

## **Robots in the factory of the future: opportunities and challenges for cable manufacturers**

**Today, manufacturing without industrial robots is hardly conceivable, and their areas of use are increasing continuously. But due to the permanent multi-axis movements in the automated factory, the cables that supply robot are subjected to extreme levels of stress. This is a special challenge for manufacturers of cables and connecting components.**

According to industry predictions, the number of industrial robots sold is expected to exceed the 250,000 mark this year. This is a huge worldwide market for robot manufacturers. To ensure that robots are supplied with data and energy without any interruption, it is worth looking carefully at the cables that have to survive the 3D movement of robots, which are continuously on the move. Robot cables for applications where the cables are subjected to torsional stress have to be constructed and manufactured in a completely different way to cables for linear motion. The latter must be as compact and closely braided as possible and have an outer jacket extruded at high pressure. The reason that this is important is because this special "hardness" enables the cable to follow the motion pattern of the energy chain.

Robot cables, in contrast, need force-compensating elements, loose braiding elements, different slip planes and completely different shield concepts in order to ensure they continue to function correctly even after several million movements involving torsional stress. This is because the cables used in robot technology have to completely and repeatedly change the directions in which they move. For example, the diameter of the braid structure can actually change in relation to the torsion angle. Cable specialist igus incorporates damping elements and torsional-force absorbing felt into the core groups, which are specially designed for use in applications involving continuous changes in torsional stress, in order to offset the forces acting on the cores. The requirements for the shielded types of cable are especially high. In order to ensure that the forces acting on the shield wires are not too large, the motion plastics specialist places gliding elements under and above the shields. These elements ensure that the shield can move freely in relation to

the overall braiding and to the cable jacket as well. The shield structure is designed with force redistribution and, in particular, has damping elements in the direction of redistribution. This "soft" nature of construction gives the entire cable the necessary freedom of movement, reduces tensile and compressing forces, and prevent shutdown of a machine due to a premature conductor break. For the chainflex "CFROBOT" cables used in applications with torsional stress and a torsion angle of up to +/- 180°, igus guarantees a service life of at least five million cycles or 36 months, depending on which occurs first.

### **Optimum protection for robot cables with energy chains**

On the basis of know-how gained over more than 50-years of experience in this area, the jacket materials have been optimally matched to the plastic of the triflex R robot energy chain, thus reducing abrasion and wear to a minimum. The triflex R TRCF is a closed energy tube based on the three-chamber principle: all three chambers of the TRCF can be opened and closed independently of each other. The supply hose is placed in one of the three chambers of the energy tube and is therefore optimally protected against damage. This makes the energy supply process reliable whatever the axial position of the robot is. The main feature that ensures reliable and operationally safe guidance of robot cables and hoses is compliance with the minimum bending radii. If the latter are not adhered to, there is a risk of cost-intensive plant failures. The technical design of the igus triflex R ensures that the prescribed minimum bending radius is adhered to whatever the working position of the robot - a surrounding outer stop prevents bending radii that are smaller than the minimum. Moreover, the modular design of the igus triflex R ensures that a torsion angle of approx. +/-10° per chain link is not exceeded. This has the advantage that the torsional stress on the cables is distributed along their whole length and not only in the area of strain relief, which is the case with other systems. The defined minimum bending radius of the triflex R robot energy supply system guarantees process reliability especially in robot applications with supply hoses as well as in the case of flow hole drilling. This is because a kink in the supply tube interrupts the power supplied to the screws on the tool and the process is disrupted.

**Tests offer planned reliability and at the same time reduce costs**

With "chainflex", igus has been repeatedly setting new standards for moving cables for more than 25 years in the areas of automation and robot technology and is regarded in the industry as a supplier of special cables available from stock for continuous motion in applications involving energy chains and torsional stress. igus has a 2,750 m<sup>2</sup> test laboratory, the world's largest lab for dynamic cables. Here, we twist our chainflex CFROBOT cables millions of times while continuously measuring core resistance in different test set-ups. The greatest challenge is undoubtedly that it is difficult to reproduce every conceivable application that involves torsion over the service life of the product. Whereas the service life limits can be dependably predicted in the case of linear travel in energy chains due to fixed parameters and known ambient-influences, robot applications are usually much more complex. In particular, the sequence of movements is often not completely clear during the planning phase. For the cable supplier, it is therefore of prime importance to test, test and test again. All the results of the tests are recorded in a database at igus. This – together with our decades-long experience in the area of plastics technology – enables us to give a 36 month guarantee on the mechanical specifications of the chainflex cables. As a result, the processes in mechanical engineering can be planned precisely. If a CFROBOT cable nevertheless fails when used for the purpose described in the catalogue, we will supply a new cable immediately and free of charge. Users can order cables of one metre or longer and the goods will then be delivered within 24 hours. The great advantage of the CFROBOT series for robot manufacturers and users is that they do not have to depend on expensive, special cables with long delivery times but can simply select from a standard range of products which has been specially developed for torsion applications and includes over 100 types of robot cables all available from stock.

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**ABOUT IGUS:**

igus GmbH is a leading international manufacturer of energy chain systems and polymer plain bearings. The family-run company based in Cologne is represented in 35 countries and employs approximately 3,180 people worldwide. In 2016, igus generated a turnover of 592 million euros with motion plastics, plastic components for moving applications. igus operates the largest test laboratories and factories in its sector to offer customers quick turnaround times on innovative products and solutions tailored to their needs.

The terms "igus", "chainflex", "CFRIP", "conprotect", "CTD", "drylin", "dry-tech", "dryspin", "easy chain", "e-chain", "e-chain systems", "e-ketten", "e-kettensysteme", "e-skin", "energy chain", "energy chain systems", "flizz", "ibow", "iglide", "iglidur", "igubal", "invis", "manus", "motion plastics", "pikchain", "readychain", "readycable", "speedigus", "triflex", "twisterchain", "plastics for longer life", "roboLink", "xiros", "xirodur" und "vector" are protected by trademark laws in the Federal Republic of Germany and internationally, where

**Captions:**



**Picture FAT1315-1**

The CFROBOT8.052 chainflex robot cable from igus is the first cable that has been tested for torsional movements when connected to robots and found to comply with the CAT7 standard. (Source: igus GmbH)



**Picture FAT1315-2**

In the 2,750 square metre test laboratory, cables are tested extensively with 2 billion test cycles per year. Due to the extensive tests, igus is able to give a 36-month guarantee on all cables, thus assuring the user of their high reliability.

(Source: igus GmbH)



**Picture FAT1315-3**

On the basis of know-how gained over more than 50-years of experience in this area, the jacket materials have been optimally matched to the plastic of the triflex R robot energy chain, thus reducing abrasion and wear to a minimum. (Source: igus GmbH)