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9 Bracken View, Brocton, Stafford ST17 0TF T:+44 (0) 1785 660247 E:info@emcstandards.co.uk

Procedural TCFs

By Eur Ing Keith Armstrong Ceng MIEE, Cherry Clough Consultants

The Technical Construction File (TCF) route to EMC compliance is available for everyone except those who make radio communication transmitting products. By the way - TCFs for EMC are not the same as the Technical Files required by the Machinery and LVD directive, because TCFs need a certificate or report from an EMC Competent Body.

Engineering companies (rather than those manufacturing mass-produced electronic products) often find the TCF route to be better than the self-certification to standards route, as it can reduce EMC testing costs. Where products are very large, or only come together on the customer's premises, it may be impossible to test to harmonised standards anyway, in which case the TCF route may be the only one possible for EMC compliance.

One type of TCF that can be very powerful indeed is the "Procedural" TCF. This relies on the Competent Body assessing how you design, construct, and test, your products, and allows a manufacturer to include a number of different products in single TCF and Declaration of Conformity, even if those products have not yet been designed!

The Procedural TCF can be very valuable for the custom engineering company, for example in machinery or robotics manufacture, or industrial and process instrumentation and control. I have seen examples of Procedural TCFs for such companies, but with a little imagination the principle they embody might be able to be very widely applied.

Custom machinery manufacturers do not usually know what features their next design will have, or what form it will take. Many manufacturers of "standard" machines also provide a range of variants and options, and often a variable amount of customisation too, with the result that many of their machines could be classed as custom.

Modern machines generally use PLCs or computers with LCD or VDU displays, employ variable speed DC or AC motors and drives or use electronic control of pneumatics and/or hydraulics, and also contain relays, contactors, power supplies, instrumentation and control (such as temperature controllers). Touch screens are often used, as are communications such as RS485 or Ethernet for other systems such as SCADA.

Taking the example of a custom machinery manufacturer: he will generally stick with a small range of electronic and electrical "components" - those he is familiar with, likes the performance and price of, and knows how to program and install. He will also tend to use a small range of cabinets and enclosures, and have reasonably consistent ways of assembling and installing them.

Some test laboratories and Competent Bodies insist that custom or modified machines are fully tested for EMC, on-site if necessary, but this is usually overkill.

The key point is that although the machines produced by a manufacturer may perform different jobs, they generally share common electrical and electronic technology, enclosures, and assembly methods, and so have similar EMC characteristics. This is what makes the "Procedural" TCF approach possible.

For our example custom machinery manufacturer, a typical "Procedural" TCF may involve

some or all of the following:

A procedure for specifying the electromagnetic environment and the acceptable performance degradations during interference events. These specifications may vary from one job to another. Most industrial environments do not seem to correspond to EN50082-2:1995 for immunity, so it is worthwhile agreeing these details with the customer at the contract stage. Salespeople can't be expected to be EMC experts, so a multiple-choice form is usually written for them to fill in with the customer.

Limiting design to a list of bought-in equipment and sub-assemblies. Design will generally be limited to a listed range of items that the manufacturer wishes to standardise on, typically the cabinets and "components" used in the EMC tested example machine, or ones that are known to have essentially the same EMC performance (usually from the same suppliers). The use of the "RSS" technique to add up emissions, as I described in an EMCJ article in October 1997, could do away with the need for this list.

Control of the "EMC quality" when purchasing equipment and sub-assemblies. Sorry, but merely checking that things have CE marks is not an adequate purchasing procedure for this.

Control of internal assembly methods and wiring techniques. This will include the way in which the various industrial control components are assembled to their backplate, the type of cables used and the routes they take and the way their screens are terminated, the earthing and external connection arrangements, etc.

Some in-house EMC testing capability. This is not essential, but can allow the manufacturer more freedom to vary his machines within the scope of his TCF, especially if his Competent Body approves his testing methods and skills.

Control of installation methods. This will involve the use of cable trays and conduits, earthing and bonding, cable routing and segregation, etc.

Control of commissioning methods. A good way to avoid extensive immunity testing for large systems and installations can sometimes be to perform "ambient threat testing" when the machine is running properly, to se if there is anything in its environment that can upset it (hitting the emergency stop on the associated conveyor belt, having the operator and the security staff lean on the control panel whilst using their walkie-talkies and cellphones, switching lights on and off, etc).

Instructions for installation, commissioning, and use. Manuals will be provided that describe how the machine is to be installed, covering location, earthing, cable and connector types, cable trays and routes, cable segregation, etc, pointing out that deviation from these instructions will negate EMC compliance. User instructions will also be needed (e.g. no use of walkie-talkie within 6 feet).

Quality control procedures. These will ensure that all the above is done properly, and that any necessary deviations (e.g. a new and untested type of PLC demanded by a customer) are discussed with the Competent Body, who may require additional testing of some sort.

A successful EMC test on an example machine. This will preferably be done on a large and complicated machine with the greatest number and power of computers, PLCs, and AC drives, which has been designed and built fully in accordance with the procedures described in the TCF. The testing can take a variety of forms, using any test limits and levels, as long as it is agreed with the Competent Body, and serves as a check that all the

EMC procedures are working as they should.

Sample testing. Every now and again another test should be done, to check that no "compliance drift" is going on. If the manufacturer has his own EMC test gear and has been "approved" by the Competent Body he may be able to do much of it himself and save cost. Obviously, using a Procedural TCF requires that the company develops sufficient EMC expertise, and this will cost money and take time. Having an ISO 9001 QC system already in place would be a big help, though is not essential. However, Procedural TCFs cost a whole lot less overall than the usual alternative of frequent third-party EMC testing and making TCFs!

Also, because Procedural TCFs are based upon the use of good EMC practices in design, construction, and installation, the resulting products will generally suffer fewer delays in assembly, testing, installation, and commissioning. They will enjoy improved reliability. All of these are valuable improvements in their own right.

To save time and cost always involve your chosen Competent Body right from the start of any TCF, which ideally means right from the start of the design of the product(s) to be covered by it.

Keith can be contacted on:
Phone: 01457 871 605
Fax: 01457 820 145
E-mail: karmstrong@iee.org

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EMC Journal Home

Eddystone Court - De Lank Lane
St Breward - BODMIN - PL30 4NQ
Tel: +44 (0)1208 851530 - Fax: +44 (0)1208 850871
nutwooduk@nutwood.eu.com
