

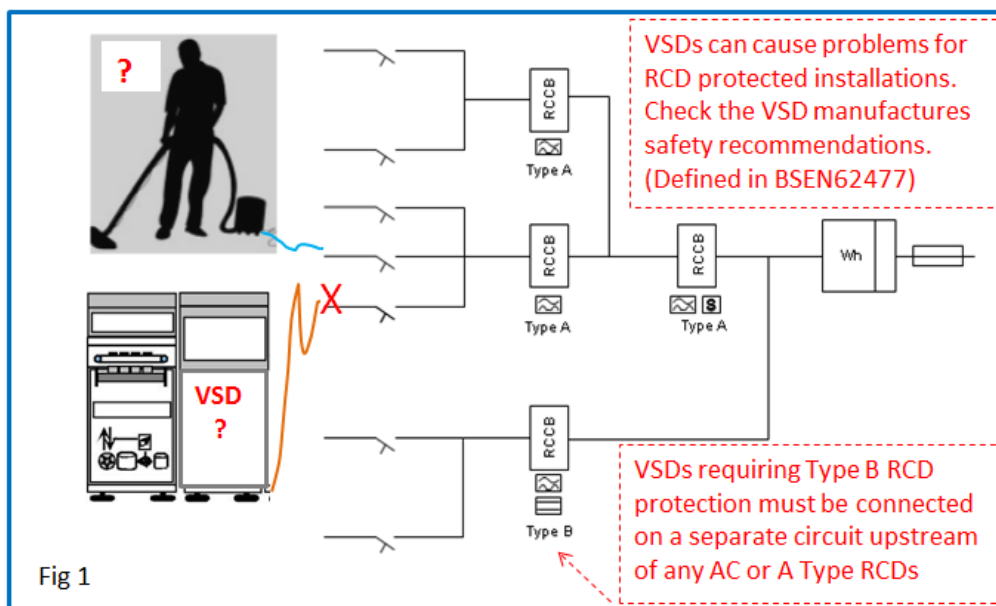
Update your Safety Policy / Site Specification to comply with essential safety requirements for machines containing Variable Speed Drives 2013!

Electrical engineering staff and contractors in the UK may not be aware of the risks associated with the connection of machines containing VSD / inverters to existing electrical installations that contain AC or A type RCDs. In Germany the Insurance Association (GDV) details specific requirements for equipment containing frequency converters connected to circuits containing RCDs (Vds 3501) to reduce the risk of death through electrocution and or fires.

Historically UK guidance covering this subject has been rather vague, resulting in increased risk of serious injury for staff using similar equipment in the UK compared to Germany, even though companies are subject to common legal requirements (Regulations).

For the UK the publication of BSEN62477-1:2012 for manufactures of electronic power control equipment and the recently updated GAMBICA Installation Guide 4th Edition - Page28. 4.2.3, clearly details the safety requirements: Use Type "B" RCCBs with 3 phase VSDs.

Equipment containing VSDs connected downstream on a mains distribution supply protected by a standard AC RCCB, will not meet the Electricity at Work Regulations see EWR 4(1) 65. In addition untrained support staff using electrical appliances connected to sockets on the same distribution circuit may also be put at risk. See Fig 1



RCCB Protection with VSDs

Where the precautions taken include an RCCB to reduce the risk of death or injury (Regulation 8): Three phase VSDs must only be used with Type "B" RCCBs. Some single phase inverters can be used with Type A RCCBs. The Duty Holder (Regulation 29) makes reference to the VSD manufactures recommendations relating to the type and characteristics of the RCCB required. If not clearly stated in the operating instruction they would need to obtain the manufactures recommendations in writing.

Understanding the risks

AC operational leakage currents: VSDs and their associated EMC filters and motor cables, generate leakage currents at nominal supply frequency (50Hz) and at various harmonic frequencies. Leakage currents in the higher frequency ranges can be significant and from a safety perspective cannot be ignored, as can be seen from the following example. Figure 1 shows the frequency range of various leakage currents present in a system containing

a 32 amp VSD; at 50Hz the leakage current is less than 3mA , however the actual maximum leakage current occurs at 7815 Hz and is approaching 2000mA. Shocks from high frequency currents may not cause immediate death, however a person subject to current above 300 mA is at risk of receiving irreversible injuries.

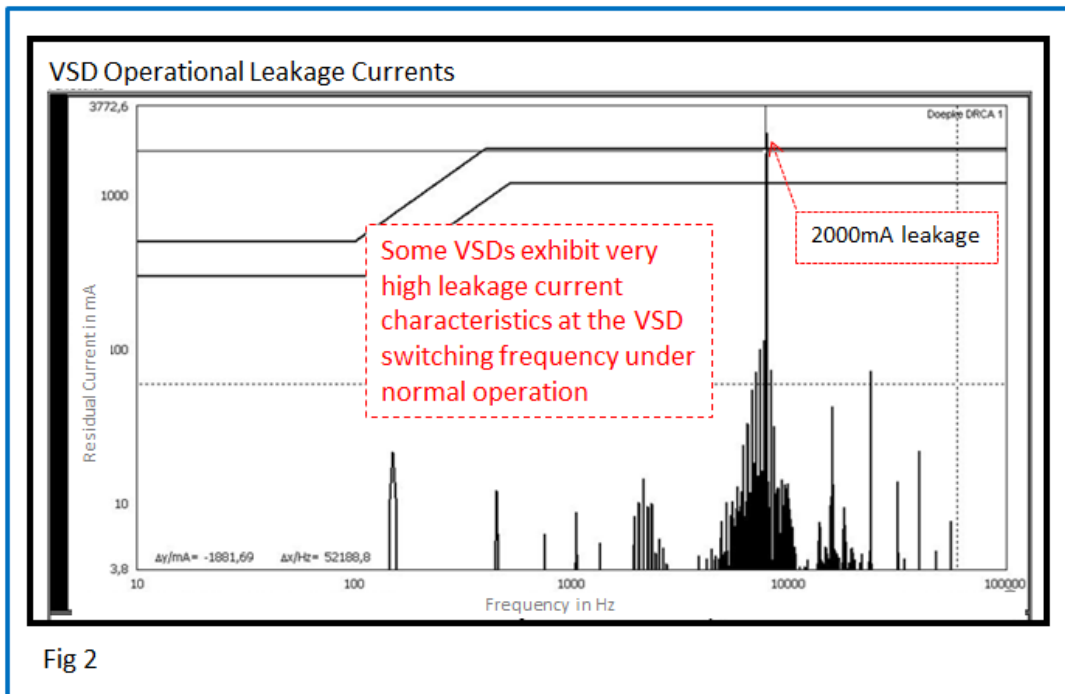


Fig 2

DC Residual Currents: Due to the topology of 3 phase inverters see fig 3, under certain fault conditions they will generate smooth DC residual currents in the AC supply. DC currents flowing through standard RCCBs result in magnetic saturation of the AC sensing coil and non-tripping of the RCCB under fault conditions.

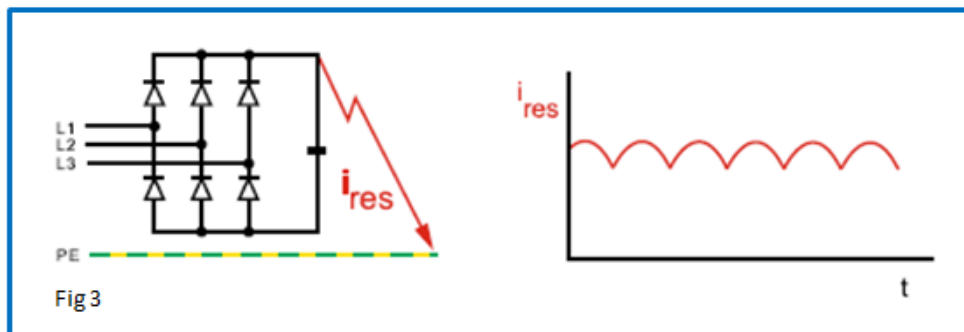


Fig 3

The Electricity at Work Regulations makes reference to the IET Regulations as a guidance document (unless the site is specifically covered by another code of practice such as Mines & Quarries); existing Regulation 331.1 is quite clear in its requirement “An assessment shall be made of any characteristic of equipment likely to have harmful effects upon other electrical equipment”. A simple risk assessment carried out under Regulation 331.1 in accordance with existing Health & Safety legislation, on a system containing VSDs and requiring RCCB protection, will quickly identify that Type B RCCBs must be used with a characteristic that is compatible with the operational and safety requirements of the installation, for People and Fire protection.

Chaz Andrews – Technical Manager, Doepke UK Ltd

If you would like more detailed information relating to this subject, Doepke UK have a free 60 page Technical Application Guide Available on request, or log on to WWW.doepke.co.uk to download the guide or obtain further information on RCCBs. For technical support please e mail chazandrews@doepke.co.uk