Hydraulic-Electric Power Steering System

Hydraulic-electric power steering systems have been developed and commercialized by Koyo first in Japan.

In addition to the advantages of the conventional hydraulic control system, this power steering system can control the rotational speed of the pump by means of an electric motor and a steering angle sensor and instantaneously supply oil pressure to the steering gear on demand to provide optimum steering force.

When the steering wheel is not in motion, the motor is kept standby in order to save the power consumption.

This system adopted many new technologies developed by Koyo and these are described below.

Steering Gear System

Features

① Rack housing:

All aluminum integral type (light weight, reduction in part numbers):

All aluminum integral housing developed first in Japan by Koyo. Adoption of ADC material with superior strength and endurance.

② Low flow rate valve:

Adoption of valve applicable up to 3 l/min:

Optimum characteristics are secured by adopting low flow rate valve with two-step chamfers for H-EPS first in Japan.

③ Floor seal:

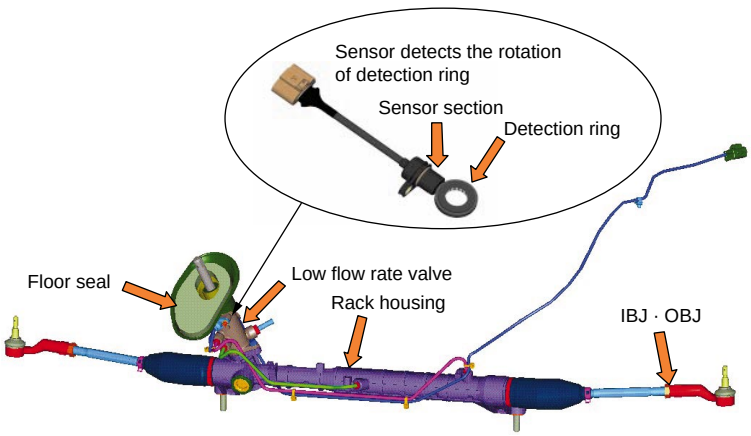
Press fitted in valve housing. The upper face is made of polyurethane (good sealing performance):

Floor seal adopted first in Japan by Koyo. For better sealing performance and noise isolation, the casing main body is duplex molded by elastomer and nylon, using polyurethane for the upper face.

④ Inner ball joint (IBJ), outer ball joint (OBJ):

OBJ double offset:

OBJ double offset adopted first in Japan by Koyo. OBJ is offset from front to back and from side to side considering the vehicle layout. Consequently a large thread of M17 is adopted for IBJ.



Gear Specifications

Stroke ratio	55.13mm/rev.
Rack stroke	162mm
Module	1.75
Pressure angle	20°
Pinion offset angle	16° 8' 24"
Rack torsional angle	4° 15' 14"
Number of pinion gears	10
Distance between shafts	18mm
Spring constant of torsion bar	1.85N·m/deg.
Diameter of cylinder/pressure area	ϕ 40mm/8.04cm^2
Rack diameter	ϕ 24
Output at 11MPa	8 400 N

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Power Pack Assembly

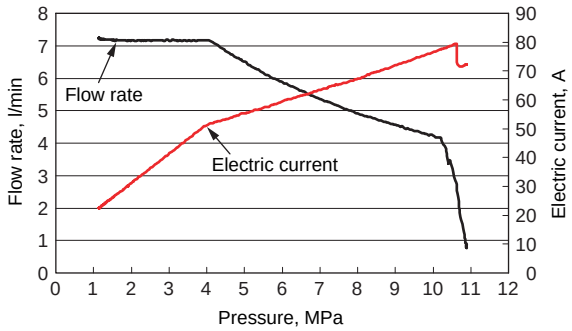
Features

1) High-efficiency gear pump is adopted (interchangeable with European products)
2) Maintenance-free due to a brushless motor.
3) Newly developed vibration insulating structure.

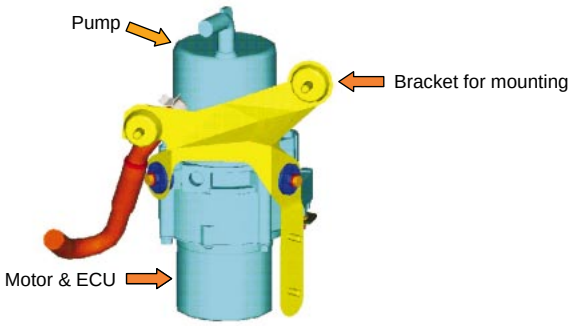
Power pack specifications

Basic discharge	1.5cm^3/rev.
Relief pressure	10.7±0.3MPa
Rotational speed	Standby (2 500 min^{-1}) ~ max. (4 900 min^{-1})
Temperature	–40℃ ~ +100℃
Rated voltage	13.5V
Max. current	85A

Characteristics (P-Q, P-I typical characteristics)



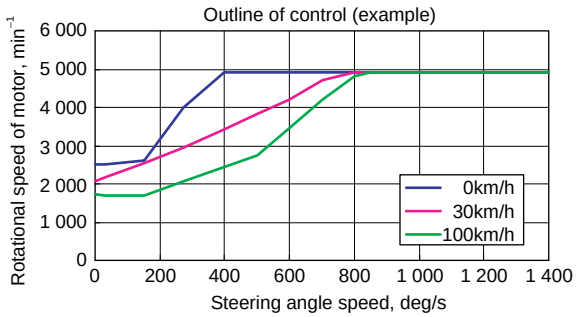
Appearance

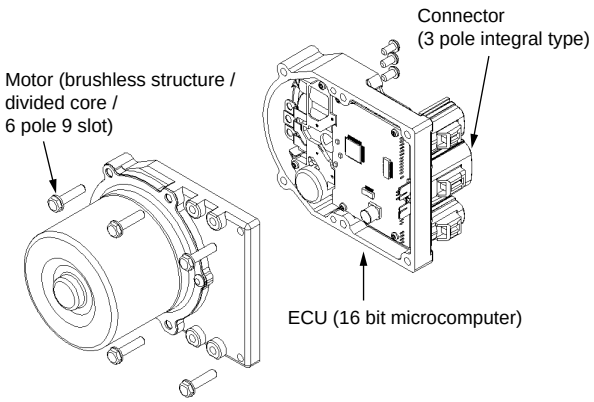


Motor and ECU

<Features>

1) Vehicle-speed/steering-speed sensing type. Controlling the feed back of the rotational speed of the motor.
2) Controlling the switch-over of driving modes (120°⇔180° power distribution).
   · Switch-over by the rotational speed of the motor
3) Compensated control of oil temperature against the variation of steering force by oil temperature.
   · Variation of steering characteristics by oil temperature is compensated by the flow rate (the rotational speed of the motor)





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