

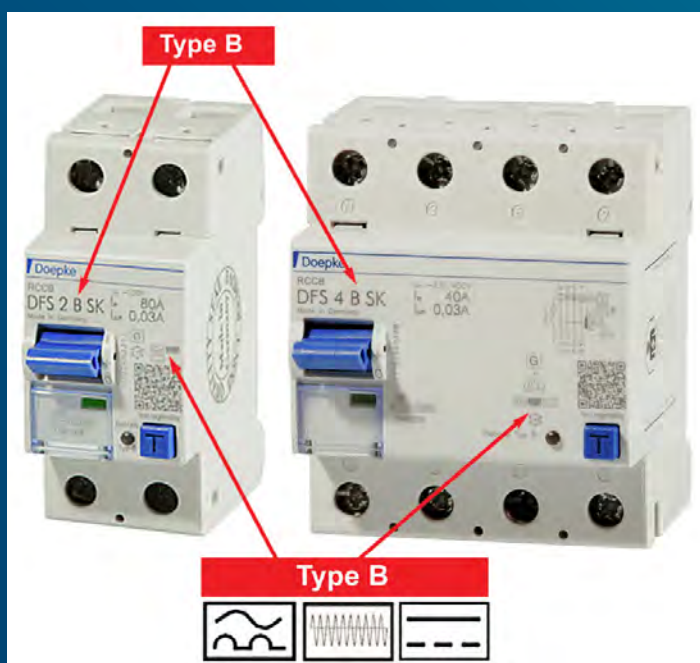
DFS 2 / 4 - RCCBs

Type B

tripping characteristics

— to be used in conjunction with BS 7671 18th Edition
UK Wiring Regulations for use by an "Appropriately
Electrically Skilled Person" Part 2 BS7671

RCCBs DFS2 / DFS4
BSK and BNK



Contents

How to use this data to select the appropriate Type B characteristic and sensitivity:

Please read pages 11 - 14 before referring to the characteristics.

For additional information on RCD selection for specific applications, please refer to www.doepke.co.uk - Technical Publications.

Page _____ **Type B characteristic and residual current sensitivity***

BNK / BSK Frequency limit 150 kHz _ For ease some graphs display < 100kHz

1. _____ DFS 2 / 4 B NK 30 mA
2. _____ DFS 2 / 4 B SK 30 mA (2024)
3. _____ DFS 4 B NK 100 mA
4. _____ DFS 4 B SK 100 mA (2024)
5. _____ DFS 2 / 4 B NK 300 mA
6. _____ DFS 2 / 4 B SK 300 mA (2024)
7. _____ DFS 4 B SK 500 mA (2024)

B+ _____ **VDE 420 mA / Frequency limit 20 kHz**

8. _____ DFS 2 / 4 B + 30 mA
9. _____ DFS 2 / 4 B + 100 mA
10. _____ DFS 2 / 4 B + 300 mA

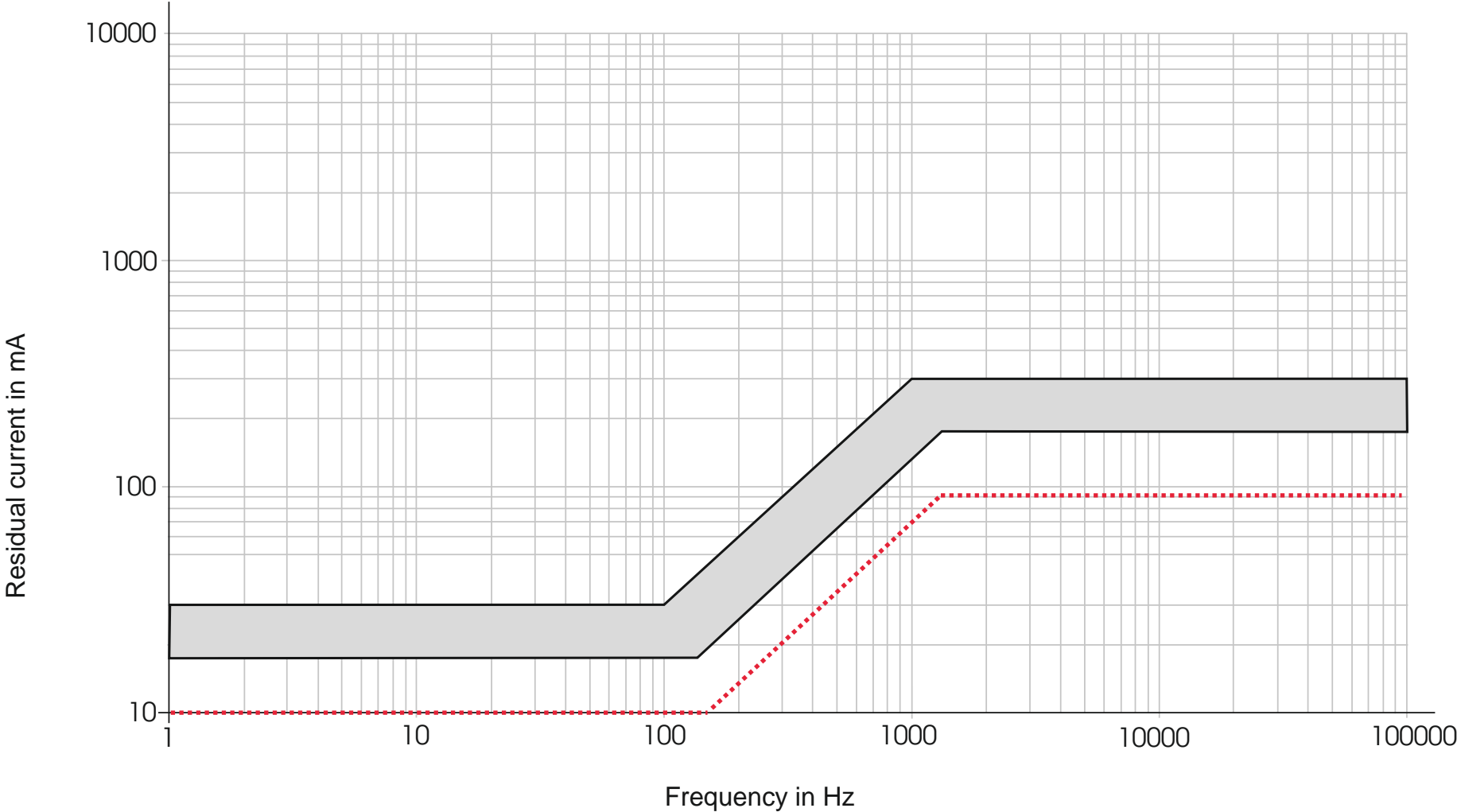
Examples _____ **Applying the characteristic curves**

11. _____ Example 1: Characteristic curves and BS7671 - 531.3.2
12. _____ Example 2: Selecting type B RCDs for an application using inverter controlled pumps.

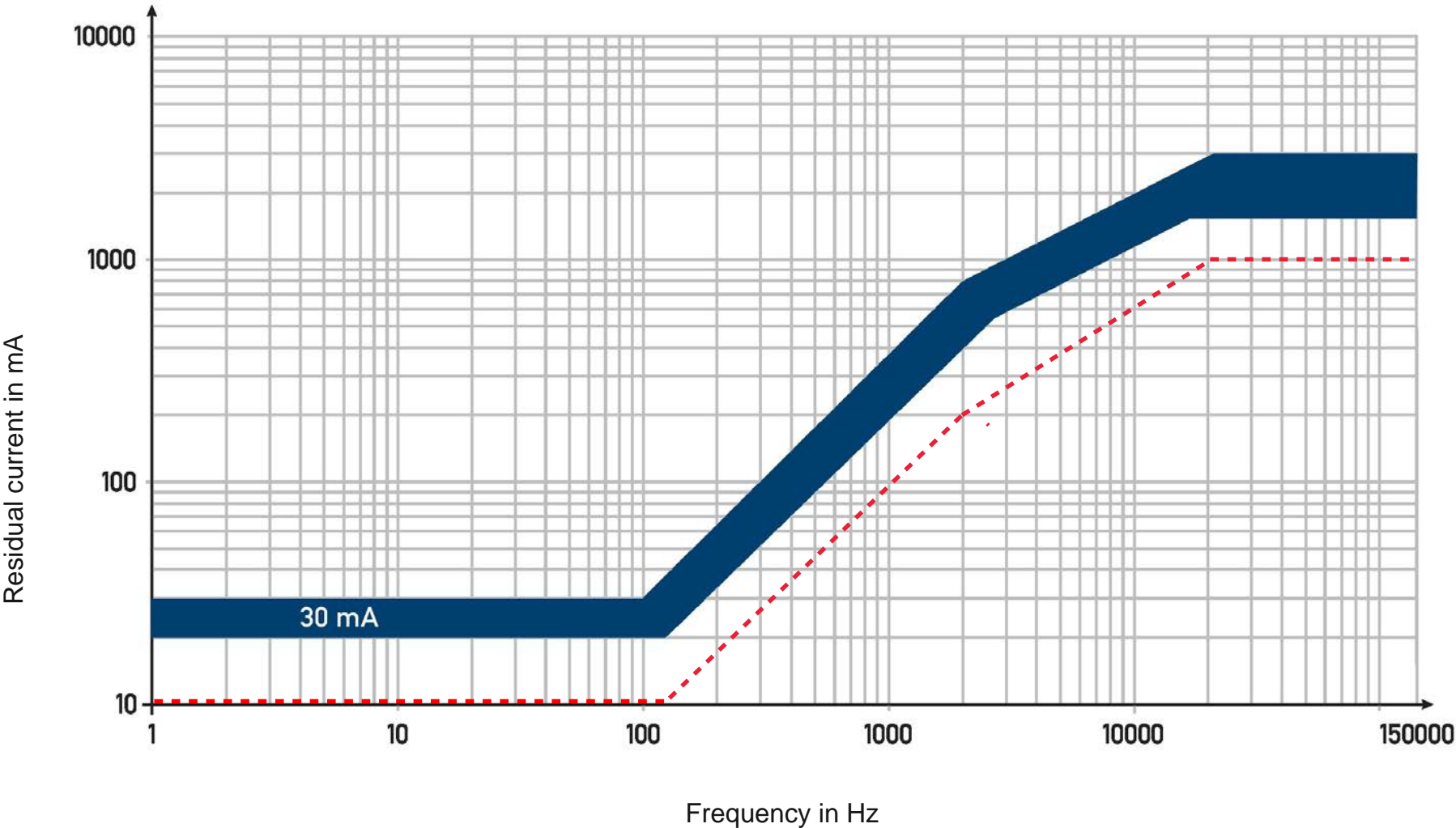
***** Note: Please check the Doepke website or contact the sales office for the availability of specific ratings and residual current sensitivity:
email "sales@doepke.co.uk" or ring "01628 829 133"

For additional information on RCD selection for specific applications, please refer to www.doepke.co.uk - Technical Publications.

DFS 2 / 4 B NK / 30 mA
Tripping current frequency response

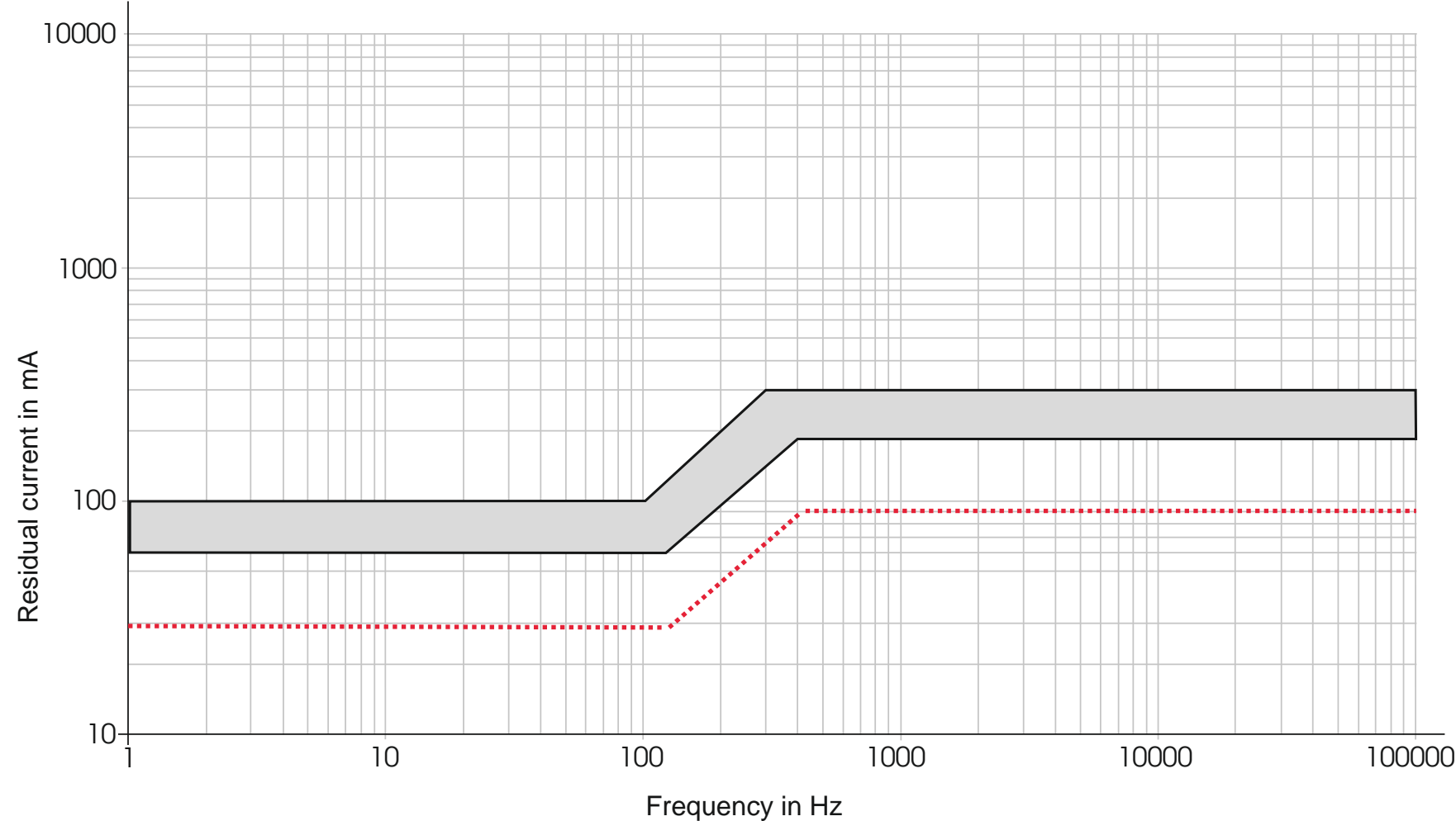


DFS 2 / 4 B SK / 30 mA
Tripping current frequency response



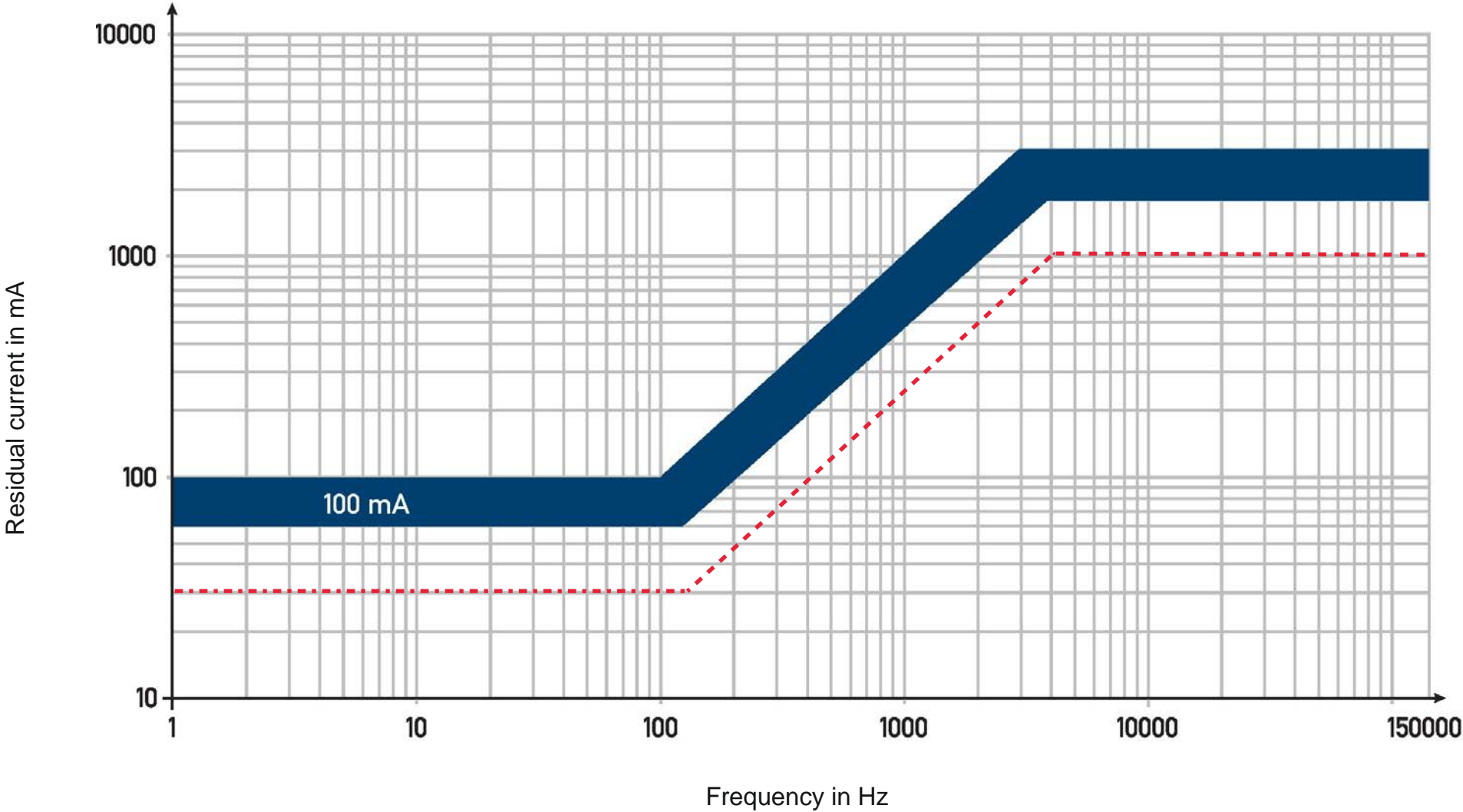
Type B characteristic curves
Refer to pages 11 to 14 for use

DFS 4 B NK / 100 mA
Tripping current frequency response

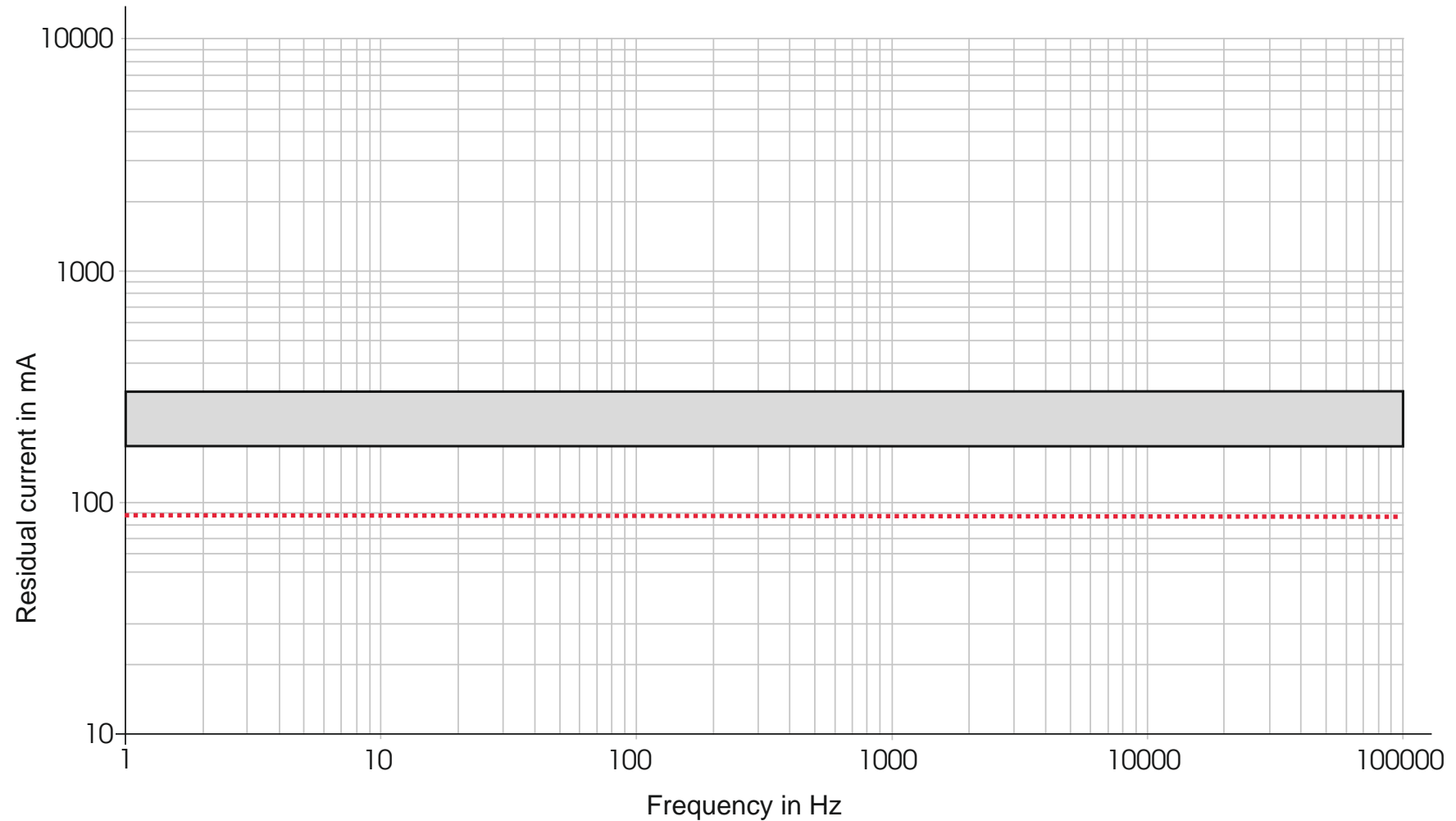


Type B characteristic curves
Refer to pages 11 to 14 for use

DFS 4 B SK / 100 mA
Tripping current frequency response

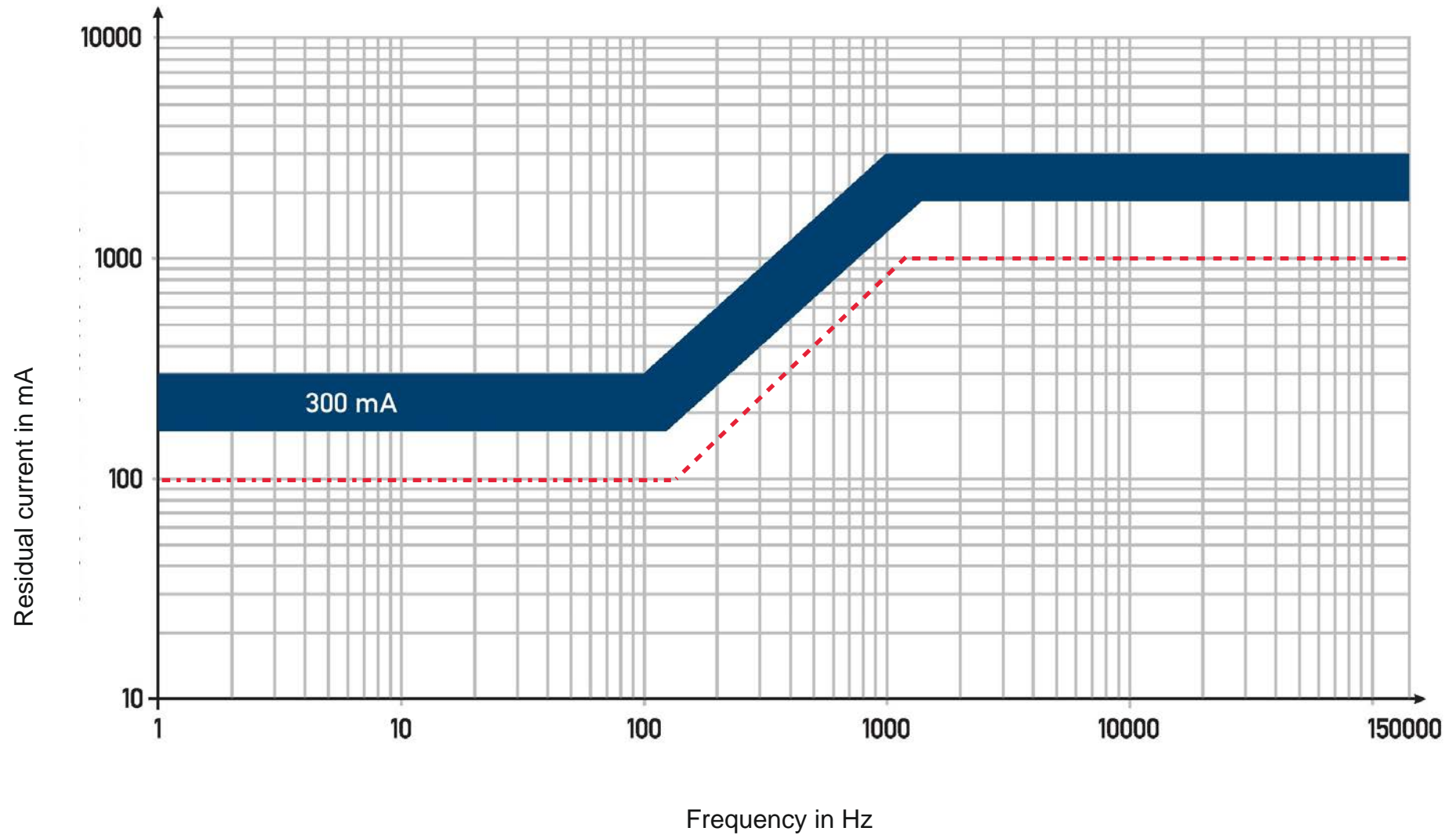


DFS 2 / 4 B NK / 300 mA Tripping current frequency response



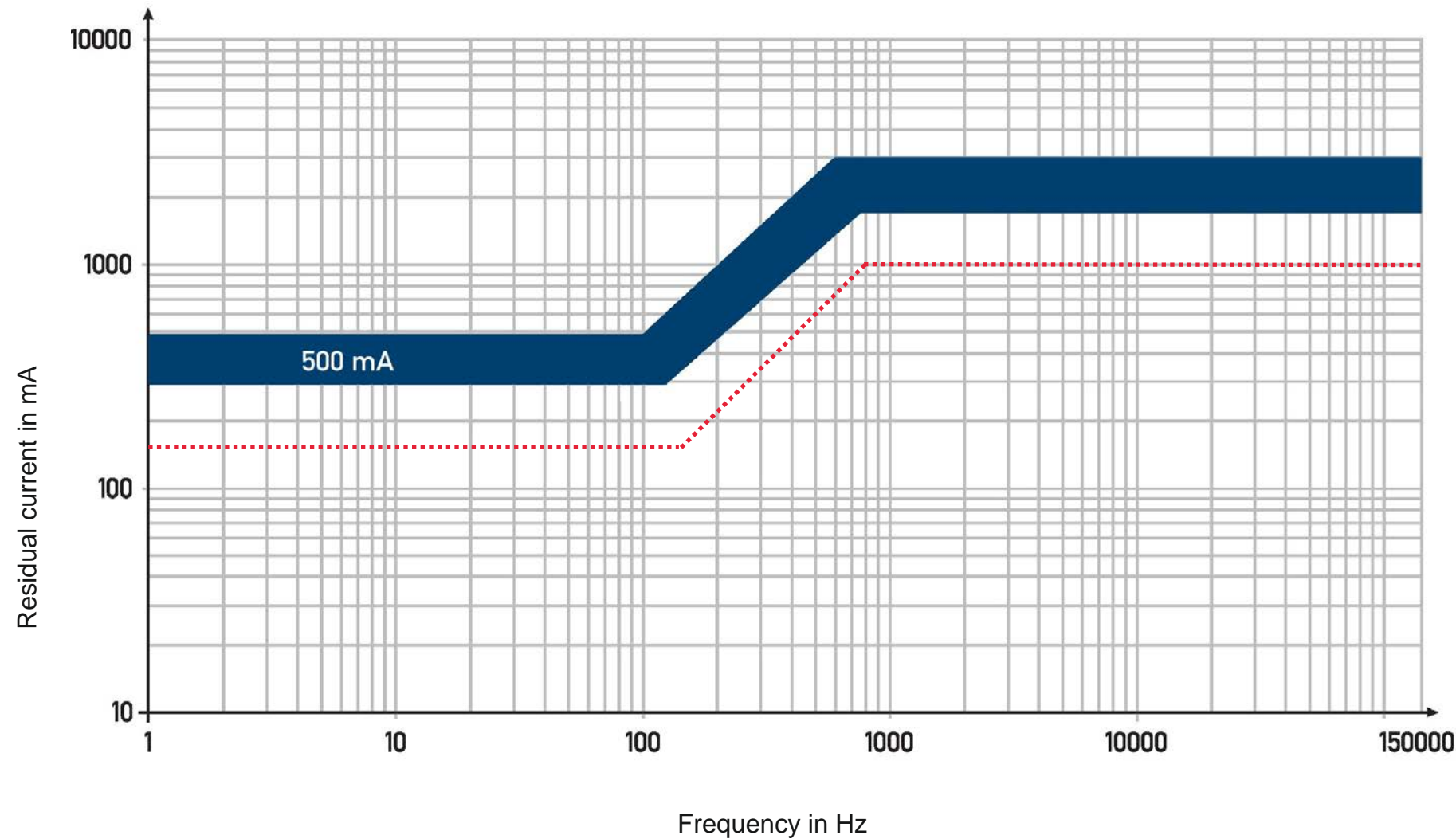
Type B characteristic curves
Refer to pages 11 to 14 for use

DFS 2 / 4 B SK / 300 mA Tripping current frequency response



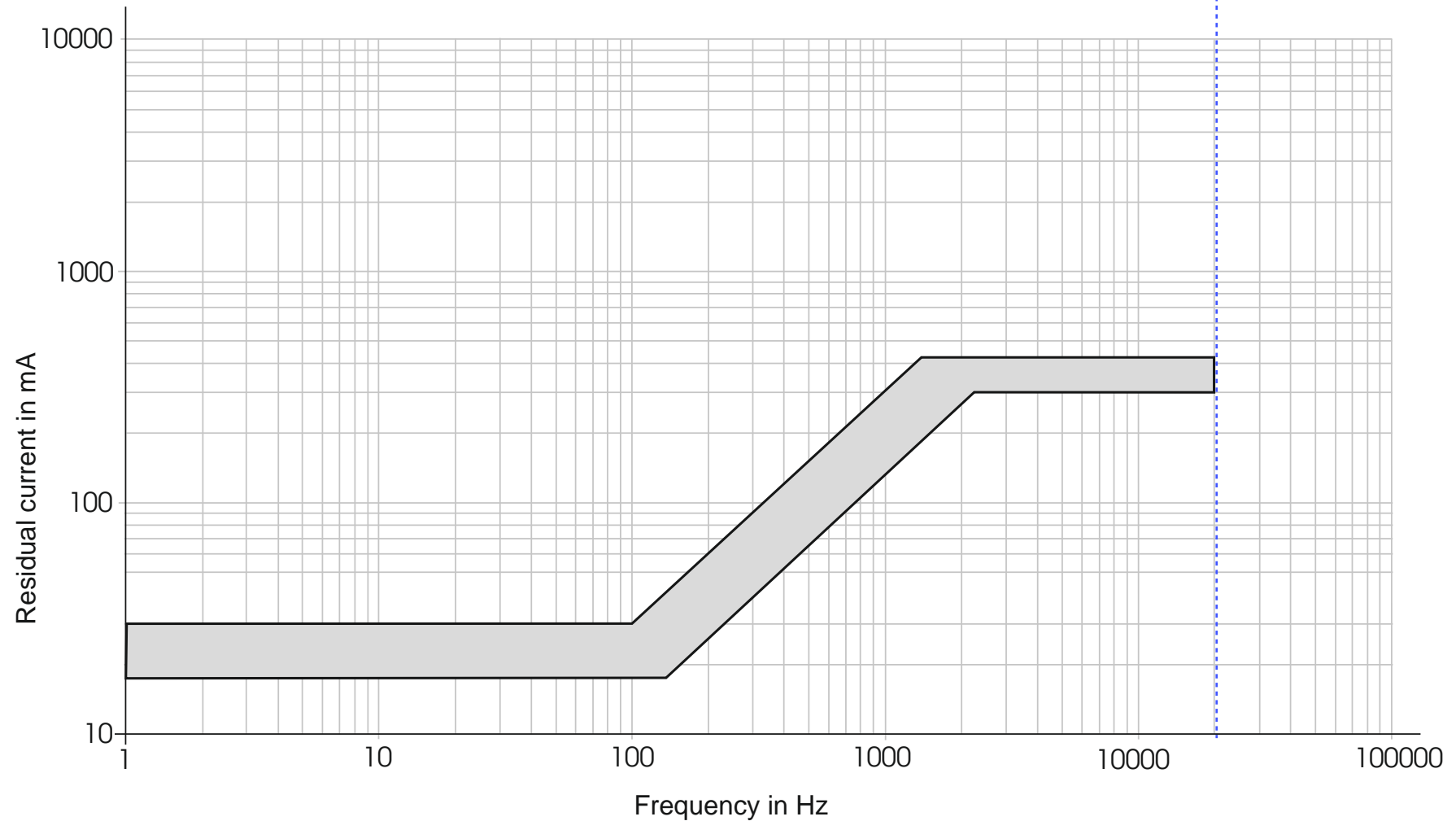
Type B characteristic curves
Refer to pages 11 to 14 for use

DFS 4 B SK / 500 mA
Tripping current frequency response

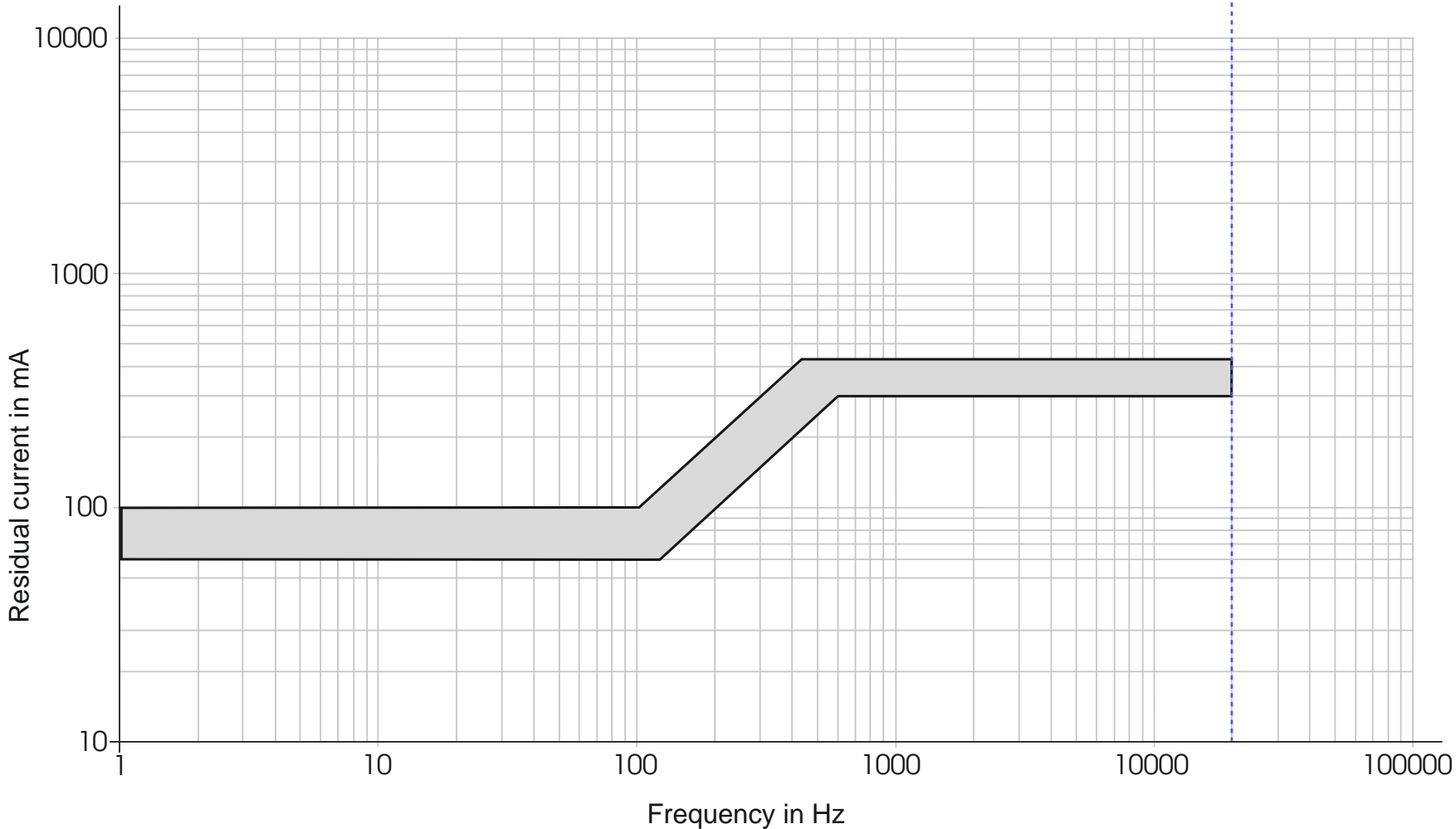


DFS 4 B+ / 30 mA Tripping current frequency response

Type B + Characteristic specific to the
VDE German Installation Standards:
Fire Protection Limit < 420 mA.
Frequency limit < 20 kHz.



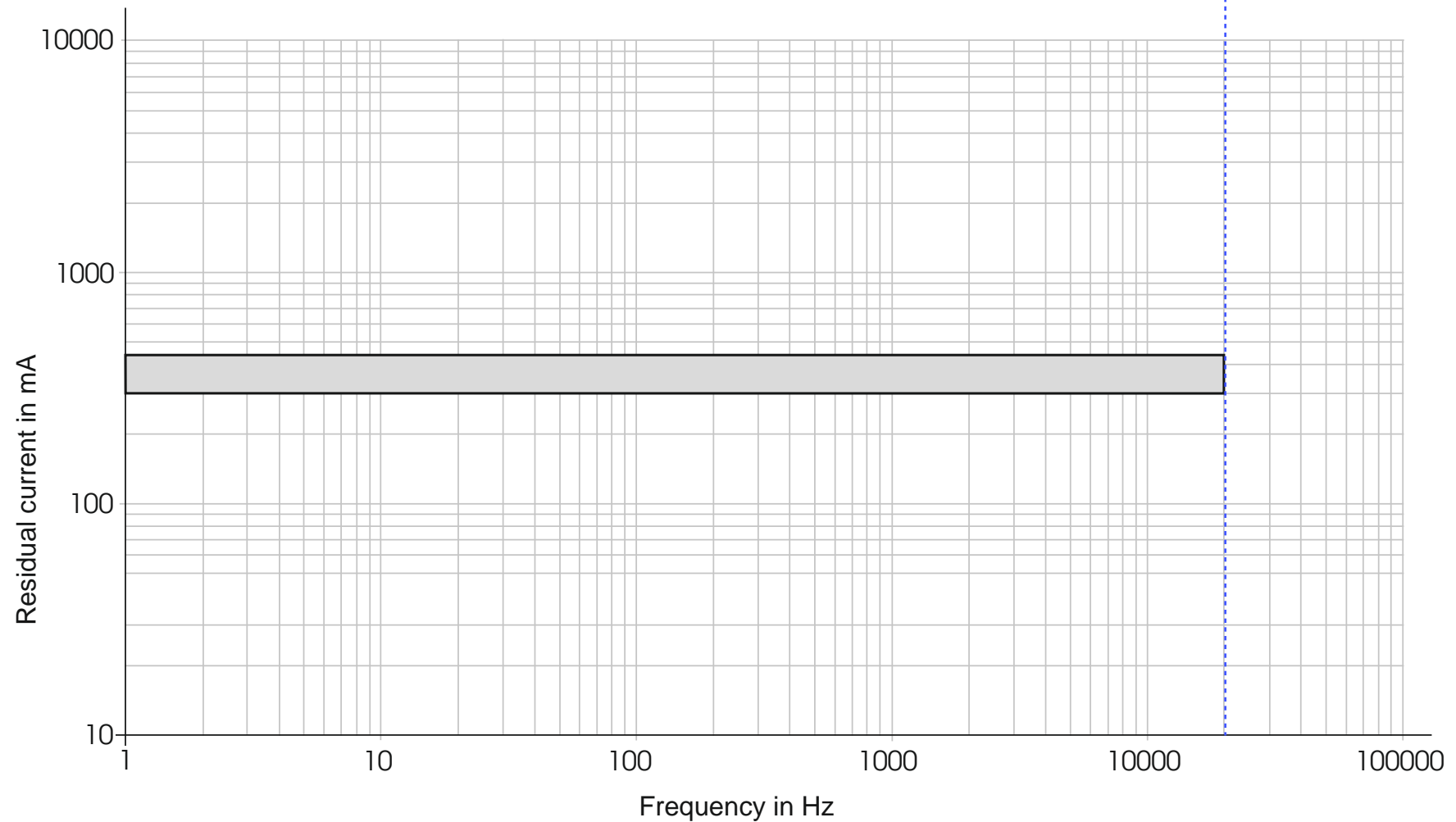
DFS 4 B+ / 100 mA
Tripping current frequency response



Type B + Characteristic specific to the VDE German Installation Standards:
Fire Protection Limit < 420 mA.
Frequency limit < 20 kHz.

DFS 4 B+ / 300 mA Tripping current frequency response

Type B + Characteristic specific to the
VDE German Installation Standards:
Fire Protection Limit < 420 mA.
Frequency limit < 20 kHz.

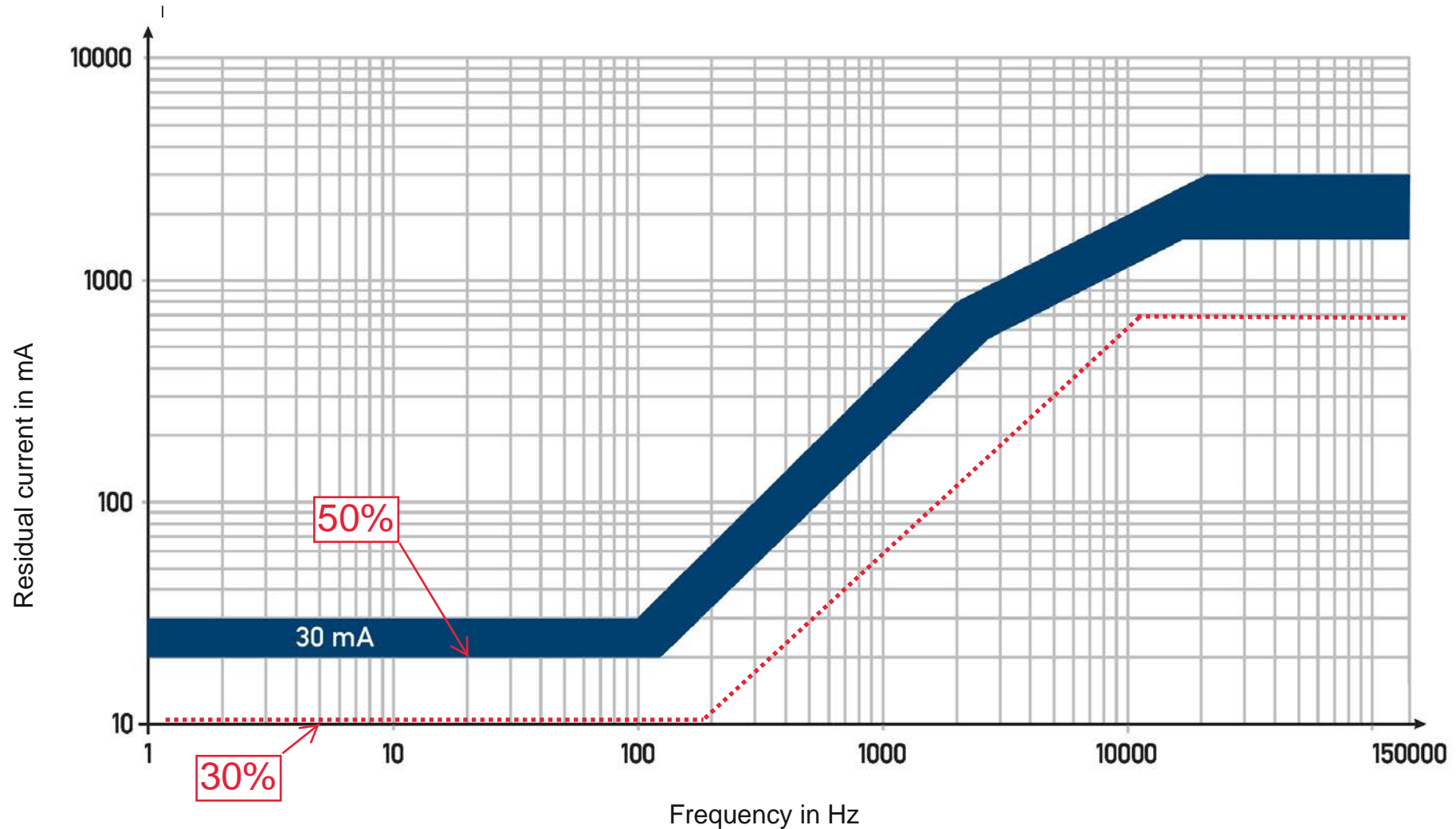


Example 1: BS 7671 Regulation 531.3.2. Unwanted Tripping mA BSK

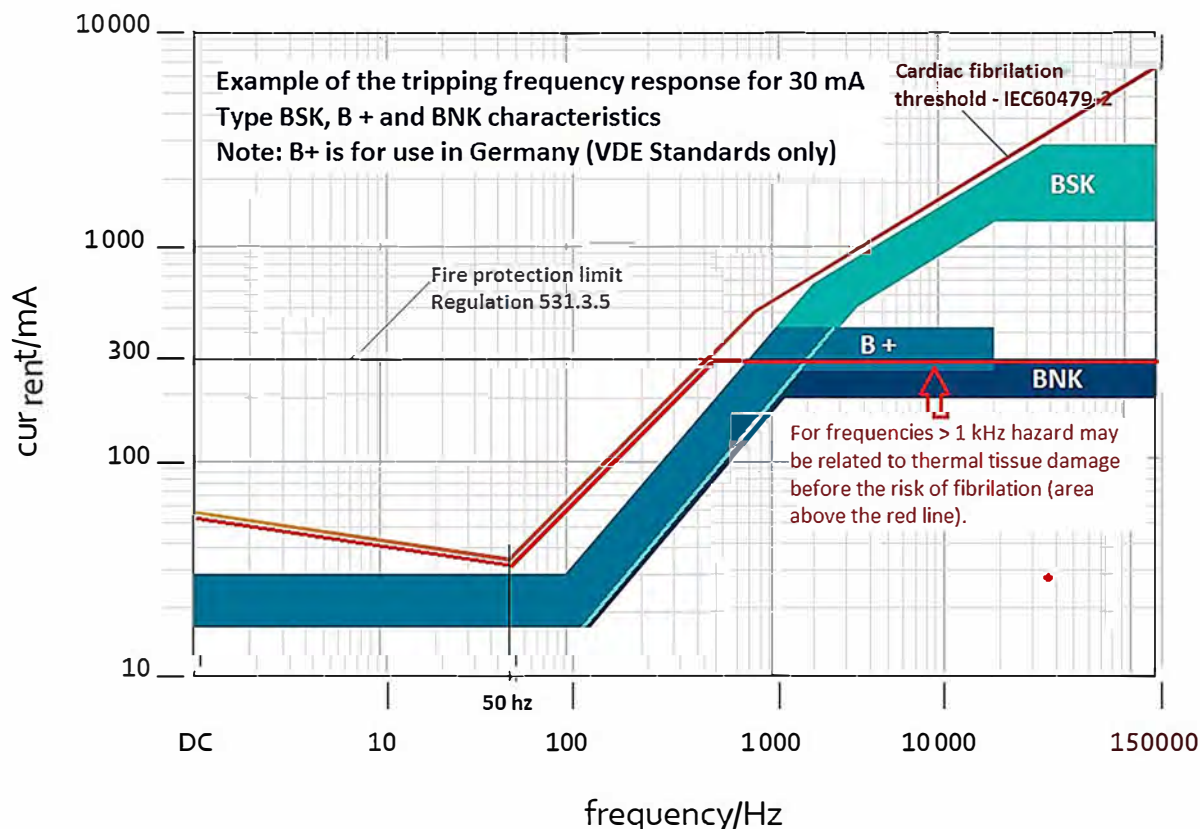
(example only, refer to full characteristic on page 2)

531.3.2 (ii): To prevent unwanted tripping, total operational leakage current should not exceed 30% of the rated residual operating current - indicated by the red dotted line for the frequency range 1 < 1000 kHz.

531.3.2 Note 2: RCDs may operate at any value of residual current in excess of 50% of the rated residual current - indicated by the dark area.



Type B tripping characteristics related to the frequency range of the residual currents produced by the equipment connected in circuit.



Example : Replacement of 2 off 3 phase pumps < 4.5 kW and 7.5 kW, with separate inverters located in a brick built pump/switch room near the swimming pool. This is fed from a main incoming distribution board located in an out building with TT earthing.

Questions the Designer / Installer has relating to RCD selection and circuit design for the pump supply: What Type of RCD and sensitivity is required and can the 2 pumps be run off the same RCD ? It is accepted that in the event of a residual current fault both pumps would stop running.

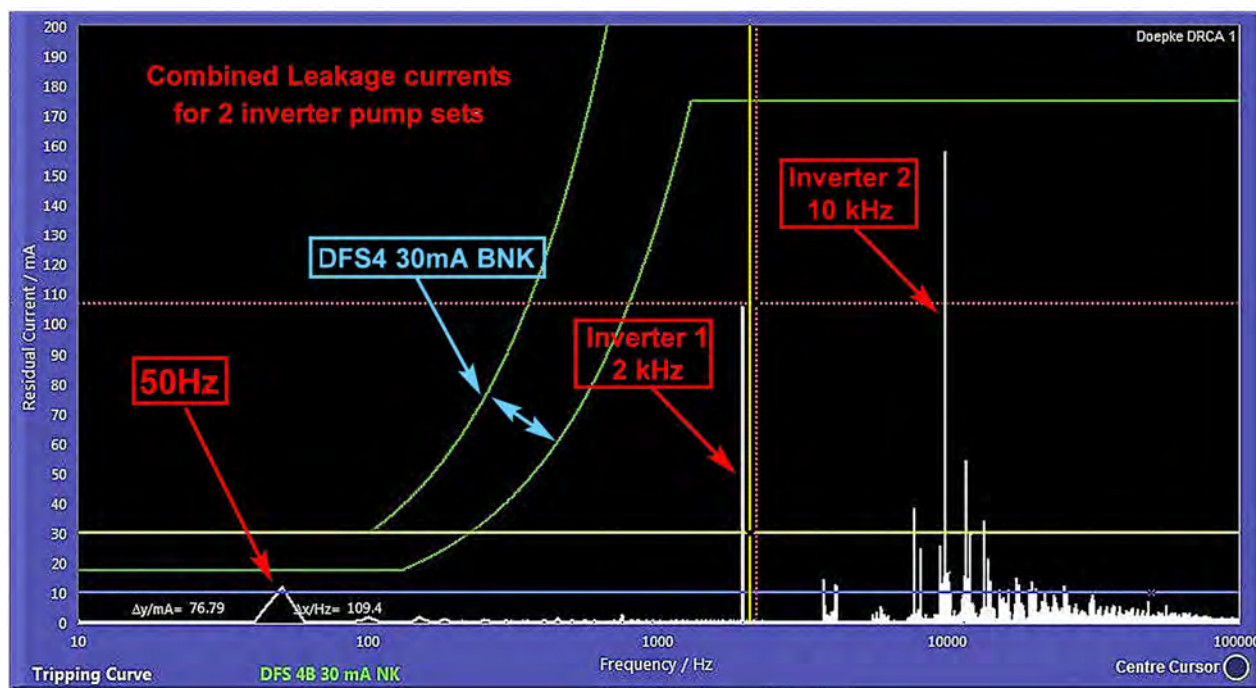
Note: RCD generic term: Generally Type B RCDs are manufactured in an RCCB format.

Equipment characteristics: The Inverter / Pump Manufacturer specifies the use of Type B RCDs upstream if required. Leakage current is stated as being > 3.5 mA. EMC test results based on the built-in filter and < 5 m of cable between the inverter and the pump. The Installer is responsible for verifying the equipment suitability prior to installation. In this example with limited information available from the Manufacturer, the Designer would have to test the equipment before installation. Results of the test set up in the workshop, with both pumps running / cable type, length and glands as per final installation.

Total leakage current @ 50 Hz = 11 mA.

Inverter 1 @ 2 kHz = 110 mA.

Inverter 2 @ 10 kHz = 160 mA.



Reg 531.3.2 Unwanted tripping: Recommended that the accumulation of earth leakage / PE current does not exceed 30% of the RCCB sensitivity.

Section 702 Location: The pump control room is located in zone 2, and will be accessed by ordinary persons during maintenance.

Environment: Damp / Risk of chlorine contamination / Increased leakage currents during normal operation.

Fault Protection : Review based on existing TT earthing arrangements - see comments under installation design.

Additional Protection : In addition to other requirements (section 702) , specifies automatic disconnection of the supply using an RCCB - see 415.1.

Fire Protection : See chapter 42 (Risk Assessment required for each installation / Location) in this particular example Reg 422.3.9 does not apply

Earthing : In addition to section 702 and 415.2.1, if both Inverters are connected as 1 item of equipment PE current > 10 mA - see Reg 543.7.1.202

RCD Selection : 30 mA Type B required to meet Reg 415.1. and 531.3.3 (iv).

In the example above if both inverters are supplied from the same 30 mA RCD: Under test conditions the leakage current at 50Hz exceeds the 30% recommendation in the Regs.

The actual leakage current on site is likely to be higher due to the installation conditions.

In addition the leakage currents at the inverter clock (switching) frequency and the harmonic content have to be considered, as the RCCB will respond to the arithmetic sum of the total leakage current across the RCCB frequency spectrum.

In this case use one 30 mA RCCB per inverter: Verify the leakage current at 50Hz for each inverter set up is < 9 mA i.e. <30% and Reg 543.7.1.202 earthing.

Type BNK characteristic: Inverter No 2 leakage current @ 10 kHz is approaching the BNK trip threshold i.e. Any site harmonics, problems with the supply or a change in the speed settings for the inverters could result in unwanted tripping.

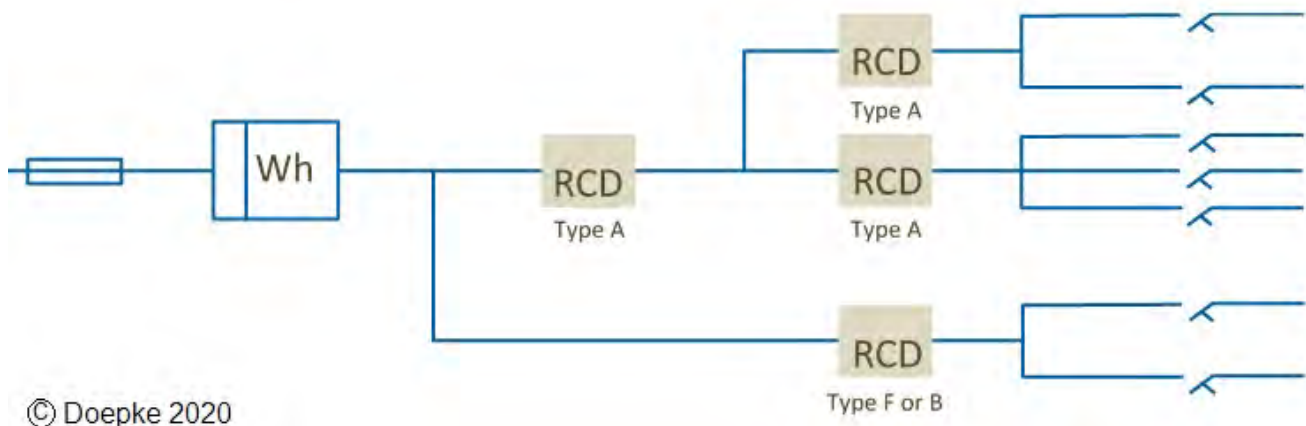
Type BSK characteristic: As Regulation 422.3.9 is not applicable in this instance, a Type BSK characteristic would still provide disconnection within the cardiac fibrillation limits set in IEC60479-2 and remove the risk of unwanted tripping under normal operating conditions. Type BSK would be the most suitable device.

HD Version RCCB: Designed for use in harsh environments see Technical Publication 07

Consideration of the installation design / layout with TT Earthing: Type B RCDs must only be connected in series with another Type B RCD

Option 1 : Install a Type B RCD in the main dis. board or next to it, with one feeder circuit to the pump room, to supply the two Type B 30 mA RCDs mounted in the pump room.

Option 2 : If practical install the two 30mA RCDs next to the main dis. board with two feeder circuits to the pump room (Cost of the additional circuits vis cost of the extra Type B RCD).



Doepke

Doepke UK Ltd.

Daventry NN11 8QH
England

@ — sales@doepke.co.uk
T — 01628 829 133

www — doepke.co.uk