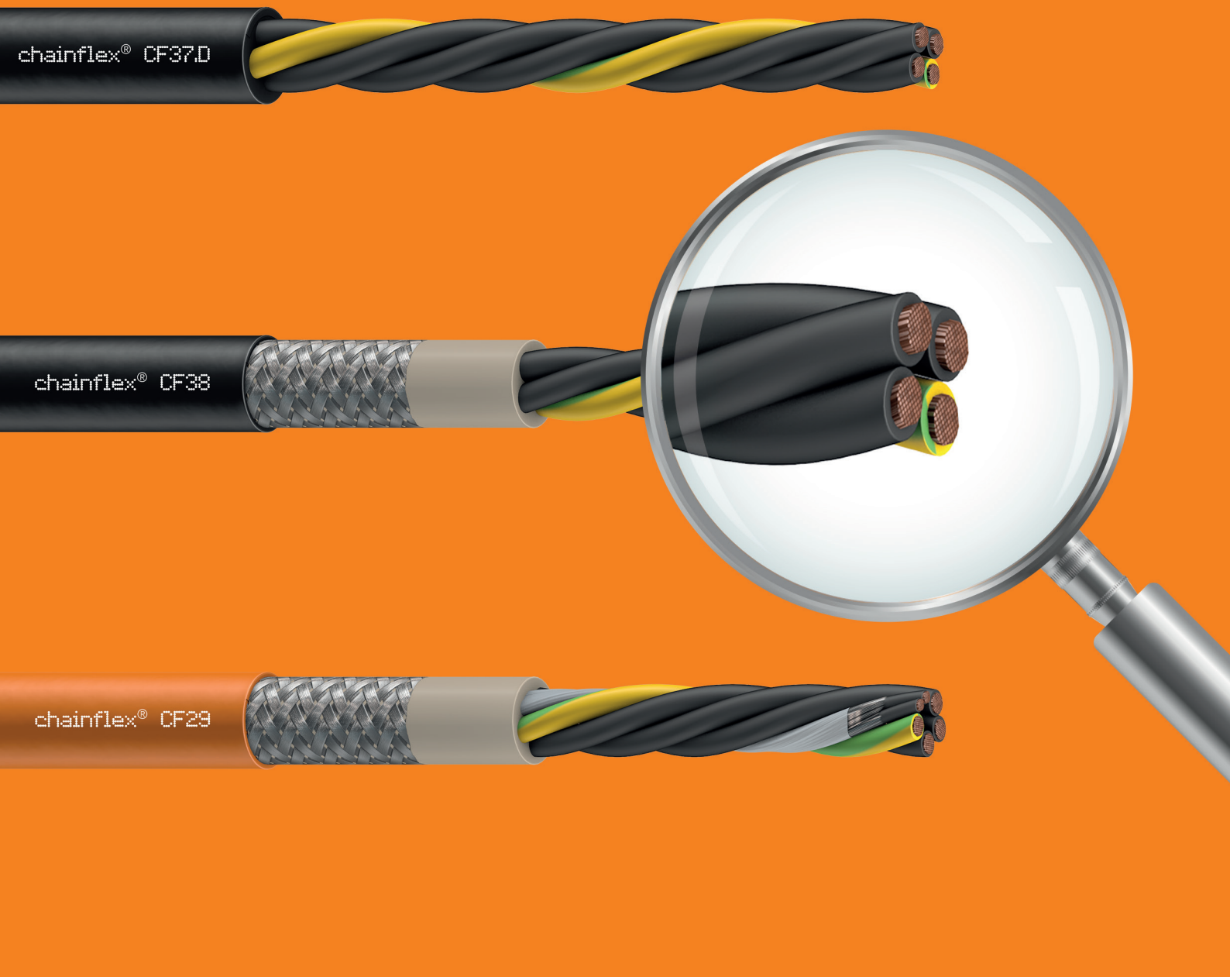
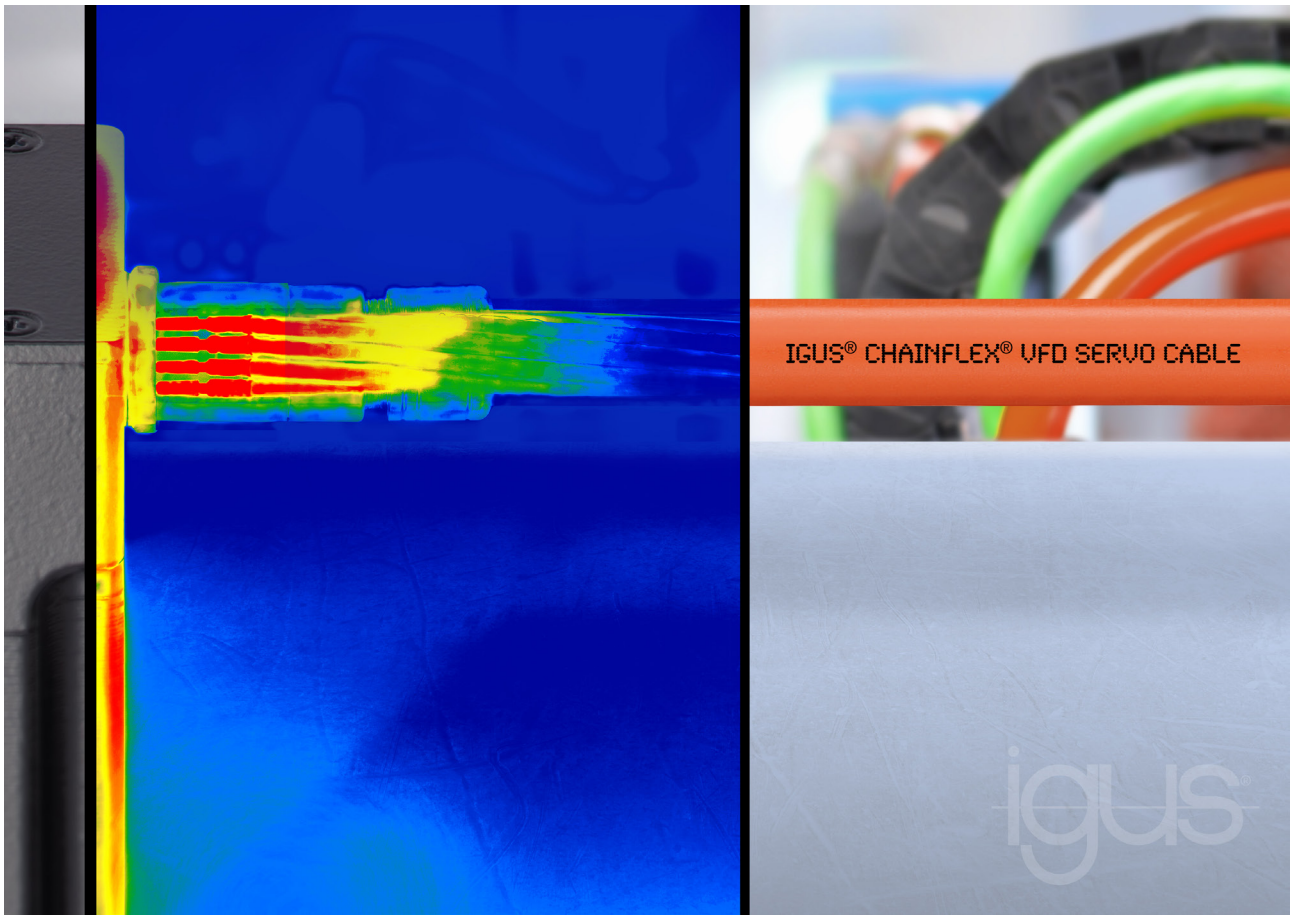


XLPE core insulation for more safety

Optimised protection of chainflex VFD servo cables for energy chain use thanks to a new high-performance polymer

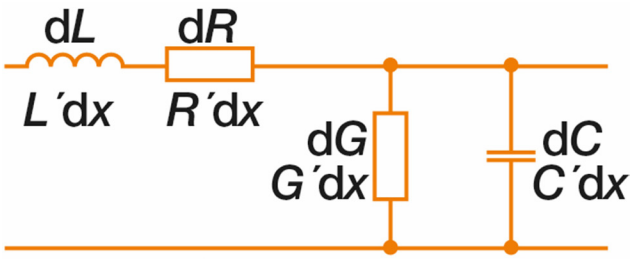
igus®



The new insulation material from igus for chainflex servo and motor cables withstands the special thermal and electrical requirements of the latest motor generations. (Source: igus GmbH)

Cables are a means to an end and are therefore often treated only as C-items. In the process, the latest developments of frequency-controlled motors, the so-called VFDs (variable-frequency drives), shown a clear trend: ever more compact design with the same or higher power with extremely high switching accuracies of the frequency converters. As a result, in the future the user not only has to pay attention to the right number of cores and cross-section combinations, but also to the electrical specifications of the motor or servo cables. For that reason, the motion plastics specialist igus has been developing and testing materials made of high-performance polymers for years, which are perfect for these challenges.

Cable theory in physics describes an electric cable as an electrical quadrupole, which is described as an inductance, capacitance, resistance and dissipation coating. In other words, each electric cable has a certain inductance, capacitance and ohmic resistance depending on its structure and the materials used. The purely ohmic resistance in the industrial environment depends mainly on the conductance value of the conductor material (usually copper), its cross section and length, while the capacitive values are strongly dependent on the insulating material.



Replacement circuit diagram for a cable element of a two-wire cable of length dx. For a required length, L‘, R‘, G‘ and C‘ are used for simplicity.

Thus, two identical cables with identical conductor structures with the same length and electrical cross section with different insulation materials have completely different capacitive specifications.

Proper insulation material as a central factor for capacitance

Although the insulating material used plays a fundamental role in capacitance, many power, motor and servo cables are still being made on the market with classic PVC insulation. This material has many good specifications: it is cost-effective and easy to process, but also has an extremely high dielectric constant [ε_r]. This means that the insulating material increases the capacitance of the cable and therefore much unnecessary energy has to be applied to charge and discharge the cable capacitances. This ultimately leads to higher losses and higher switching inaccuracies of the overall system. In short, the relatively high dielectric constant of PVC has the disadvantage that the capacitance coating is much higher than when using low-capacitance insulation materials with a much lower ε_r.

Safe and reliable cables for high-frequency drives

Among other things, today‘s generation of (VFD) frequency-controlled drives change their speed by changing the frequency of the drive voltage. Now, if a high capacitance coating cable is used in such high frequency control system, a significant amount of energy is lost for the capacitance of the cable alone. This can lead in the worst case to unwanted reflections and voltage overlaps. So the solution here lies in low-capacitive insulation materials. For more than 15 years, igus has been offering materials made of high-performance polymers for all its chainflex motor and servo cables used in the energy chain. The polymers have a lower ε_r with a high electrical resistance. Customers of the motion cable specialist can use such safe and tested cables for their frequency converters even today.

Smaller motors require a new electrical supply

The maximum current carrying capacity of an electric cable is defined by the permissible maximum conductor temperature at a given ambient temperature. Depending on the material used, this is for example 70° Celsius for PVC or 90° Celsius for TPE materials. The data for the temperatures are independent of the connector used in such cases. Since the old generation motors were usually larger than today‘s with the same power level, and the metallic round connectors used were relatively large, both the motors and the connectors served as heat sinks. Today, however, customers are demanding ever smaller, more compact, and above all, more powerful motors. Drive manufacturers are already coping with this demand with many structural parts, which of course also require smaller connectors in order to keep the overall size small. While in the past the motors in use were mostly relatively large, with metallic round size M23 or larger connectors, today the trend in the new, much smaller motors is towards compact M18 or M16 round connectors with additional plastic housing insulation. Due to their small size, the motors get hotter when they run at the same power level as their predecessors. This means that a significant amount of the waste heat acts directly on the first metre of the insulation of the cable, since now the large metallic connectors that act as a heat sink is missing. The servo cable can thereby heat up more than it used to. Although there are no consequences for the motor and the connected components in the short term, serious problems may be the outcome in the long term. Because, if the insulation material of the cable does not withstand the elevated temperatures in the long term, short circuits can occur inside the cable and in the vicinity of the connectors,

which in the worst case lead to fires. It is therefore important for cable manufacturers to respond to market developments with new insulation materials that can withstand the current requirements.

Tested igus insulation material for the latest servo motors

To prevent insulation and consequential damage to the compact motors, igus now offers the solution in the form of a new insulation material for its chainflex motor and servo cables. Due to the high level of expertise in the development of new high-performance polymers, the researchers of the motion plastics specialist were able to develop a new material. After five years of testing in the igus laboratory and extensive practical tests, the new insulation material was able to qualify. On the one hand, it meets the requirements for low capacitance and, in addition, withstands the increased thermal requirements of the latest generations of motors. This makes igus the only supplier in the global market to offer long-term tested series of motor and servo cables for continuous use in energy chains, which meet the specific thermal and electrical requirements of the latest converter generations.

Largest variety of cables tested, verified and certified

The igus range of cables undergoes extensive testing under real conditions in the company‘s own 2,750 square-metre test laboratory. For example, the servo cable CF29 was also tested with the new insulation material. In test no. 5034, the cable with a bend radius of 5.4 x d withstood over 45 million strokes under real operations. The acquired test data enabled igus to become the only manufacturer on the market to offer a 36-month guarantee on its entire cable range. The data collected in the tests is also included in the chainflex service life calculator. With this, the customer can determine the service life of his selected cable online in advance. With more than 1,300 types, igus offers the largest product range of cables for the energy chain: from servo cables, motor cables and robot cables up to bus, data or fibre optic cables. With its range of cables, igus also has the world‘s most comprehensive selection of international approvals. This includes cables with UL, EAC or DNV-GL approval. These help to keep the cost of export and customs clearance of machines as low as possible while purchasing. On request, igus also offers all cables harnessed as ready-to-connect and tested readycable.

About igus:

igus GmbH develops and produces motion plastics. These lubrication-free, high-performance polymers improve technology and reduce costs wherever things move. In energy supplies, highly flexible cables, plain and linear bearings as well as lead screw technology made of tri-bo-polymers, igus is the worldwide market leader. The family-run company based in Cologne, Germany, is represented in 31 countries and employs 4,900 people across the globe. In 2021, igus generated a turnover of €961 million. Research in the industry‘s largest test laboratories constantly yields innovations and more security for users. 234,000 articles are available from stock and the service life can be calculated online. In recent years, the company has expanded by creating internal startups, e.g. for ball bearings, robot drives, 3D printing, the RBTX platform for Lean Robotics and intelligent „smart plastics“ for Industry 4.0. Among the most important environmental investments are the „chainge“ programme – recycling of used e-chains - and the participation in an enterprise that produces oil from plastic waste.

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