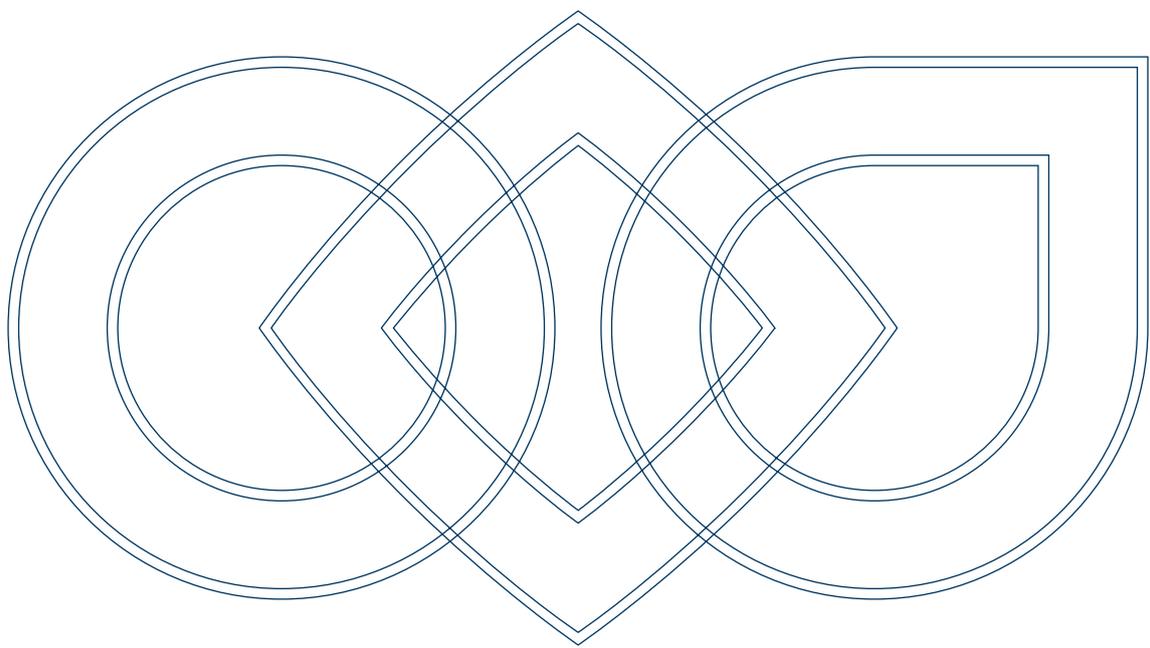




Electromobility Solutions



PRODUCT
RANGE



Product offer

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Electric powertrain solutions

Heavy duty vehicle manufacturers are eagerly seeking improvements in efficiency and are looking for solutions that can increase productivity and reduce the total cost of ownership for the end user. The emission regulations currently applied to the automotive industry is extended to heavy duty vehicles too and the only way to meet these strict standards is to improve powertrain efficiency.

Hydraulic motors conventionally installed on Heavy duty powertrains machines are gradually being replaced by electric motors in order to be more efficient.

Bonfiglioli, thanks to its Bonfiglioli Trasmital product range, began developing and producing powertrains consisting of planetary gearboxes driven by electric and hydraulic motors back in the 1980s. More recently, Bonfiglioli also began investing in the personnel, tools and technology.

Standard products for various applications

Various solutions have been designed

specifically for use with electric motors, and offer a wide range of performance specifications and deliverable torque ratings. The latest products include a series of planetary drives for electric material handling vehicles and planetary drives with integrated electric motors for hybrid agricultural machines. These solutions have been shown to deliver numerous benefits in terms of machine manoeuvrability, reliability, operating costs and sustainability, thanks to low emissions and low working noise levels.

Custom solutions

Wherever a custom solution is required, manufacturers benefit from Bonfiglioli's vast technical expertise. Bonfiglioli works closely with powertrain designers and component suppliers to develop innovative, tailored solutions. Bonfiglioli can draw on years of experience in powertrain design for light and medium duty vehicles, and the concepts and technologies involved are likely to be scaled up to heavy duty applications over the medium term.



Electric solutions for material handling.



600F series

Electric powertrains for material handling trucks.

Bonfiglioli supplies high efficiency, low noise planetary axles and drives with integrated, high performance electric motors and low maintenance braking systems for Class 1 material handling vehicles. Typical applications include 3 and 4 wheel counterbalance lift trucks and ground support equipment. Bonfiglioli electric powertrains are fully tested in the factory and guarantee reduced energy consumption. This, in turn, means longer battery operating times, extended service intervals and a lower total cost of ownership. Bonfiglioli's 600F Series drives are complemented by a range of idle steering systems based on axles or steering units, depending on the number of wheels on the vehicle.

Type	Lift capacity (kg)
601F	2000
602F	3500
603F	5000
605W	9000

Type	Max deliverable torque (Nm)
601F	3000
602F	5500
603F	7000
605W	18000



Applications

- Material handling vehicles (CB forklifts, articulated forklifts, airport equipment)
- Indoor and outdoor use
- CB trucks with lift capacity from 1.6 to 9.0 tons
- GSE vehicles with draw bar pull from 6000 to 25000 kgf
- Vehicle speeds up to 20 km/h

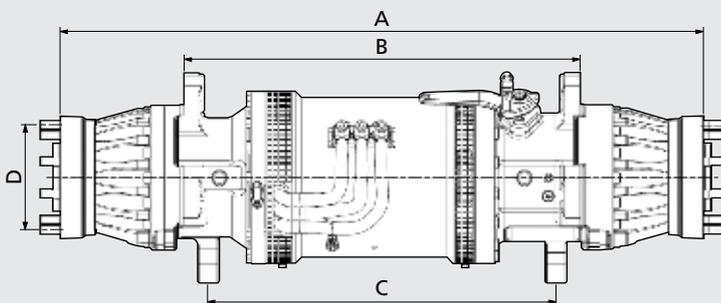
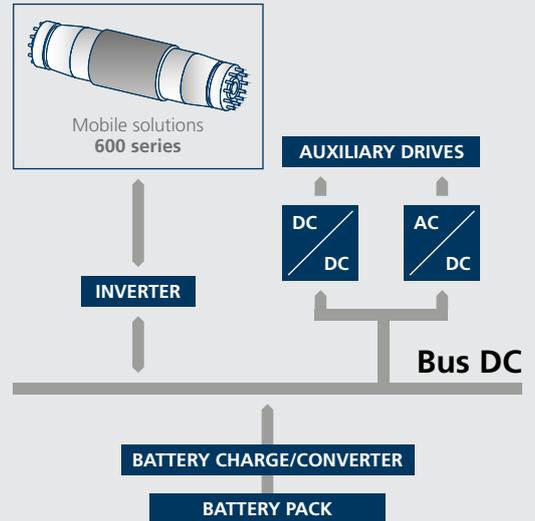
Standard features

- Dual planetary gearbox
- Optimised gear design for maximum efficiency and minimum noise
- Wet disc service brake with low displacement actuation
- Parking brake with mechanical lever actuation
- Integrated, customised mast support
- Integrated AC traction motor in IP20 or IP43 protection ratings
- Integrated, high accuracy, silicon based, KTY temperature sensor
- Integrated, high resolution, Hall effect speed sensor

Optional features available on request

- Spring applied hydraulic release parking brake
- Mechanical disengagement for towing, with no need to remove the wheel and without oil drop

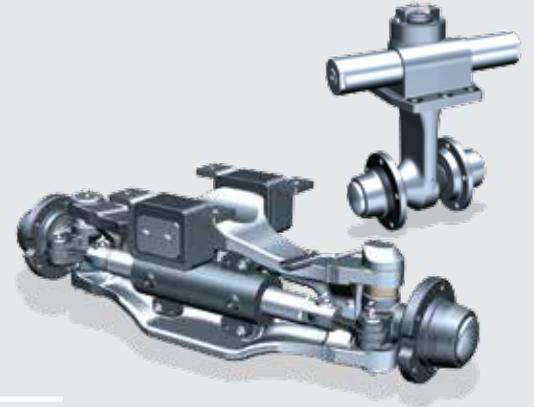
Functional diagram



TYPE	A Flange to flange [mm]	B Frame mounting [mm]	C Mast mounting [mm]	D Wheel stud PCD [mm]
601F	1015	610	630	120
602F	1090	640	600	170
603F	1150	670	620	225
605W	1440	1200	/	275

Max input speed [min ⁻¹]	Rated motor power [kW, S2-60']	Typical wheel size [inches]
5500	2x4.5	18
5500	18	23
4500	26	28
4500	2x14	35

Idle steering solutions for material handling.



600W0C series

Idle steering systems for material handling trucks.

Bonfiglioli has been building idle steering systems for material handling vehicles since decades. These solutions are typically applied in the rear part of 3- and 4-wheel counterbalanced forklifts. They can be axles or steering units for twin wheels. Depending on the steering unit model, anti-vibration parts can be included and they serve as support for fixing brackets.

The steering is realized by means of hydraulics that guarantees a high steering angle, in order to minimize the steering radius of the vehicle and allow the truck to move easily inside narrow aisles.

Depending on customer requests, it is possible to customize main dimensions and other characteristics of the units, like the presence of a potentiometer to read out the steering angle.

Type	CB Truck Lift capacity (kg)
601W0C	2000
602W0C	3000
603W0C	3500



Applications

- Material handling vehicles (forklifts)
- Indoor and outdoor use
- Counterbalanced trucks with lift capacity from 1.0 to 3.5 tons

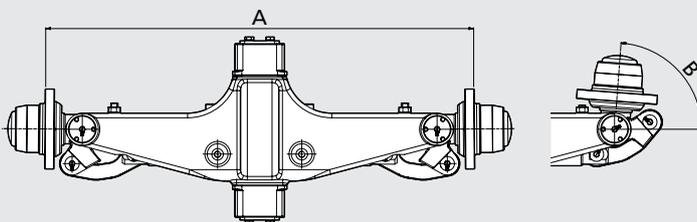
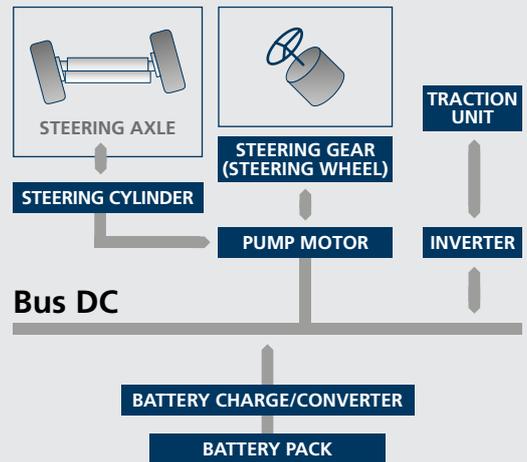
Standard features

- Steering by means of hydraulics
- Optimised design for steering angle

Optional features available on request

- Anti-vibration parts
- Potentiometer for steering angle

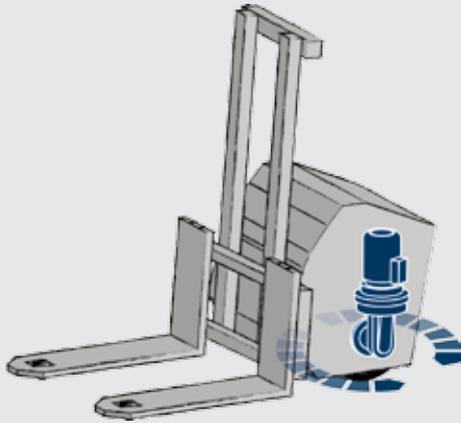
Functional diagram



TYPE	A	B
	Flange distance [mm]	Max steering angle [deg]
601W0C	175	85
602W0C	830	95
603W0C	930	85

Number of wheels
3
4
4

Electric steering solutions for warehouse.



EL series

Electric powertrains for warehousing trucks.

Bonfiglioli EL powertrains have been proved to be fit for the most demanding warehousing application for decades. Warehousing trucks require high manoeuvrability in tight spaces and are therefore demanding drives like EL series, capable of smallest operating radius both in its vertical and horizontal arrangements. Bonfiglioli, thanks to its capabilities, represents a system supplier capable of cooperating with OEM and of supplying all electromechanical components, from the brake, up to the maintenance-free electric motor and to the gearbox, specially designed for low maintenance and optimized gear profiles for noise reduction. All systems are tested at the end of assembly line before they are released for shipment.



Drives with vertical motor

Applications

- Stackers, Reach Trucks, Pallet Movers
- Multidirectional Forklifts, Sideloaders
- Other warehousing / material handling trucks
- Indoor and outdoor use

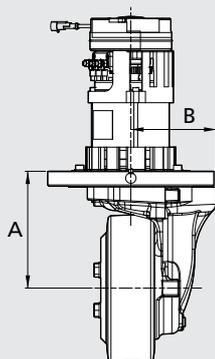
Standard features

- Two stages helical & bevel gearboxes
- Manual Steer and Power Steer versions
- Optimized gear design for efficiency and noise
- Integrated low voltage electric motor
- Integrated parking brake
- Complete system supply with tire/pneumatic

Optional features available on request

- Cold environment versions
- Integrated tiller or castor wheels supports

Type	Max wheel torque (Nm)	Max wheel load (kg)
EL100	450	1200
EL96	500	1500
EL300	1100	2200
EL92	1500	3000
EL93	1500	3000
EL94	1500	3000



TYPE	Max wheel dim.	Max ratio	Max power	A	B
	[inc]	[i]	[kW]	[mm]	[mm]
EL100	9"	32	2	184	134.5
EL96	10"	24	3	215	147
EL300	12"	24	4.5	249	175
EL92	14"	24	7	277	187
EL93	16"	25	7	304	187
EL94	18"	25	7	325	187

Drives with horizontal motor

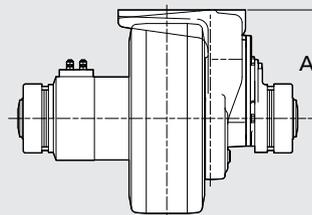
Applications

- Pallet Movers
- Sweepers
- Other warehousing / material handling trucks
- Indoor and outdoor use

Standard features

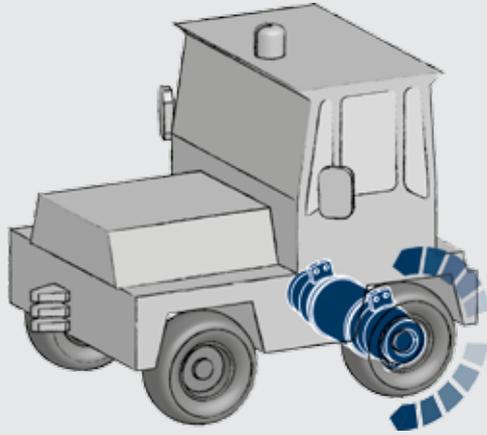
- Optimized gear design for efficiency and noise
- Integrated low voltage electric motor
- Integrated parking brake
- Complete system supply with tire/pneumatic

Type	Max wheel torque (Nm)	Max wheel load (kg)
EL98	600	800
EL20	550	1100
EL14	400	1000
EL140	850	2000
EL150	850	2000



TYPE	Max wheel dim.	Max ratio	Max power	Envelope radius	A
	[inc]	[i]	[kW]	[mm]	[mm]
EL98	10"	32	0.5	134	141
EL20	10"	27	2	302	150
EL14	10"	34	0.85	238	170
EL140	12"	29.3	2	177	164
EL150	14"	29.3	2	183	200

Electric solutions for Airport Equipment.



600 series

Powertrains for electric vehicles used at airports.

Bonfiglioli supplies high efficiency, low noise axles with integrated, high performance electric motors and low maintenance braking systems for ground support equipment (Industrial Trucks Class VI, electric type) and other material handling electric machinery used at airports. Bonfiglioli electric axles are fully tested in the factory. All drives guarantee reduced energy consumption, this means longer battery operating times, extended service intervals and a lower total cost of ownership.

Type	Max deliverable torque (Nm)
600D	1000
602WE	3500
602F	5500
605WE	8500



Applications

Electric vehicles for internal use at airport:

- Luggage trolley collection
- Other utility vehicle (police, passenger transport)

Electric vehicles for external use at airport:

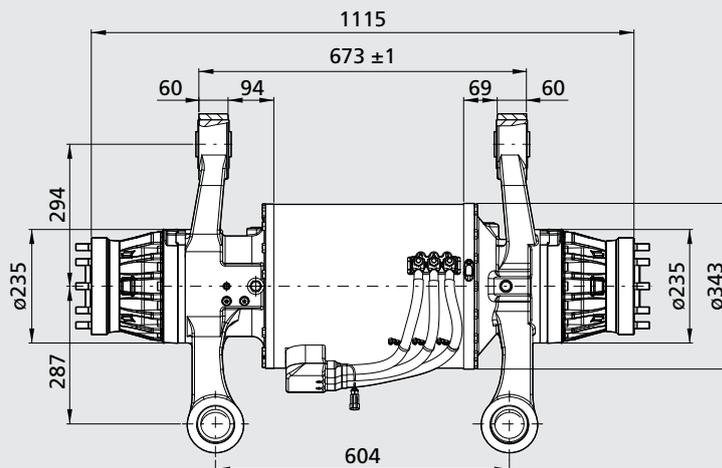
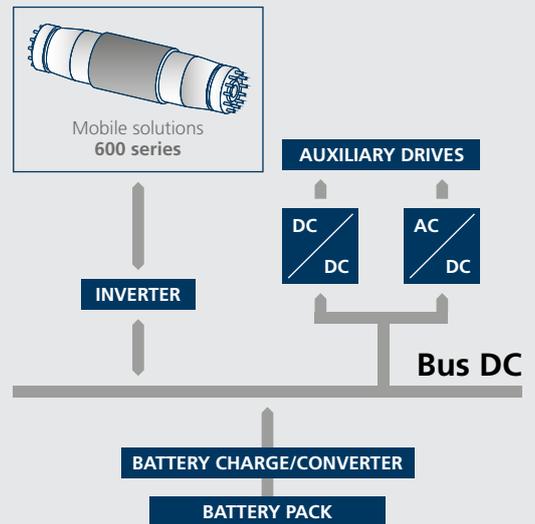
- Towing tractors for baggage carts, container dollies
- Passengers fingers

Other utility vehicles (refilling, power units)

Standard features

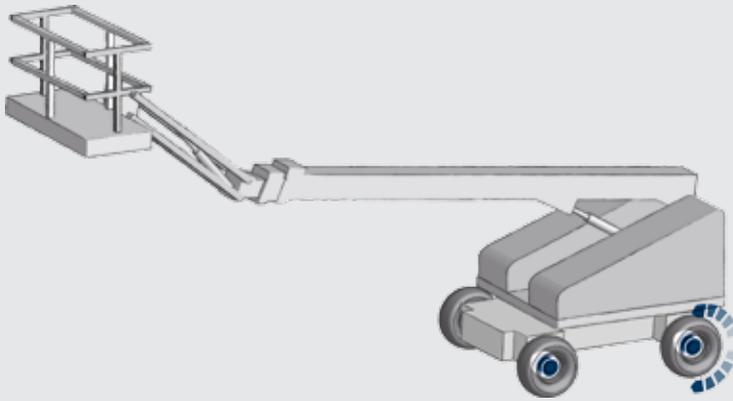
- Output torque from 1000 to 8500 Nm
- Draw bar pull from 5 to 40 kN
- Vehicle speeds up to 20 km/h
- Optimised gear design for maximum efficiency and minimum noise
- Parking and/or service brake depending on configuration
- Integrated AC traction motor with different protection ratings
- Low voltage electric motors with inverter control

Functional diagram



TYPE	Max draw bar pull force	Rated motor power	Number and type of drive
	[kN]	[kW, S2-60']	
600D	5 ... 8	5.5	1 axle
602WE	10 ... 17	2x 5.5	2 wheel drives
602F	20 ... 30	25	1 axle
605WE	30 ... 40	2x 15	2 wheel drives

Electric solutions for lightweight industrial machinery.



600 series

Electric powertrains for lightweight industrial machinery.

Bonfiglioli's 600 planetary drives incorporate an integrated, maintenance-free electric motor and offer significant benefits in terms of compact dimensions, low noise and high efficiency. 600 Series drives are designed for use with all kinds of aerial platforms and other kinds of industrial machinery, for indoor and outdoor use. This advanced powertrain solution uses a two or three stage gearbox offering reduction ratios of up to 1:95 to satisfy the widest possible range of needs. The gearbox is coupled to a low voltage induction motor (BT Series) specially developed for traction power and control applications.

Type	Max deliverable torque (Nm)
600WE	900
601RE	3000
602RE	3500
602WE	4500
604WE	7000
605WE	10000

Type	Rated motor data
	[kW, S2-60']
600WE	0.9 ... 3.4
601RE	2.5 ... 4.3
602RE	3.4 ... 5.4
602WE	3.4 ... 5.4
604WE	4.3 ... 6.2
605WE	5.4 ... 9.1



Applications

- Aerial platforms (vertical, scissor, articulated or telescopic)
- Industrial equipment (airport, sweepers, modular trailers)
- Light construction equipment
- Indoor and outdoor use

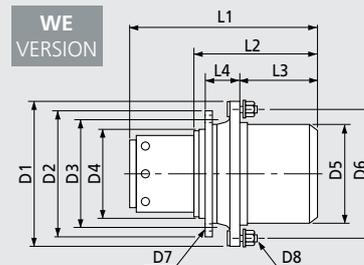
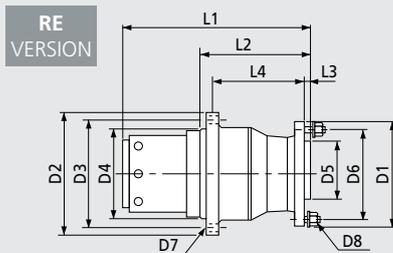
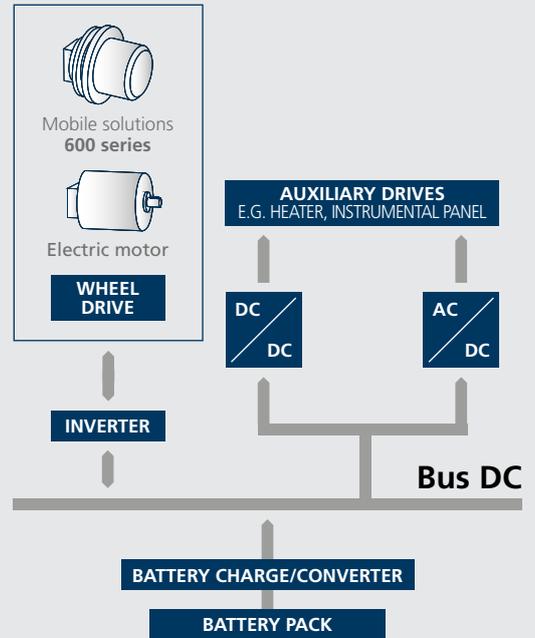
Standard features

- Two or three stage planetary drive with reduction ratios of up to 1:95
- Optimised gear design for maximum efficiency and minimum noise
- Integrated, low voltage, 3 phase induction motor with inverter
- Integrated, high accuracy, KTY temperature sensor
- Integrated, high resolution, Hall effect speed sensor

Optional features available on request

- Speed sensor-bearing
- Other types of temperature sensor
- Mechanical disengagement for towing, with no need to remove the wheel and without oil drop
- Parking brake (spring applied with hydraulic or electromagnetic release)

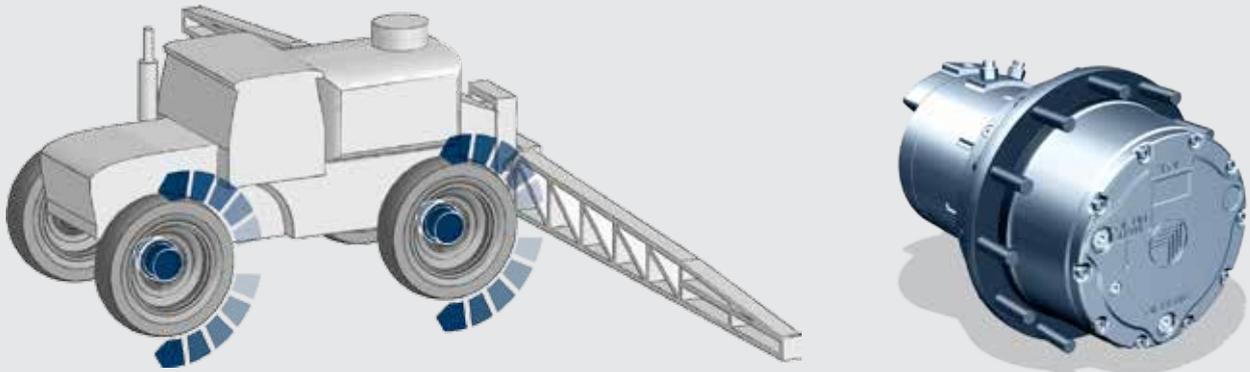
Functional diagram



TYPE	L1						L2	L3	L4	D1	D2	D3	D4	D5	D6	D7	D8
600WE	275	325	375	290	340	390											
601RE					453	503	412	462									
602RE						524	434	484	534								
602WE						455	375	425	475								
604WE							464	514	446	496							
605WE							524	456	506	556							

	BT 135-			BT 150-			BT 170-			BT 200-		
	50	100	150	50	100	150	50	100	150	50	100	150
P _n (S2 60') (kW)	0.9	1.6	2.3	1.5	2.5	3.4	2.4	4.3	5.4	3.1	6.2	9.1
T _n (Nm)	3	5.6	8.5	4.8	9.1	12.5	7.7	14	22	10	20	29.5
V _{batt} (V)	24	24	24	24	24	24	48	48	48	80	80	80
I _n (A)	55	95	128	80	130	175	67	110	143	53	98	137
n (rpm)	2930	2927	2632	2894	2617	2610	2945	2952	2357	2957	2963	2958
cosφ	0.77	0.8	0.81	0.85	0.86	0.87	0.77	0.83	0.8	0.77	0.8	0.84
η (%)	86.9	89.5	90.0	85.5	88.7	89.2	88.3	89.6	91.3	88.8	91.6	92.5

Electric powertrains for off-highway hybrid machinery.



600W series with BPD® electric motor

Electric powertrains for off-highway hybrid machinery.

Bonfiglioli's 600W planetary wheel drives can be coupled to a high power density electric motor, instead of conventional hydraulic. This complete mechatronic solution is designed for a high voltage hybrid powertrain system and was originally conceived for use on self propelled crop sprayers. It can, however, also be applied to other types of new generation off highway machinery for use in industrial and construction sectors.

Using this solution can deliver many advantages and assure interesting benefits both to the machine manufacturer and to the end user. Thanks to the compact dimensions, the technology development phase is faster because it is easier to convert a off-highway equipment from traditional into a innovative hybrid electric one.

Type	Max deliverable torque (Nm)
606 W	12000
607 W	17000
609 W	23000
610 W	36000
611 W	42000



Applications

Hybrid-electric wheeled off highway machinery:

- construction sector (bucket loaders, road building equipment, etc)
- agriculture sector (sprayers, trailed or self propelled harvesters, etc)
- industrial/material handling field (forwarders, aerial lifts, mobile cranes, etc)

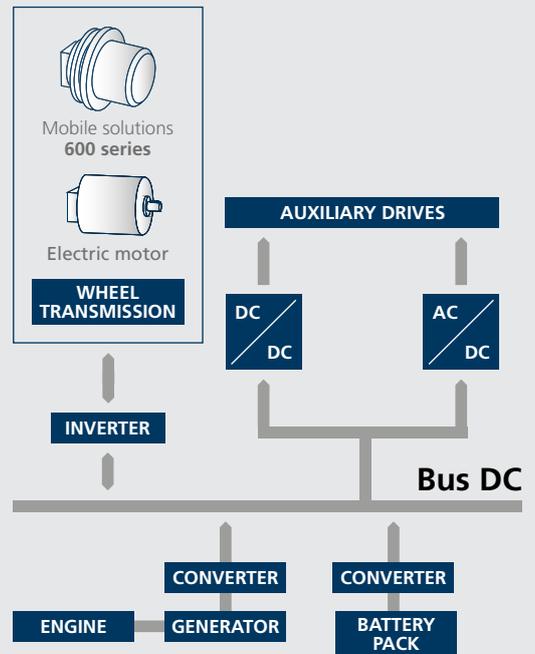
Advantages for OEM

- Possibility of downsizing and downspeeding of the combustion engines
- Ease of installation: electric solution dimensions comparable to standard hydrostatics
- Higher system reliability: fewer mechanical parts
- Virtually maintenance-free electric motors
- From wheel bolt to electric wire with only one supplier

Advantages for final user

- Reduction of fuel consumption
- Increase of productivity
- Better machine manoeuvrability
- Electric solution is cleaner: lower danger of oil spills

Functional diagram



Motor data

Technology

BPD® Hairpin Stator Winding

DC bus operating voltage

400 - 700 V_{DC}

Max power output

25 - 85 kW

Max torque output

200 - 400 Nm

Max operating speed

8000 rpm

Max efficiency

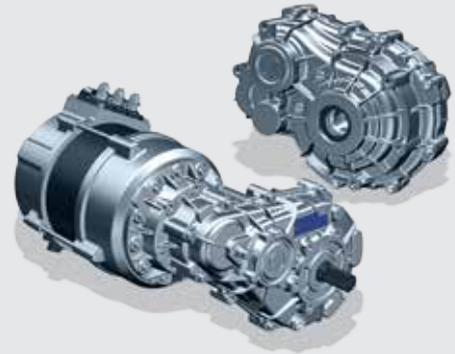
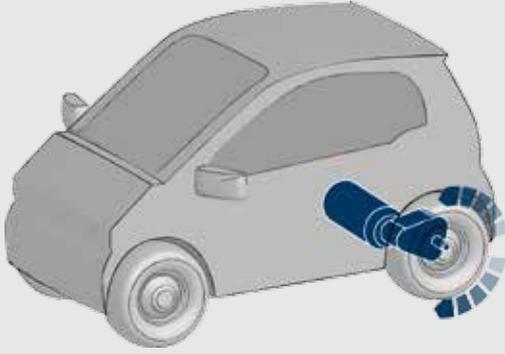
95.6 %

Cooling

PGW 50/50 or oil



Electric solutions for lightweight vehicles.



600D series

Electric powertrains for lightweight vehicles.

Bonfiglioli supplies versatile, low noise drives coupled to electric motors for all-electric, battery powered vehicles like urban passenger cars, commercial vehicles and delivery trucks. This solution ensures more energy-efficient operation and extended autonomy from the battery thanks to optimised, low backlash helical gears and high speed bearings. Bonfiglioli's 600D Series of drives is extremely lightweight thanks to cast aluminium casings developed using all of Bonfiglioli's vast process expertise. 600D drives allow vehicle manufacturers to satisfy even the toughest restrictions on gross vehicle weight. They are complemented by a range of electric motors, inverters and matched mechanical joints and shafts to provide vehicle OEMs with complete powertrain solutions.

Type	Max deliverable torque (Nm)
600D	1000
601D	1500
602D	3000



Applications

- Light duty, lightweight, battery powered vehicles
- Passenger transport and/or commercial deliveries
- Urban or suburban use
- Vehicle weights from 700 to 3500 kg
- Vehicle speeds up to 100 km/h
- Battery autonomy from 100 to over 200 km

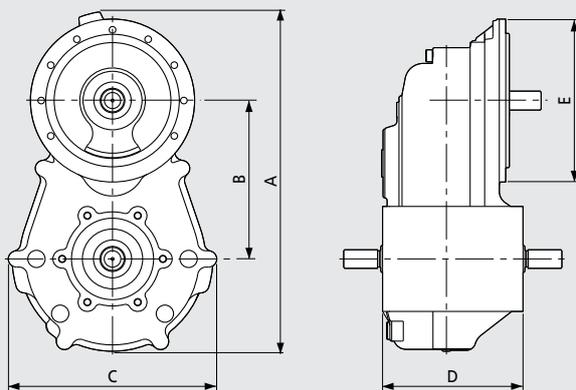
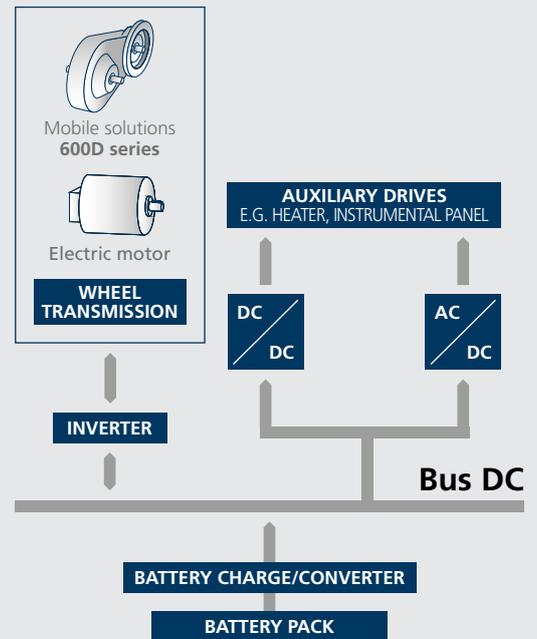
Standard features

- Multi-stage, parallel shaft gearbox with reduction ratios of up to 1:15
- Optimised gear design for maximum efficiency and minimum noise
- Integrated mechanical differential
- Lightweight cast aluminium housing
- Versatile gearbox installation in the chassis
- Low voltage electric traction motor with inverter control

Optional features available on request

- Integrated mechanical parking brake
- Integrated, high resolution, Hall effect speed sensor
- Matched mechanical joints and shafts
- Matched electric motors and inverters

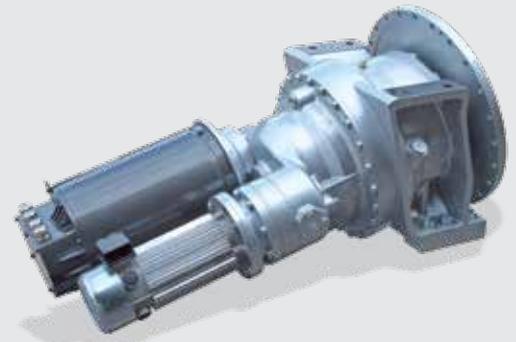
Functional diagram



TYPE	A	B	C	D	E
	[mm]	[mm]	[mm]	[mm]	[mm]
600D	375	175	229	154	180
601D	445	175	235	190	205
602D	462	175	314	224	252

Rated motor power	Vehicle weight
[kW, S2-60']	[kg]
5 ... 20	700 ... 1250
20 ... 30	205
30 ... 45	1800 ... 3500

Electric solutions for concrete mixers.



500 series drum drive with electric motor

Solutions for hybrid concrete mixers.

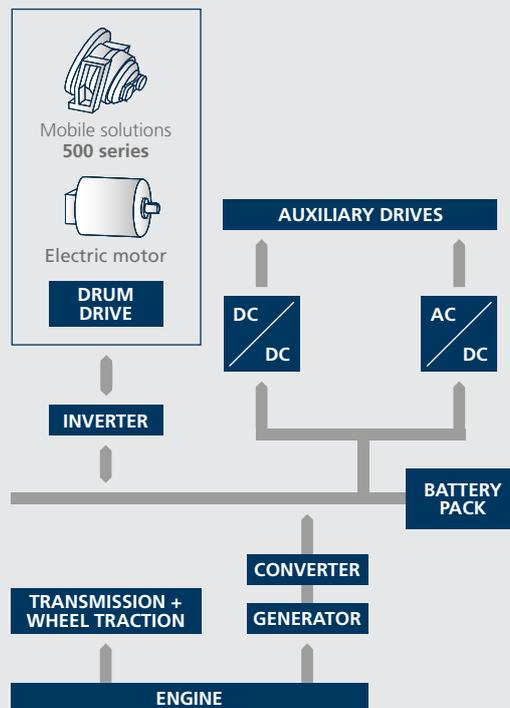
This solution is designed for use with medium/large mixer trucks that have medium/long delivery distances to travel. Drum rotation speed is between 15 and 22 rpm and capacity between 6 and 14 m³. Bonfiglioli innovative solution comprises a gearbox of Bonfiglioli's historical 500 Series coupled to an AC electric motor that provides normal power and a DC electric motor for emergency use. This solution not only guarantees greater energy efficiency and reduced fuel consumption, but also helps cut cement mixer truck operating costs (for example by extending service intervals and making servicing simpler than on hydraulic drive solutions). Performance is improved too: rotation speed control is more accurate, operating noise levels are significantly lower (thanks to the electric motor and the helical tooth profile of the high speed gearbox stage). Finally, functionality remains higher in the event of a failure: the presence of a second, backup DC motor gives reassuring redundancy and eliminates the risks and potentially hazardous situations caused by failures of the drum emptying system (if the drum cannot rotate, the cement can solidify and put the mixer truck out of action).



Main benefits

- Increased Energy Efficiency
- Reduced fuel consumption
- Service intervals less frequent and simplified vs the standard hydraulic solution
- Better drum rotation speed control
- Optimised gear design for maximum efficiency and minimum noise
- The emergency electric DC motor allows a higher availability in case of machine failure

Functional diagram



Solution main features

Gearbox data

Ratio

Main: 1:220

Emergency: 1:2200

Max output torque

Main: 60000 Nm

Emergency: 10500 Nm

Max input speed

Main: 3500 rpm

Emergency: 2000 rpm

Oil quantity

8 lt

Dry weight

328 kg

Motor data

Type

Main: Induction AC

Emergency: PM DC motor

Rated Power

Main: 40 kW

Emergency: 2 kW

Voltage

Main: 170 Vac

Emergency: 24 Vdc

Protection degree

IP66

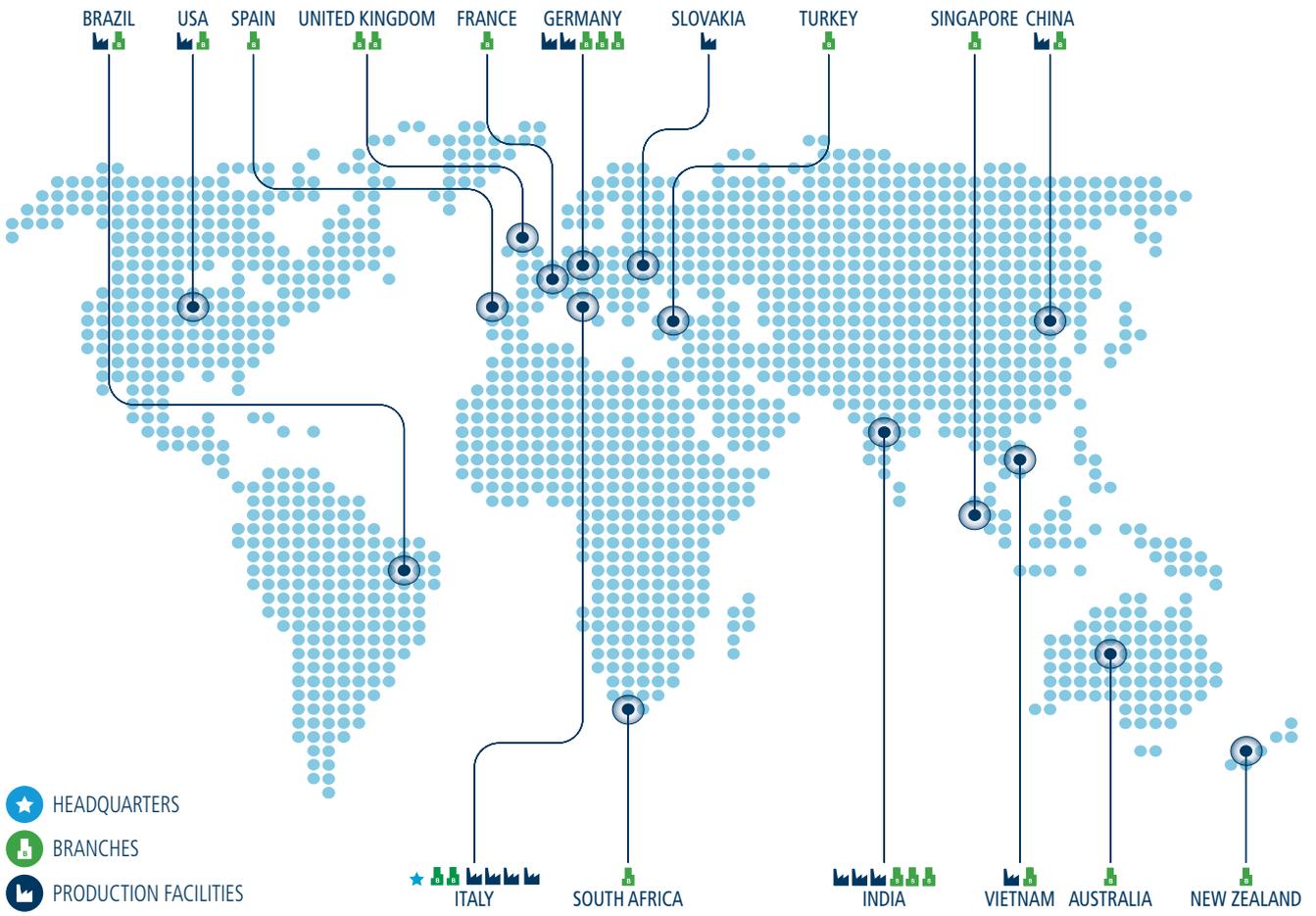
Cooling

Main: Liquid

Emergency: Air forced

Bonfiglioli worldwide presence

Bonfiglioli is located in regions and countries around the world that enable us to provide faster sales and service to customers.
We are around the world, and around the corner.



LOCAL SUPPORT
 Sales, Customer Service,
 Warranty, Tech support,
 Spare parts



**21 BRANCH OFFICES
 IN 15 COUNTRIES**



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