The Benefits of Brass F-Connectors

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Relevant decision has to be taken when choosing coax distribution passive components for your broadband network infrastructure. From a price/quality point of view, the typical initial focus will be on the CAPEX investments; especially in a case where all components in the network has to be upgraded due to introduction of higher frequencies such as with the DOCSIS 3.1, but planners tend to forget about derivative costs that might be associated with a wrong choice of supplier and component. This paper describes the reason why the F-connectors on distribution passives should be made of brass material, even if it means a higher CAPEX.

Whenever speaking to network operators about the stability in their network, one fault dominates; the loose connector. Some claims that 90% of all network failures are caused by this. The first action any service technician takes when called out is to tighten all cable connectors. And annoyed by experiencing loose connectors over and over again – no wonder – the temptation to tighten the connectors with a higher torque than recommended is huge. However, this even makes things worse.

The loose connectors are not due to too weak tightening; rather it is the effect of the material selection. Most taps and splitters in the network are made by a zinc-alloy, e.g. Zamak 3, which – under long-time stress and even at room temperature – creeps and deforms permanently. So when a cable connector is fastened to the F-female connector on e.g. a tap, the zinc-alloy will start to deform. The more stress (i.e. tightening torque) the faster the creep happens. Eventually, the thread on the female connector is pressed out of shape, the connector is loose, and the noise level in the network grows. In addition, the stress from the temperature dependent change in lengths of connected cables adds to the creep.
F-connectors made in brass material have a very low likelihood of self-loosening compared to F-connectors made in die-cast zinc alloy, e.g. Zamak 3. The latter material is typically used in low cost products, and many component suppliers offer these to the broad market today.

All metals will at temperatures higher than 0.4 times their melting temperature[1,2] (measured by the Kelvin scale) deform in a way called creep[3], when pressure or stress is applied. The rate of deformation is a

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[1] Slide 7 in http://ocw.utm.my/file.php/160/edited_creep_part_1.pdf
On the web-page http://ocw.utm.my/ search the course SME3622, select the search results, and find the presentation "creep part 1"
[2] http://www.doitpoms.ac.uk/tlplib/creep/other_metals.php
[3] https://en.wikipedia.org/wiki/Creep_(deformation)

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function of the material properties, exposure time, exposure temperature and the applied structural load. Depending on the magnitude of the applied stress and its duration, the deformation may become so large that a component can no longer perform its function.

The table below lists the melting temperature T_m and creep on-set temperature $0.4T_m$ for Zamak 3 and for a type of brass.

Metal	T_m	0.4 T_m	Relative room temperature
Zamak 3 [4]	657K / 384°C	263K / -10°C	0.45
Brass [5]	1173K / 900°C	469K / 196°C	0.25

Table 1 Melting temperature T_m, creep on-set temperature 0.4 T_m, and room temperature (25°C) relative to T_m for Zamak 3 and Brass.

As shown in Table 1 the die-cast material Zamak 3 has a melting temperature of 657K = 384°C, so Zamak 3 will start to creep (deform) at temperatures above

$$0.4 \times \mathrm{T_m} = 0.4 \times 657\mathrm{K} = 263\mathrm{K} = -10\ ^{o}C$$

Thus even at room temperature, a structure made in Zamak 3 will creep when put under stress. As described above this is typically seen in HFC networks where any cable installed on a die-cast F-connector loosen over time.

The type of brass used for F-connectors of the DKT Signia line has a much higher melting temperature, 1173K = 900°C. So these connectors only deform at temperatures above

$$0.4 \times T_m = 0.4 \times 1173\mathrm{K} = 469\mathrm{K} = \ 196\ ^{o}C$$

In conclusion, therefore, with the DKT's Signia Series of distribution passives the thread of an F-connector retains its original shape, and a cable installed on this connector keeps tight after installation.

It is important to take the above into account when doing the network planning; as unnecessary OPEX spending can be wasted, as labor work is used both to fault finding and to tighten the installed base of connectors. And on the same time, the customer satisfaction is under heavy pressure when broadband services are interrupted time and time again due to loose connectors.

For more information on the DKT Signia Line, please visit our homepage, http://dktcomega.com/ or download the Signia brochure from http://dktcomega.com/product-coax/signia

[4] http://www.dynacast.com/zamak-3
[5] The brass type used for the Signia F-connectors

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