viewed locally / remotely
  - Suitable for 'New Build' and retrofit facilities
  - Vendor Neutral

The Problem...



- A compromised joint can be identified by the excess heat generated (Newton's Law of Cooling). However, if the circuit on which the joint resides is at low load (typically below 40% of design load), there is insufficient current to generate excess heat, therefore making it very difficult for a fault to be detected early via thermography.

- As an example, if the Delta T temperature alarm threshold on a joint operating at 100% load is 40˚C, the equivalent alarm threshold when the circuit is operating at 30% is 3.6˚C. Clearly a generic alarm threshold does not have the ability to mitigate risk at low operational loads.

- In many cases the design load of a data centre will be 1.5 - 2x the initial operational load estimates. Consequently, generic alarm thresholds based on 100% load will fail to identify compromised joints/terminations at low loads.

- In addition to the issue of detecting compromised joints/terminations at low loads, a further problem is knowing how much load can be safely applied to a circuit at any given ambient temperature. Manufacturers provide maximum operating temperatures for conductors, which must not be exceeded. These are dependent on specific ambient temperature specifications.

- Thus the problem is knowing what load can be safely applied to a circuit if the ambient temperature is elevated beyond the 'normal' operating level. This can also be important as the power system ages and operating temperatures increase.

Exertherm LoadMap™ Features & Benefits...

A new predictive tool (patent pending) that will dynamically detect and identify compromised joints/ terminations residing on circuits operating at low loads (typically below 40% of maximum design load).

Predicts the maximum load that can be safely applied to a circuit on which a compromised joint has been detected, irrespective of the load that is being applied to the circuit.

Dynamically predicts the equivalent Delta T alarm threshold applicable at 100% load for any lower load being applied to the circuit.

Will dynamically provide the maximum load that can be safely applied to a circuit at the ambient temperature in which the circuit resides.

Will dynamically predict the ambient required to operate the circuit at any load up to 100% (or beyond).

LoadMap™ also accurately predicts maximum redundancy capacity and capability in N+1 / N+2 facilities.

As equipment ages & degenerates it often has to be de-rated e.g. max 80%. This can be avoided via predictive thermal control of the ambient.

Figure 1

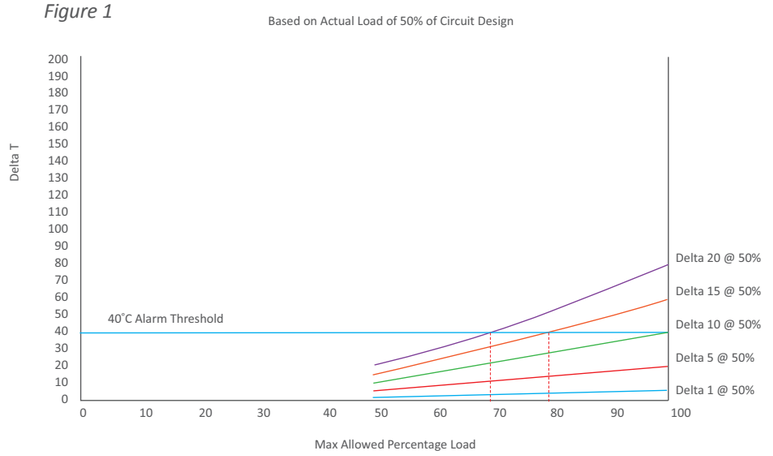
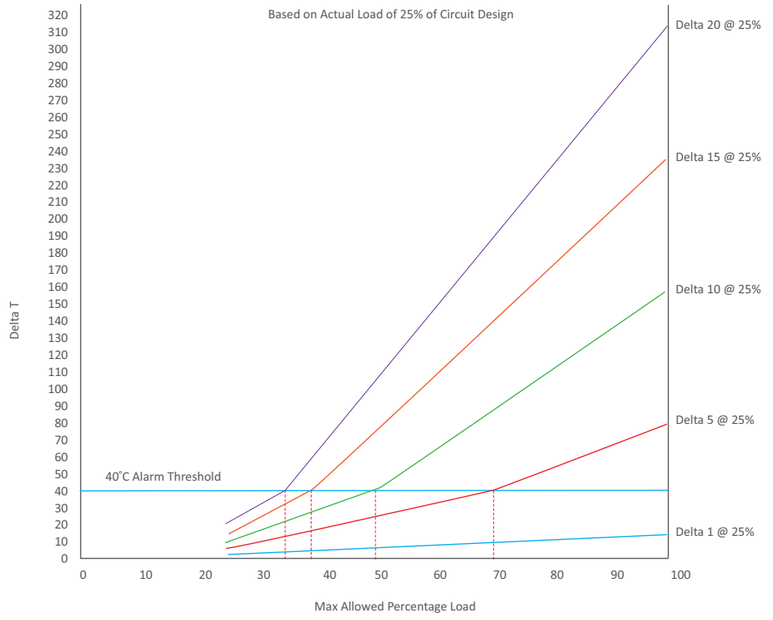


Figure 2



- Figure 1 shows that operating at 50% load with a Delta T of e.g. 20˚C the temperature reaches the 40˚C alarm threshold as load is increased to 70%. The Delta T reaches 70˚C when operating at 100% load.
- Figure 2 shows that operating at 25% load with a Delta T of e.g. 10˚C the temperature rapidly escalates past the 40˚C alarm threshold when load exceeds 50%. Delta T rises to 150˚C when operating at 100% load.

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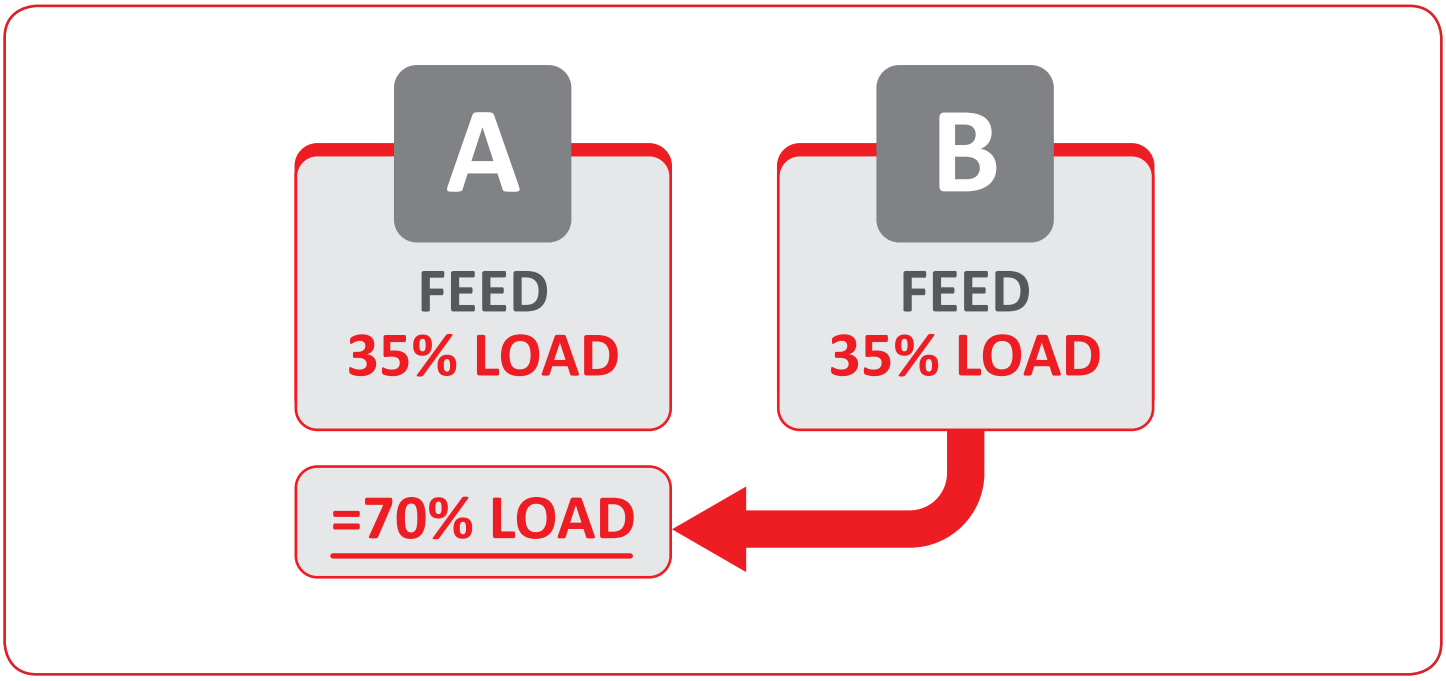
N+1 / N+2 Capacity:



By combining continuous thermal monitoring temperature data with circuit load data from metering, LoadMap™ applies algorithms to provide a unique level of dynamic protection and verification of safe loading limits on mission critical circuits.

LoadMap™ 'LoadMap™ detects and identifies compromised joints / terminations on circuits operating at low load to a level which would be very difficult for thermal imaging to detect (typically below 40% of design load).

LoadMap™ also verifies the maximum safe load that can be applied to a circuit on which a compromised joint resides.

Now N+1 / N+2 sites can verify that no "hidden" compromised joints are present on circuits operating at low loads. For the first time this enables verification that load can be switched from one power feed to another with knowledge that the circuits receiving the increased load do not have compromised joints residing on them (which could potentially fail if load is significantly increased).

LoadMap™ unique (patent pending) features provide a new level of protection for all N+1 / N+2 data centers and other organisations operating dual redundancy power systems.

A further application is where a multi-sited organisation wishes to switch IT load from site A to site B & consequently increase the power loading on site B circuits. Now verification that additional load can be safely applied to site B circuits can be obtained prior to switching load.

LoadMap™ also monitors the local ambient within the panel. This enables verification that bus operating temperatures remain below manufacturers recommended maximum temperature ratings. This can be important in locations where ambient is capable of elevating to high levels. Normally this would result in a requirement to de-rate the load capacity of the circuits. LoadMap™ provides the opportunity to control / reduce the local ambient and maintain maximum operating efficiency.

As switchgear equipment ages it often has to be de-rated e.g. because it runs hotter the maximum load rating has to be reduced. LoadMap™ advises the maximum safe load that can be applied at any given ambient. This has two advantages; firstly it can objectively indicate when is the correct time to renew / upgrade equipment, and secondly, as equipment ages, rather than just de-rate the load capacity, it is now possible by control of the local ambient to maintain maximum load capacity for an extended period.