

Linear actuator for solar tracking systems (solar tracker)

Solar tracking systems

Renewable energy from sun and wind makes an important contribution to worldwide electricity supplies. When one considers that the solar energy striking the Earth each year in the form of light and heat is $1,5 \cdot 10^{18}$ kWh, it is easy to understand that a continually increasing proportion of energy requirements can be generated from solar radiation.

In order to make the most efficient use possible of this energy source for electricity generation, specific technologies are used such as those of the solar thermal power plants CSP (Concentrating Solar Power) and CPV (Concentrating Photovoltaic). In both technologies, the modules are moved with high precision in order to track the sun's position. Tracking is carried out by means of single axis or twin axis tracking systems. Their quality has a significant influence on the energy yield of the systems.

CSP – Concentrating Solar Power

A solar power or solar thermal power plant uses the heat of the sun as a primary energy source by means of absorbers.

CPV – Concentrating Photovoltaic

A fundamental distinction is made between power plants operating on the line focus and the point focus principle.

Line focus technologies are tracked in a single axis about the horizontal axis:

- In a parabolic trough power plant, parabolic troughs up to a length of 200 m are moved.
- In a Fresnel power plant, a series of several long reflector segments are moved to track the sun.

Point focus technologies are tracked in two axes:

- A solar dish power plant comprises several individual parabolic reflectors with Stirling motors.
- In a solar tower power plant, several thousand reflectors (also known as heliostats) focus sunlight on the tip of the tower.

Depending on the technology used, the temperatures reached at the receiver can range from +390 °C to +1 200 °C. This heat is used, for example, to create steam which then drives conventional steam turbines.

The decisive advantage of solar thermal power plants is the capacity for the highly efficient storage of solar energy in the form of heat. As a result, it is possible to call off electricity even overnight that has been generated from solar energy.

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Tracking systems for CSP and CPV

For the tracking of CSP and CSV systems, Schaeffler supplies the linear actuator, bearings for the axes and the slewing gear, *Figure 1*.

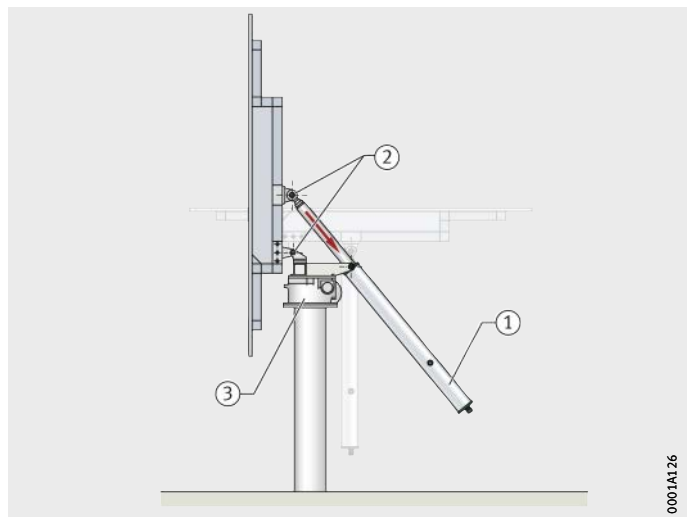
For the development of these products, there are principally three decisive requirements:

- High cost-efficiency, since a large proportion of the total investment in such power plants – up to 18% in tower type power plants and up to 33% in CPV trackers – is accounted for by the drives.
- High accuracy – even the slightest angular deviations in the reflectors or CPV tracker will lead to losses in energy generation, because the sun will then fail to strike the receiver or PV cell.
- Long life and freedom from maintenance, since a project can quickly become uneconomical if the operating costs are high. In order to ensure reliable function over the long term and in continuous operation, good sealing, corrosion resistance and lubrication matched to the application conditions are decisive.

Schaeffler tracking systems comprehensively fulfil these requirements. With their components, they thus make an enormous contribution to the cost-efficiency and operational security of these sustainable technologies for energy generation.

- ① Linear actuator
- ② Plain bearing
- ③ Bearing components for slewing gear

Figure 1
Linear actuator in a solar thermal power plant



Linear actuator

The linear actuator supplied by the Business Unit Linear Technology was developed by the system solution specialists specifically for the demanding application in the tracking systems of solar thermal power plants, *Figure 2*, page 3.

The complete system comprises rolling bearings for the bearing positions, the screw drive including the spindle nut, the slide tube, a compact single piece housing with a housing cover, seals, the drive system (motor/gearbox unit), the sensors and the rod end for connection to the solar module. Due to its design, the linear actuator can easily be customised in relation to its length (stroke) and connection.

Complete solution matched to the application

In order to ensure functioning of the systems, the operating and environmental conditions (sun, sand, rain, storm etc.) require solutions that are matched to the application. The single piece encapsulated housing therefore has very good sealing and very few joint positions. The seal components give secure protection against the ingress of contamination, water, sand etc. into the actuator and the damage which could occur as a result. Since the bearing arrangements of the screw drive are matched to the operating conditions, the linear actuator is either low-maintenance or maintenance-free depending on its operation. Since even the slightest deviations in the tracking systems cause considerable losses in energy efficiency, the axial clearance in the actuator is reduced to a minimum in order to ensure the best possible energy efficiency.

Linear actuator for tracking motion of heliostats

Technical features:

- design and development oriented to the application
- high cost-efficiency
- electronic components integrated in the housing and securely protected against environmental influences
- three stage motor/gearbox unit for very high performance density
- variable output for electricity supply in accordance with customer specifications
- integrated lubrication pockets for low-maintenance or maintenance-free operation
- self-locking drive system
- solution transferable to other solar applications (e.g. CPV).

Technical data:

- lifetime = up to 25 years
- dynamic load F = up to 5 kN
- static load F_0 = up to 15 kN
- stroke H = 200 mm to 1000 mm
- velocity v = from 5 mm/s
- encoder resolution = 89 impulse/mm
- motor = 12/24 V BDC or 24/48 V BDC
- protection class IP66.

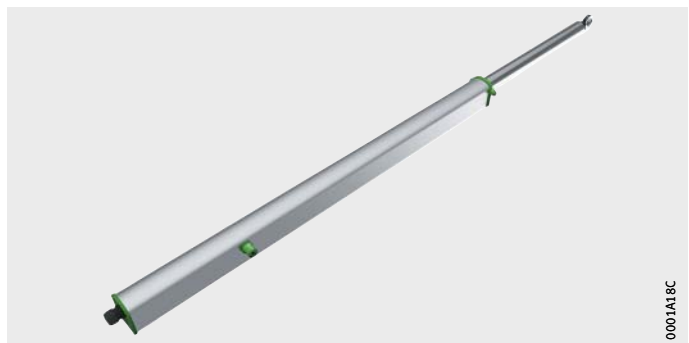


Figure 2
Linear actuator

Also suitable for other applications

The solution described was developed specifically for solar thermal power plants. Due to the versatility of the basic design and the matched components, however, it can also be used for other market sector and customer requirements.



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