



# Drives

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# Division of drives

Basic classification of drives :

- elektrik,
- pneumatic,
- hydraulic,
- combustion engines,



# Electric motors

Electric drives can be further divided into:

- asynchronous motors,
- EC motors,
- DC motors,
- step motors,
- servomotors,
- Linear servomotors,
- Solenoids,



<https://www.machinedesign.com/mechanical-motion-systems/article/21835874/whats-the-difference-between-ac-dc-and-ec-motors>

# Pneumatic drives

Pneumatic drives can be further divided into :

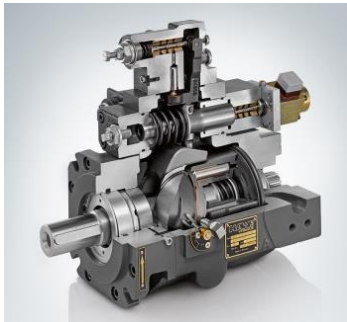
- pneumatic cylinders,
- bellows cylinder,
- rotary actuators,
- rotary pneumatic drives,
- Membran drives,
- pneumatic muscle actuators,



# Hydraulic drives

Hydraulic drives can be further divided into:

- linear drives,
- rotary drives,
- Axial piston drives,
- Radial piston drives,



# Advantages and disadvantages of electric drives

## Advantages

- big variability of power, torque, speed,
- high efficiency and overload capacity,
- long durability,
- low noisy running,
- easy handling, full control,
- wide range of design adaptations,

## Disadvantages

- Dependent on power electric energy,
- lower ratio performance to weight indicator compared to hydraulic drives,
- the operating temperature range is limited,

# Advantages and disadvantages of pneumatic drives

## Advantages

- simple design,
- applicability over a larger temperature range than electric drives,
- applicable in hazardous environments,
- low price and weight,
- minimal maintenance,

## Disadvantages

- low efficiency,
- precise positioning are difficult and expensive,
- high operating costs,



# Advantages and disadvantages of hydraulic drives

## Advantages

- good weight/power ratio,
- the hydraulic drive can hold power or torque even in the event of a hydraulic pump failure,
- the hydraulic pump can be located at a considerable distance,

## Disadvantages

- risk of hydraulic fluid leakage,
- hydraulic circuit complexity,
- application limited by flammability of hydraulic fluid,



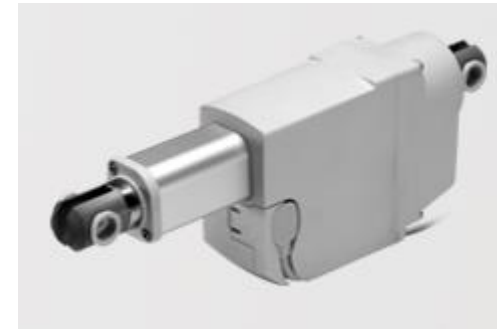
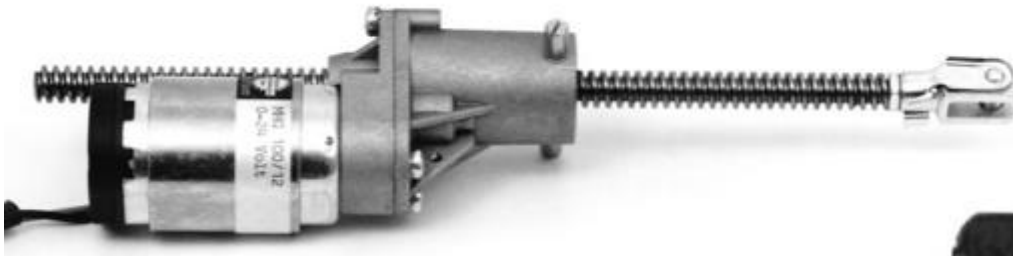
## Comparison of different systems

Property	Mechanical	Electrical	Pneumatic	Hydraulic
Relative cost	Best	Good	Good	Fair
Energy cost	Good	Best	Fair	Good
Torque	Poor	Fair	Good	Best
Power/weight ratio	Poor	Fair	Best	Best
Stiffness	Good	Poor	Fair	Best
Control	Fair	Best	Good	Good
Response speed	Fair	Best	Fair	Good
Dirt sensitivity	Best	Best	Fair	Fair

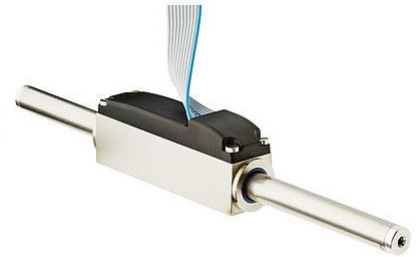
# Examples of electric drives - geared motors



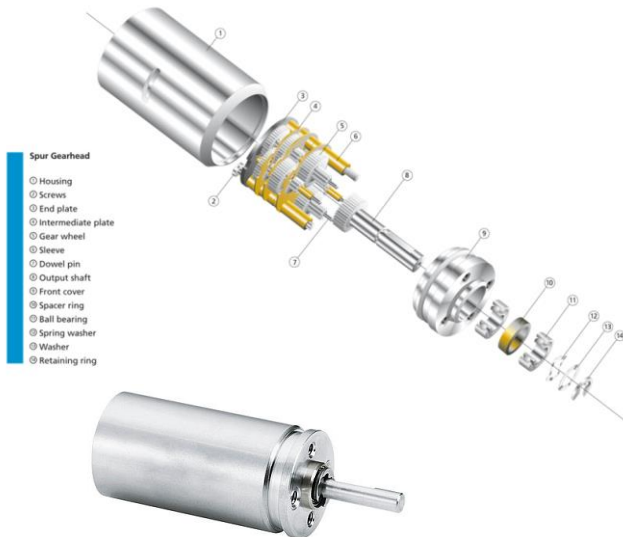
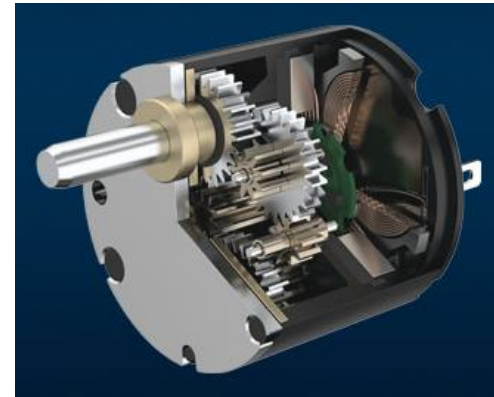
# Examples of actuators



# Example of servodrives



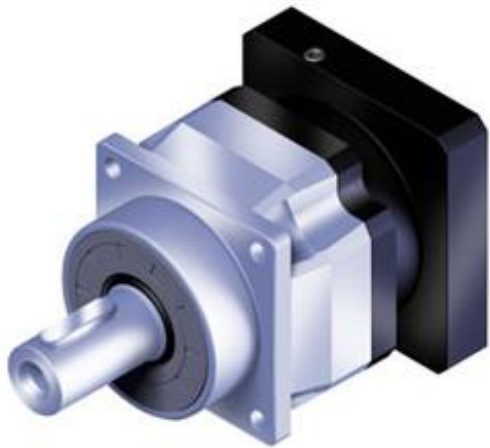
# Mini drives



<https://www.faulhaber.com>

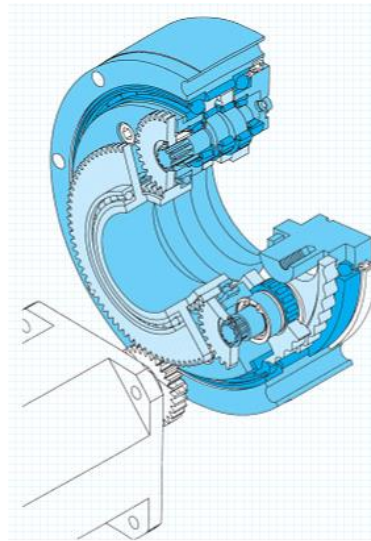


# Planetary gearboxes



<https://www.raveo.cz>

# Cycloidal gearboxes



<https://www.raveo.cz>

## Harmonic gearboxes



## Variator



<https://www.raveo.cz>

<https://www.raveo.cz/plaromaster>



# Pneumatic drives

- pneumatic cylinders by to standards,
- compact cylinders,
- swinging actuator with piston,
- swinging drives with rotary piston,
- linear drives,
- minislide,



<https://www.festo.com>

<https://www.smc.eu>

# Examples of hydraulic drives



## Conclusion

Choosing the right drive is now a matter for the drives specialists. The range are very extensive and a number of aspects need to be considered. The aim of the lecture is to familiarize students with basic information from the perspective of CAD designer.



## Questions:

- What are the advantages and disadvantages of electric drives?
- What are the advantages and disadvantages of pneumatic drives?
- What are the advantages and disadvantages of hydraulic drives?

**Topic of the next lecture**

**„Basic rules for creating drawing documentation“**

**Thank You**



# Used literature and sources of information :