CONFIDENTIAL

BYD Yangwang U8
Teardown Analysis and 3D Scanning Data / BOM

Chapter 1
e-Powertrain / e-Axle Structural Analysis & Motor Cost Analysis

Consulting Division
MarkLines Co., Ltd.

Contents

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Outline of BYD Yangwang U8

Vehicle overview

Manufacturer: BYD
Country/Region: China
Date of release: Launched in China in September 2023
Manufacturing plant: BYD, Xian Plant
Base price: CNY 1,098,000

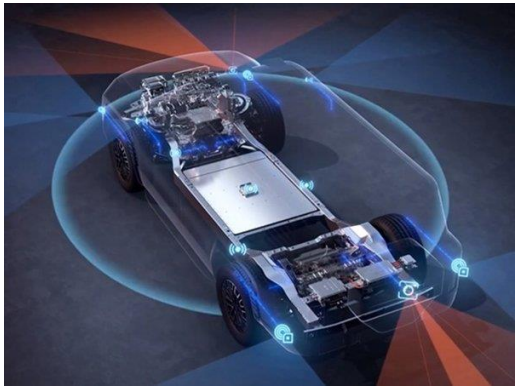
Main specifications

Item	Specifications
Length x width x height	5319 x 2050 x 1930mm
Wheelbase / front / rear tread	3050 / 1740 / 1731mm
Curb weight total / front axle / rear axle	3460 / 1730 / 1730kg
Engine displacement / exhaust gas regulation level	1997cc (dedicated for power generation) / China-6
Engine rated power / RPM	200kW / 5000rpm
Vehicle drive system	4 motor, drive force control of each wheel
Drive motor type	Permanent magnet synchronous motor
Maximum / rated power (1 motor x4)	880 / 260kW
Drive battery capacity	49.05kWh
Maximum speed / hill climbing capability / water depth	200km/h / 100% grade / 1m
0-100km/h acceleration	3.6 seconds

Outline of BYD Yangwang U8

Characteristic technology

- **BYD's unique individual wheel drive (IWD: Individual Wheel Drive)**
  Sliding parallel parking and tank turns are possible by driving the wheels with four independent electric motors and rotating the left and right wheels in opposite directions.
- **Blade battery (lithium iron phosphate)**
  Capacity: 49.05kWh, Total voltage: 800V, Cell to Chassis
- **Emergency float mode**
  Can traverse water to a depth of up to 1,000mm
  (Max 1,400mm with snorkel)
  Water navigation is also possible as an emergency evacuation measure during floods and other disasters. (The vehicle can remain afloat for 30 minutes and move forward at a speed of 3 km/h.)
- **Intelligent Hydraulic Body Control System for Off-road Vehicles**
  Total adjustable suspension-stroke: 150mm
  Max wading depth: 1m
  The vehicle can be leveled in a single click
- **Advanced intelligent driving assistance system**
  Equipped with 38 sensors including 3 LiDARs, 5 millimeter-wave radars, 14 ultrasonic radars, and 16 high-resolution cameras.
- **Intelligent cabin for all-round enjoyment**
  Active side support seats
  12.8-inch OLED flexible curved screen with R800 curvature
  Starry sky sunroof
- **Drone bay (not installed in survey vehicle)**
  Intelligent storage, automatic battery swapping, charge management, one-click drone takeoff and landing



Outline of BYD Yangwang U8

Survey vehicle specifications

U8 2023 Deluxe Edition without optional equipment
Exterior color: Dragon Stone Green
Interior color: Black Orange
https://www.yangwangauto.com/car-type-detail

Vehicle weight (empty): 3,520kg (LF: 880kg, RF: 870kg, LR: 900kg, RR: 870kg

Exterior

Front

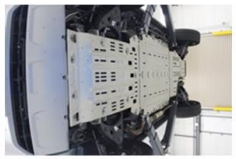
Back

Left

Right

Top

Bottom



Profile Top

Profile Back

Interior

Outline of BYD Yangwang U8

AD/ADAS Technology

- Automated driving level: Level 2
- ADAS equipment

Legend) ◎: All vehicles standard ○: Partial standard △: Manufacturer option ×: No setting

Item		Setting	Device / system name
Sensors	Sonar	◎	Sensors (14 units standard for all vehicles)
	Millimeter wave radar	◎	Radar sensor (5 units standard for all cars)
	Laser radar	×	-
	LiDAR (laser scanner)	◎	LiDAR (3 units standard for all vehicles)
	Monocular camera	◎	Camera (14 units standard for all vehicles)
	Stereo camera	◎	Stereo camera (1 unit standard for all cars)
Collision avoidance / mitigation system	Collision warning	◎	Active braking
	Collision avoidance	×	-
	Automatic braking	◎	Active braking
	Suppression of false start	×	-
Steering control system	Lane escape warning	◎	Lane departure warning
	Lane departure prevention	◎	Lane keep assist
Visibility / blind spot assist system	Surround view monitor	◎	Panoramic view system
	Rear side blind spot warning	◎	Blind spot safety assist
	Rear crossing warning / brake	◎	Rear cross traffic alert
	Forward crossing warning / brake	×	-
	Adaptive high beam system	◎	Adaptive high beam system
	Night vision	×	-
Other safety equipment	Sign indicator	◎	Traffic sign recognition system
	Driver status monitor	◎	Driver monitoring system
Acceleration/deceleration control system	Tracking the car in front / Tracking in traffic jams	◎	Adaptive cruise control
Steering control system	Lane change assist	◎	Lane change assist
	Automatic lane change / Automatic overtaking	◎	Navigation on Autopilot (Urban, Highway)
Parking assist system	Automatic parking	◎	Automatic parking assist

Outline of BYD Yangwang U8

Other equipment specifications

Equipment name	Equipped status (●: Standard equipment)
Braking and suspension systems	
Front and rear brake type	Perforated ventilated disc
Front and rear suspension type	Double wishbone independent suspension
Yunnian-P Intelligent Hydraulic Body Control System	●
Speed-dependent Electric Power Steering (R-EPS)	●
Caliper type	Front 6-piston fixed caliper, rear single-piston floating caliper
Off-road equipment	
Vehicle external discharge function	6kW
Tooth-type differential lock (including front differential lock and rear differential lock)	●
15+1 off-road modes	●
Water sensing system	●
Hill Descent Control (HDC)	●
Maximum 30kW on-site power generation function	●
Convenient boarding and alighting function	●
Trunk convenient access function	●
Security Configuration	
LATCH child safety seat interface (compatible with ISO-FIX)	x2
Rear electronic child safety locks	●
Driver and passenger front airbags	●
Driver knee airbag	●
Front and rear seat side airbags	●
Front and rear through-type side airbags	●
Front and rear seat belt not fastened alarm	●
Front seat pre-tensioner seat belts	Motor-operated pre-tensioned seat belt with dynamic locking tongue
Rear left/right pre-tensioned seat belts	●
3D holographic transparent imaging system	●
Sentry Mode	●
Driving Recorder	●

Equipment name	Equipped status (●: Standard equipment)
Blind Spot Safety Assist	●
Electronic Parking Brake (EPB)	●
Automatic hold system (AVH)	●
Anti-lock Braking System (ABS)	●
Intelligent dynamic braking system	●
Hydraulic Brake Assist (HBA)	●
Traction Control System (TCS)	●
Parking brake deceleration control system (CDP)	●
Vehicle Dynamics Control (VDC)	●
Electronic Brake-force Distribution (EBD)	●
Hill Start Control (HHC)	●
Comfort brake function (CST)	●
Brake Disc Wiping System (BDW)	●
Rollover Mitigation System (RMI)	●
Brake Override System (BOS)	●
Driver Monitoring System (DMS)	●
OMS	●
Trailer Stability Management (TSM)	●
Direct tire pressure monitoring system	●
Speed sensor automatic locking	●
External Configuration	
Interstellar matrix LED headlights (with automatic height adjustment)	●
Automatically turn on the headlights	●
LED daytime running lights	●
Adaptive Driving Beam (ADB)	●
Headlight early on/delay off function	●
Intelligent sensor dynamic welcome light and welcome light carpet	●
Side marker lights	●
LED high-mount brake light	●
Interstellar LED rear combination lamp	●
Rear fog lamp	●
Corner lighting	●
Charging port lighting	●
D-pillar energy tower	●

Outline of BYD Yangwang U8

Other equipment specifications

Equipment name	Equipped status (●: Standard equipment)
External equipment	
Dot matrix grille	●
Rain-sensing boneless front window smart wiper	●
Fender Yi Sifang logo	●
Roof detection system	●
Starry skylight (one-touch opening and closing with anti-pinch function)	●
Electric sunroof shade	●
Electric hidden door handle	●
Electric suction door	●
Electric running board outside the vehicle	Electric
Side-opening tailgate with electric closing function	●
Exterior rearview mirror (electric folding, heating and defrosting, automatic anti-glare, automatic adjustment when reversing, automatic folding when locking the car, position memory, turn signal)	●
Front windshield (UV protection, heat insulation, sound insulation)	●
Rear windshield (UV protection, heat insulation)	●
Rear windshield privacy glass	●
Rear windshield electric heating defogger and defrost	●
Front and rear door window glass (UV protection, heat insulation, sound insulation, double layer)	●
Rear door window privacy glass	●
Four-door windows one-touch lifting with anti-pinch function	●
Wheels and tires	
22-inch sports forged wheels (with 275/50/R22 road tires)	●
22-inch simple forged wheels (with 275/50/R22 road tires)	●
Full-size backpack spare tire	●
Spare tire decorative cover	●
Interior Configuration	
Front and rear seats (electric adjustment, heating, ventilation, memory, massage, 4-way electric adjustment of lumbar support, electric adjustment of leg rest, height-adjustable headrest)	●

Equipment name	Equipped status (●: Standard equipment)
Premium Nappa leather seats	●
Front intelligent adaptive seats	●
Passenger gentleman key	●
One-touch electric folding and reset of rear seats	●
Rear seat backrest angle electric adjustment	●
Suede headliner	●
"Look Up" welcome plaque	●
Second row center armrest (with double cup holders)	●
Leather multi-function steering wheel (four-way electric adjustment, heating, position memory)	●
Suede sun visor with vanity mirror and lighting for driver and passenger	●
Car refrigerator (can be used for both refrigeration and heat preservation)	●
Car audio system	
Dynaudio Platinum Evidence Series Hi-End Audio System	
Number of speakers	22
Driver headrest speaker	●
127-color interior ambient lighting	●
Driver and passenger foot ambient lighting	●
LED touch reading lights throughout the vehicle	●
Storage box lighting	●
Luggage compartment light	●
Intelligent four-zone independent heat pump air conditioning system	●
Green air purification system (PM2.5 high-efficiency detection and filtration, high-temperature sterilization, negative ion generator)	●
USB/Type-C interface, 12V power interface in the car	USB/Type-C 8+12V
50W mobile phone wireless charging	3 places
220V AC socket in the car	●
In-vehicle ETC	●
Smart Cockpit	
DiLink intelligent network system	●
BYD and Qualcomm custom-develop 4nm 5G chips	●
Memory	16 GB

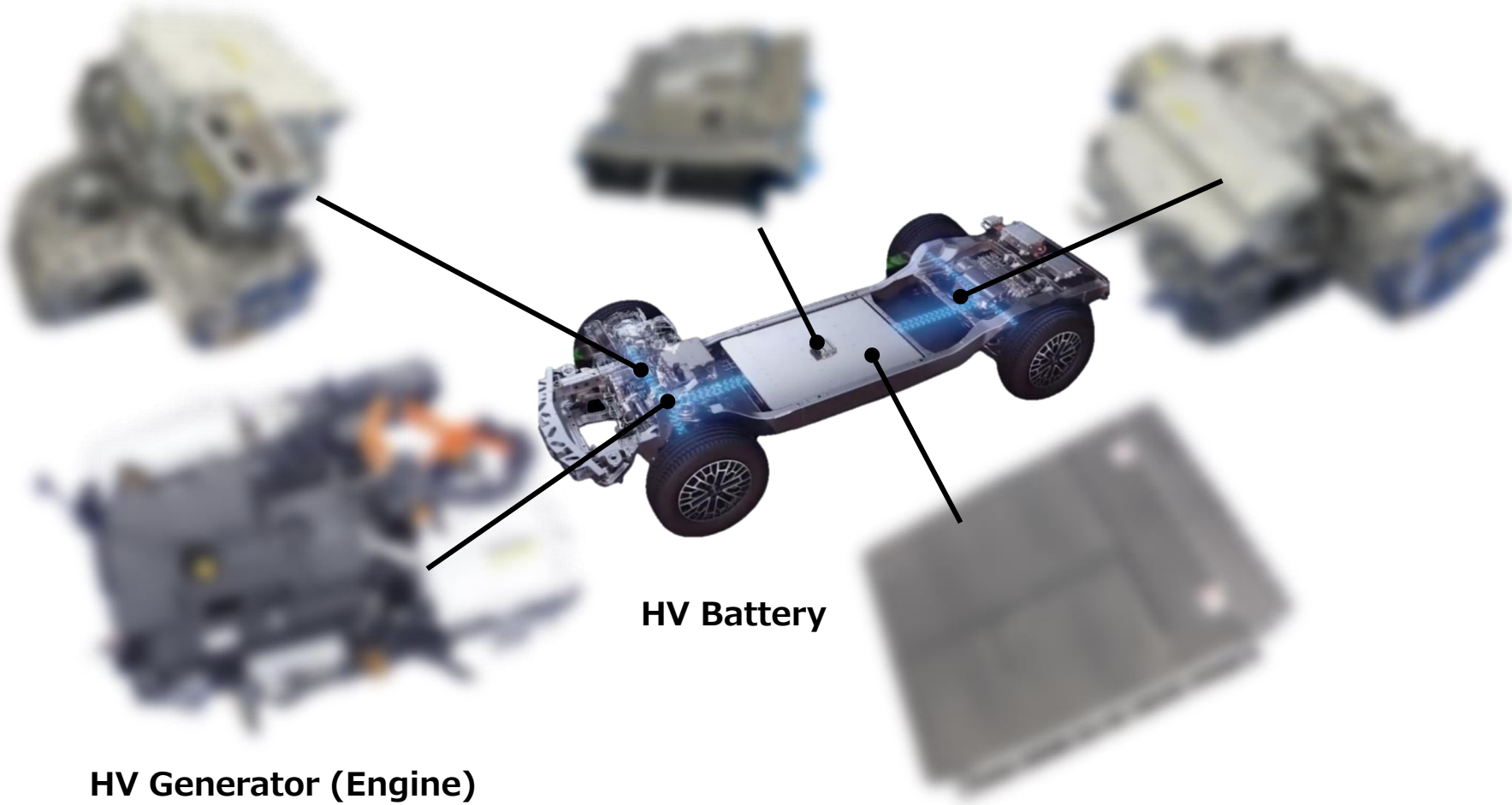
Outline of BYD Yangwang U8

Other equipment specifications

Equipment name	Equipped status (●: Standard equipment)
High-speed storage	512GB
12.8-inch OLED Galaxy curved central control screen	●
23.6-inch Mini LED instrument panel	●
23.6-inch Mini LED passenger multimedia screen	●
7-inch rear center armrest LCD screen	●
Streaming media rearview mirror	●
Streaming media rearview mirror camera	1
Full-scenario intelligent voice (four-zone independent wake-up, four-zone recognition, full-car full-time wake-up-free, continuous conversation, and speaking as soon as you see it)	●
5G Connectivity	●
70-inch AR-HUD head-up display	●
OTA remote upgrade	●
NFC digital key	●
UWB Digital Key	●
Bluetooth key	●
Remote APP car control	●
UHF Microphone	●
Look up to the exclusive roadside assistance call service	●
Look up to the exclusive emergency rescue call service	●

1. e-Powertrain Structural Analysis

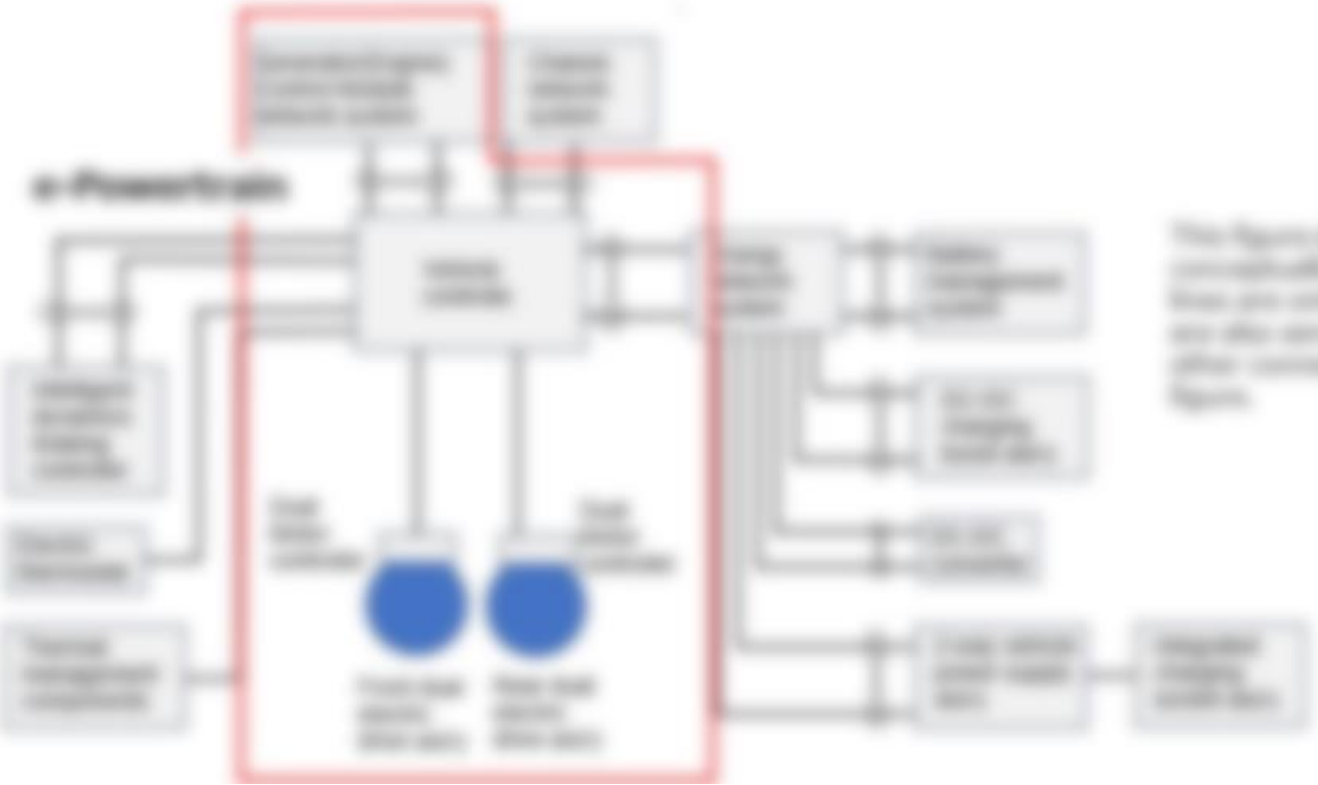
1.1 e-Powertrain components



1.e Powertrain Structural Analysis

1.2 e-Powertrain System outline

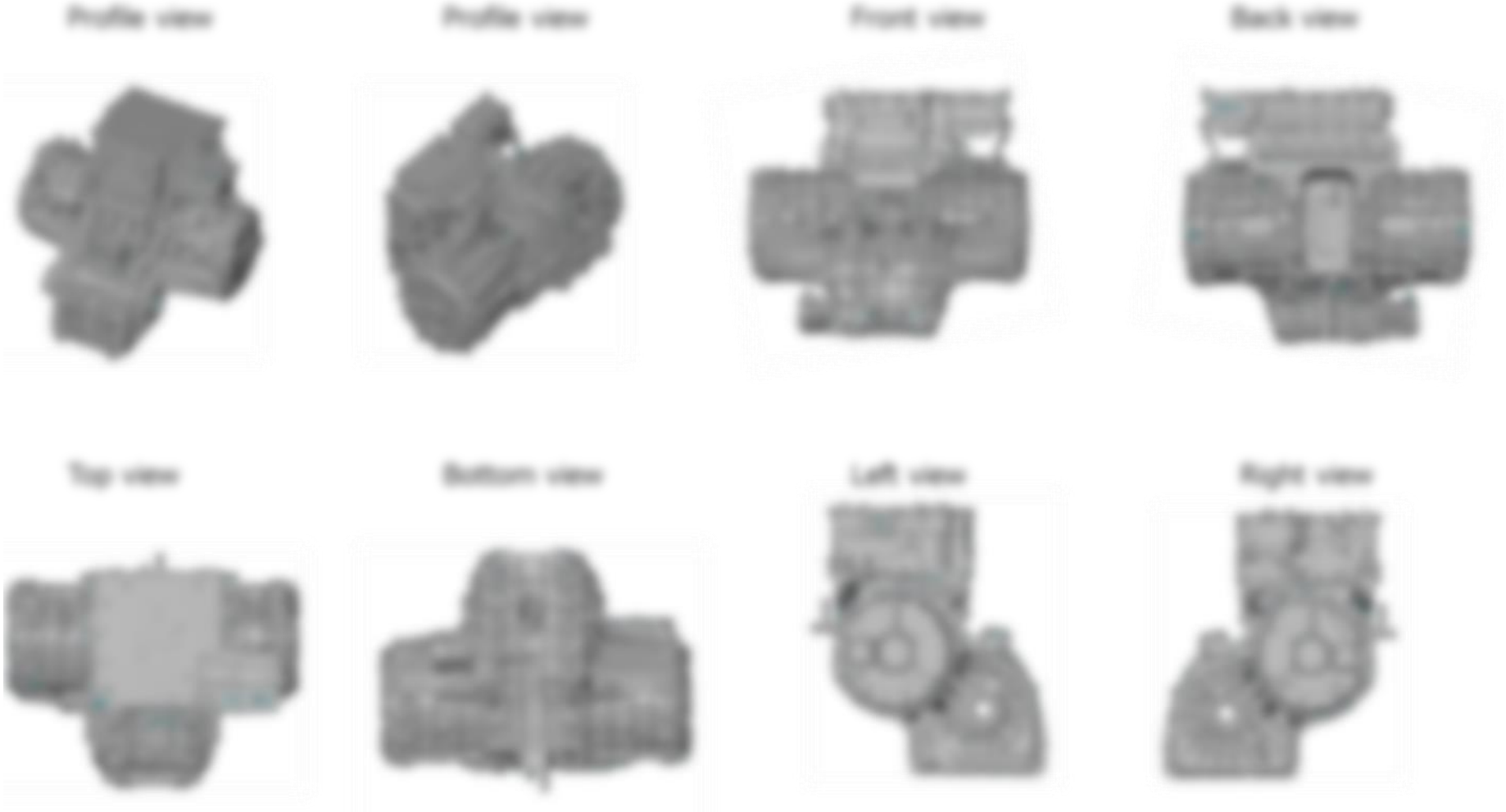
Mechanical layout



2. e-Axle Structural Analysis

2.1 e-Axle outline

Front e-Axle



2. e-Axle Structural Analysis

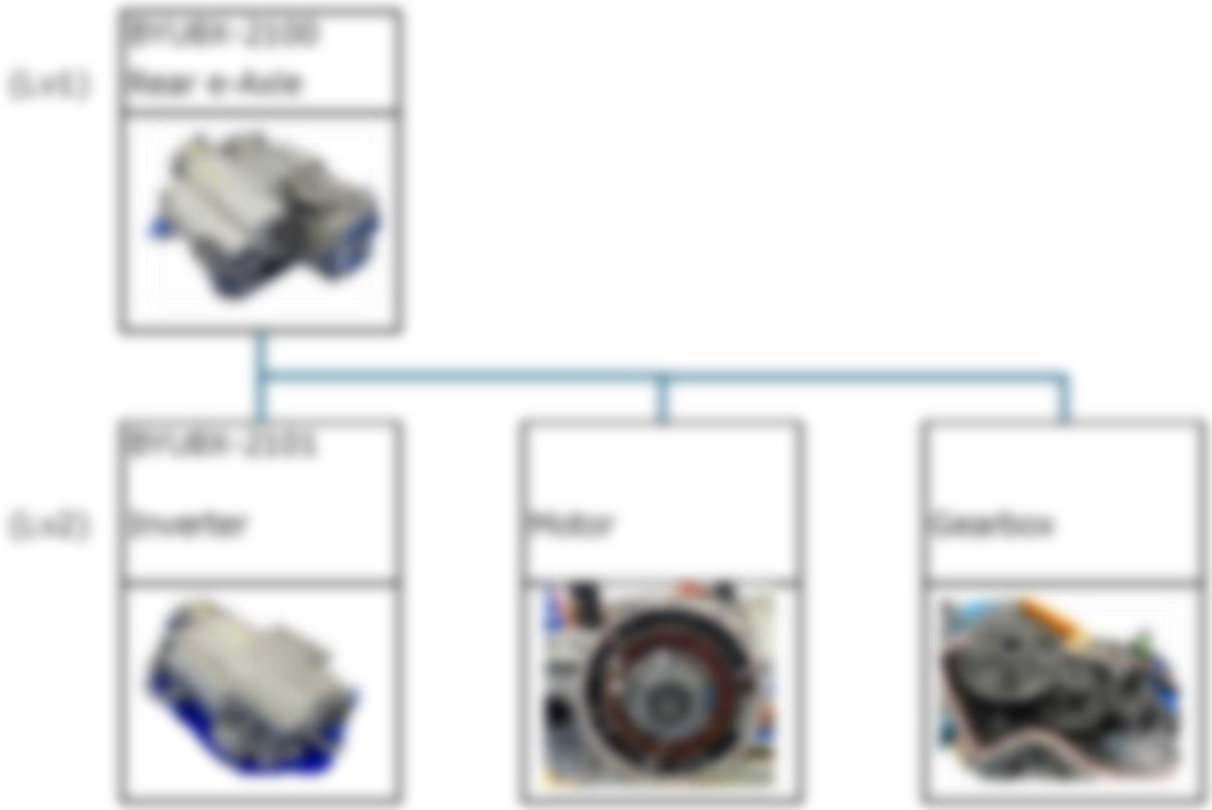
2.1 e-Axle outline

Rear e-Axle components (exploded view)

2. e-Axle Structural Analysis

2.1 e-Axle outline

Rear e-Axle components (Parts configuration diagram)



2. e-Axle Structural Analysis

2.1 e-Axle outline

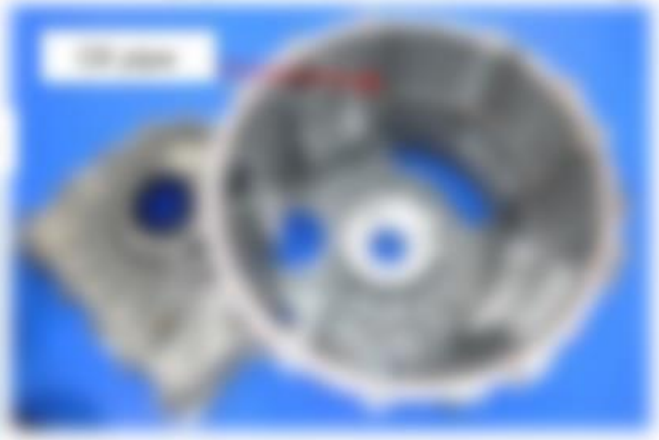
Rear e-Axle oil-cooling structure

RR unit central part

Electric oil pump

Mechanical oil pump

Coolant-oil pipe inside motor housing



Oil cooler

Electric oil pump (rear)

Mechanical oil pump (rear)

Coolant-oil pipe

Oil outlet

The RR unit central part is equipped with an electric oil pump and a mechanical pump (operates with differential gear on the left side), coolant and a heat exchanger which cools the coolant-oil. In addition to lubricating the gears and bearings in the unit, the motor is cooled.

In the RR unit motor, (1) oil drips out of the oil pipe attached to the interior of the motor housing and (2) oil flung out of the oil holes on the end plate by centrifugal force cools the coil end parts.

2.2 Inverter components & structure

Rear inverter components (Parts configuration diagram)

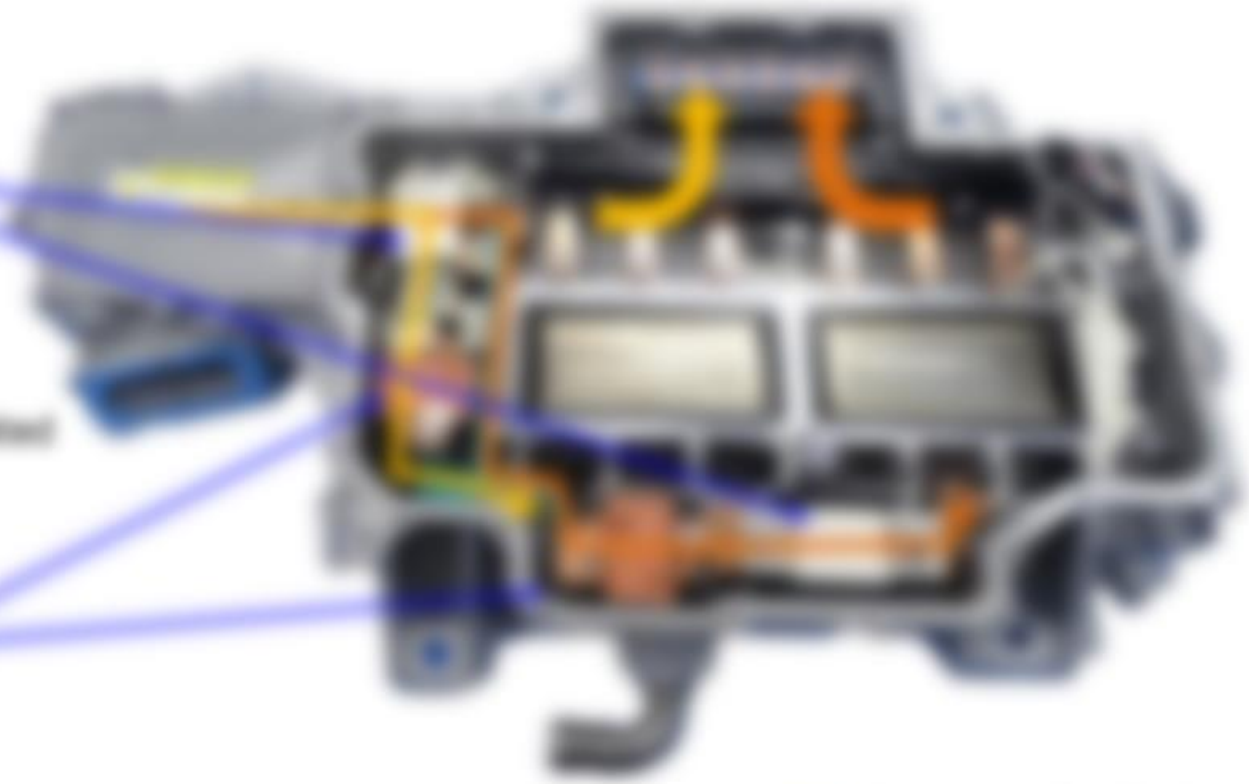
2.2 Inverter Components & Structure

Busbars, fuse, and noise filter

The busbars have wiring that branches out from the inverter entrance to the left and right drive motors.

Fuse: DC 800V 11 20kA indicated

Noise Filter: 60uH 120A indicated



Busbar circuit for left side motor

Busbar circuit for right side motor

2. e-Axle Structural Analysis

2.2 Inverter Components & Structure

Control board and surface

The left and right drive motors are controlled by a single microcontroller chip, the Infineon AURIX TriCore (2 cores built in). The signals for the gate drivers are connected to the gate board via separate left and right connectors. This microcontroller also generates oil pump control and motor speed signals. There is a high voltage section on the left side of the board, where separate left and right bleed resistors and a high voltage divider resistor for the comparator are wired.

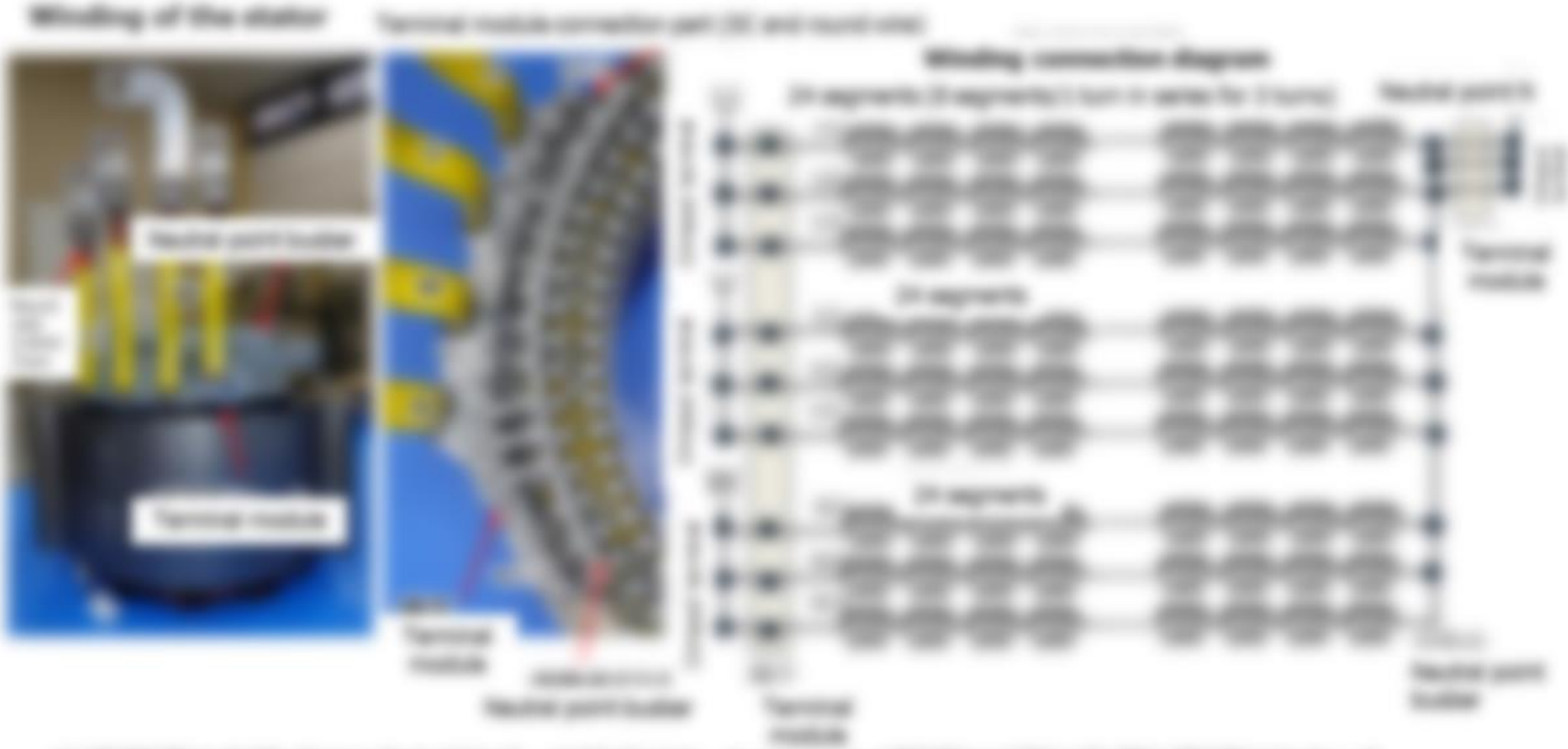
2. e-Axle Structural Analysis

2.3 Motor Components & Structure

Rear motor RH components (Parts configuration diagram)

2. e-Axle Structural Analysis

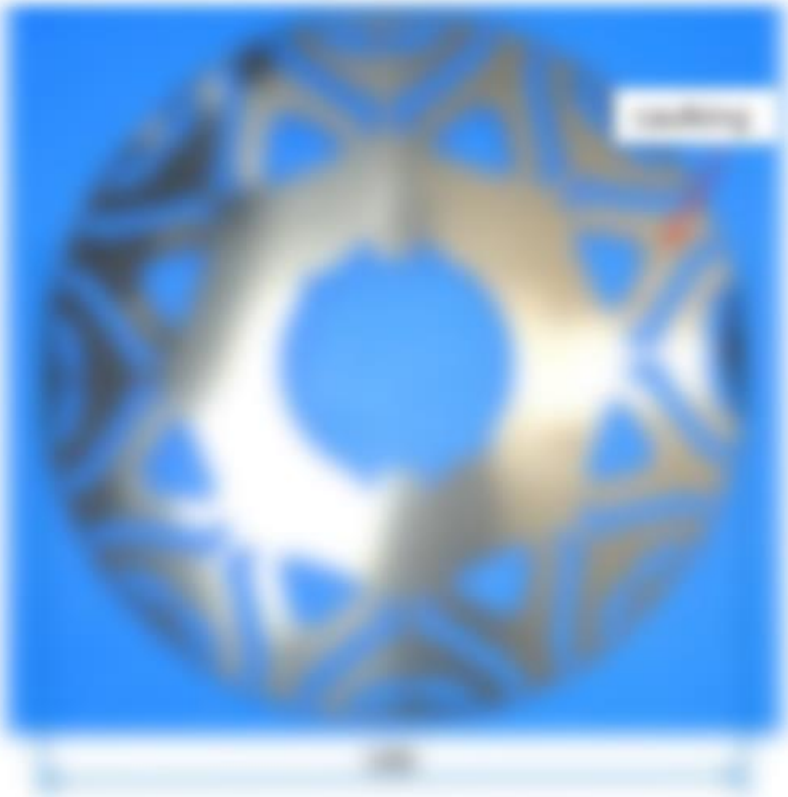
2.3 Motor Components & Structure



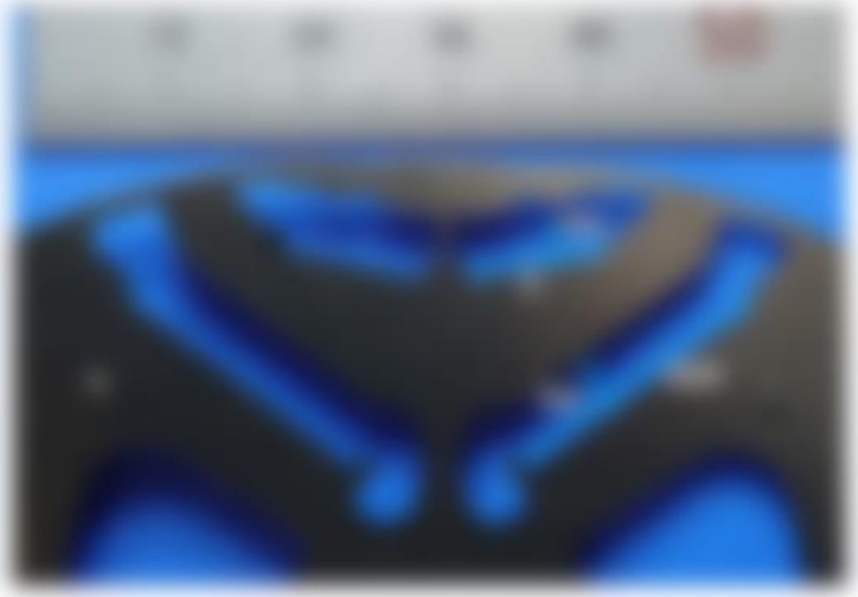
2. e-Axle Structural Analysis

2.3 Motor Components & Structure

Rotor core shape



Enlargement of a single pole

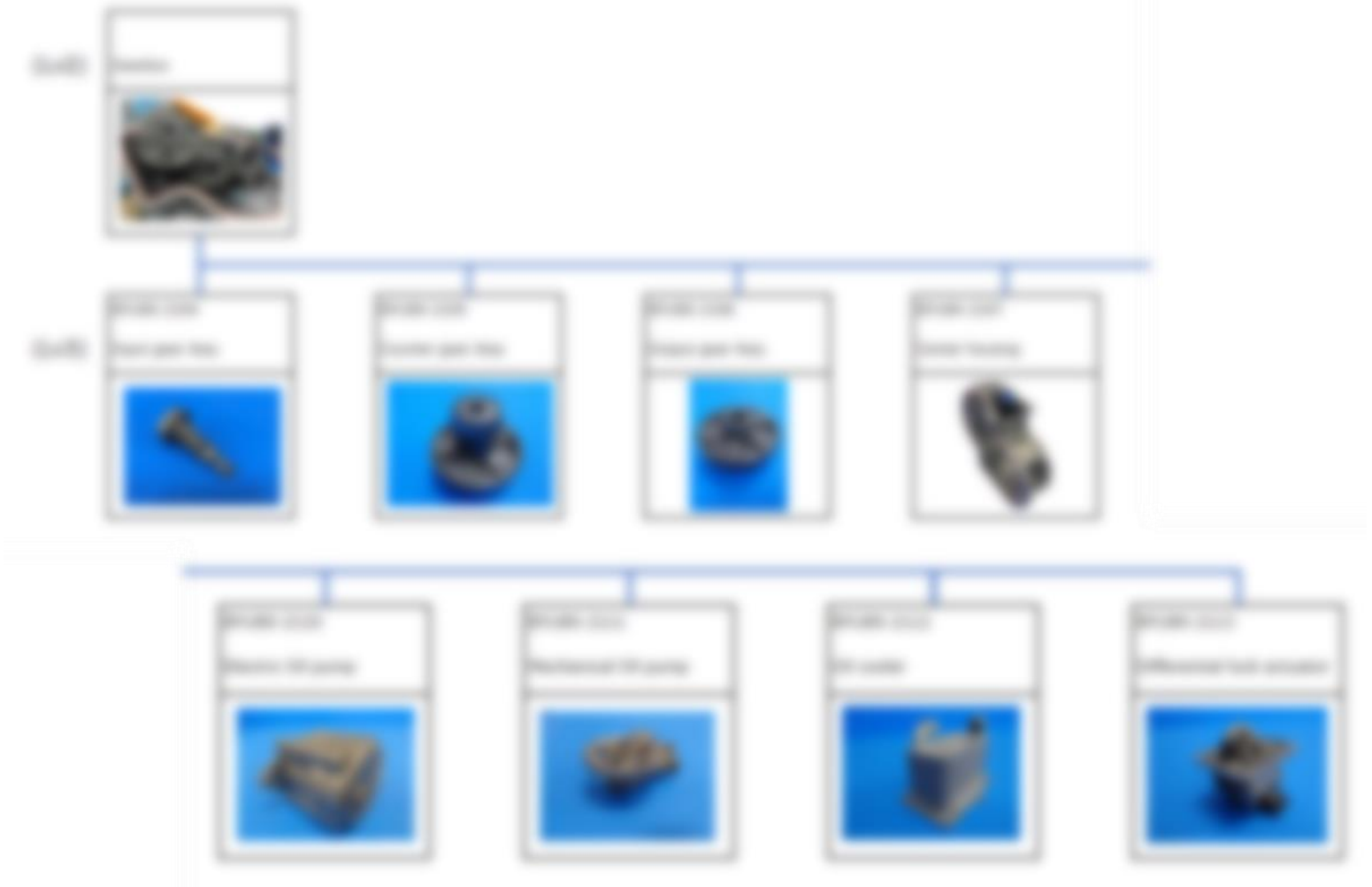


- The four blocks of the rotor core are made of electromagnetic steel sheets with an outer diameter of 140mm and are fastened with eight caulking (H-shaped) points.
- The size of the magnet holes is 15.2mm wide x 4.4mm thick on the outer circumference, and 9.6mm wide x 4.4mm thick on the inner circumference, which are larger than the magnet dimensions.
- The electromagnetic steel sheet is 1.1mm thick, and appears to be formed together with the stator core.

2. e-Axle Structural Analysis

2.4 Reduction Gear Components & Structure

Components of reduction gear (Parts configuration diagram)



2. e-Axle Structural Analysis

2.4 Reduction Gear Components & Structure

- The BYD UK has independent motors and reduction gears for each of the four wheels to enable tank turns, but it has a locking mechanism for the left and right drive shafts (equivalent to a differential lock), and the actuator in the mesh is electrically controlled.
- When the actuator is removed and the moving part is moved with a finger, the moving ring that makes with the inner gear of the RR/R gear moves.
- The actuator is controlled by a motor, bevel gear, and proximity sensor.

3. Motor Cost Analysis

- **The parts subject to the cost estimation are the rear Motor LH (Case, Stator, and Rotor) and Gear (reduction gear). The detailed parts are those within the dashed line in the figure below.**

3. Motor Cost Analysis

Summary table of U8 e-Axle 220kw (RR LH side only)

(JPY/LH)

Expenses	Calculation conditions	Motor	Gear	Total
Material cost (Materials)				
Processing cost				
Direct cost				
Plant management cost				
Development cost				
General management cost				
Profit				
Price				
Dies and jigs cost				
Weight				
Cost per kg				

Excluding tank turn unit

3. Motor Cost Analysis

<Case exploded view>