Wheatstone

Wheatstone underwater Motors



Motors can be customized to meet customer requirements

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Wheatstone

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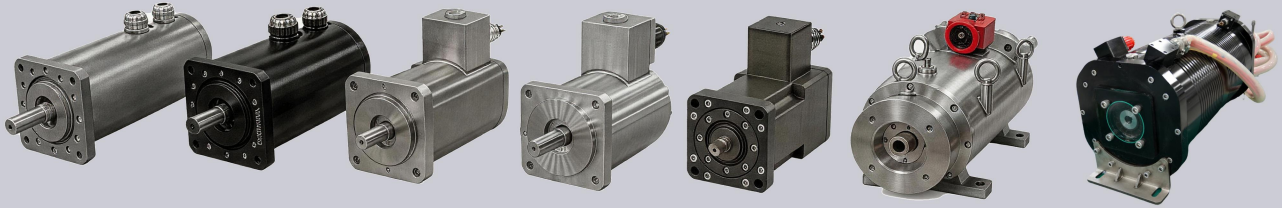
04 Underwater Motor Application Cases

01

Nomenclature and Classification of Underwater / underwater Motors

1. Naming by Motor Application Scenario

2. Naming of Induction Motor Series



Wheatstone Underwater underwater Motor Nomenclature

H1-L1 -F1 -Z1 -S1
1 2 3 4

No.	Item	Detailed Description
4	underwater Resistance Depth	S1 = dry sealed type (depth 0–20 m) S2 = dry oil-filled combination (depth 20–200 m) S3A = stator potted pressure-resistant type (depth 20–200 m) S3B = stator potted pressure-resistant type (depth >1000 m) S4A = oil-filled type (depth within 1000 m) S4B = oil-filled type (depth >1000 m) (Customizable upon request)

Wheatstone Underwater / underwater Motor Nomenclature — Induction Motor Series

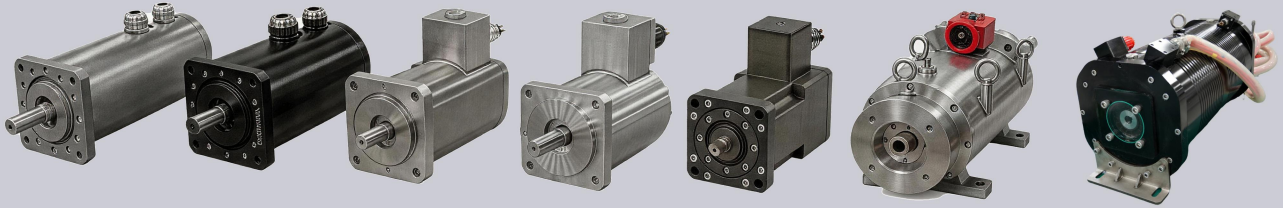
Wheatstone

Y 254 -310 -2P 1450 -(20KW) -XXV -B - F/SS
1 2 3 4 5 6 7 8 9

No.	Item	Detailed Description
1	Product Code	Y: squirrel-cage rotor induction motor YVP: variable-frequency speed-regulating induction motor YR: wound-rotor induction motor YD: pole-changing multi-speed induction motor YB: flameproof induction motor YZD: crane induction motor YT: axial-flow fan induction motor
2	Frame Size	Frame size: indicated by housing dimensions; e.g. an outer diameter of 254 mm is marked as 254
3	Stator Core Length	e.g. a core length of 310 mm is marked as 310
4	Number of Poles	e.g. a 4-pole motor is marked as 2P
5	Speed	Indicates rated motor speed, in rpm
6	Motor Power (kW)	Rated motor power: e.g. 20 kW is marked as 20
7	Voltage	220 V / 380 V / 660 V / 1140 V / 3000 V (voltage customizable upon request)
8	Brake	With brake is marked as B; without brake is omitted
9	Motor Type	F = radiation resistant SS = deep water

02

Underwater / underwater Motor Testing Equipment



Type Testing Laboratory

Wheatstone



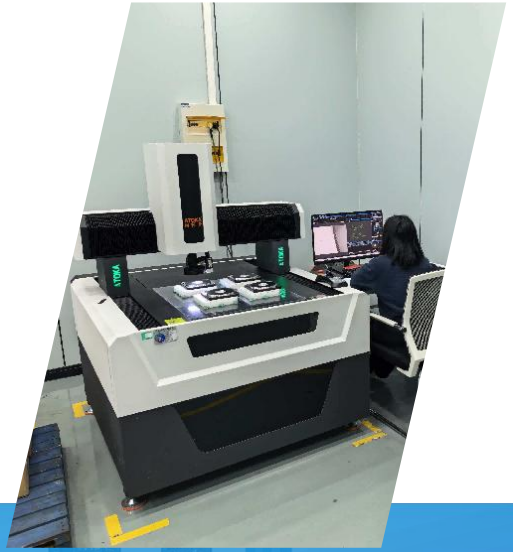
Type Testing Laboratory

High/low temperature operation and storage, temperature shock, constant and alternating damp heat, low air pressure (25 kPa), temperature cycling + random vibration, and bulk road transportation. Fully covering the requirements of GB/T 28046.3, GJB 150A and other standards, it verifies structural integrity, insulation reliability and functional stability under multi-stress coupling such as extreme temperature and humidity, high-altitude low pressure, mechanical vibration and long-distance transportation.

Type Testing Laboratory Equipment



High/Low Temperature Alternating Damp Heat Test Chamber



Fully Automatic Gantry Image Flash Measuring Instrument



9K Rain Spray Test Chamber



Salt Spray Tester



Motor Performance Test System



Electrodynamic Vibration Test Bench



Cable Bending Machine

Company Testing Equipment



Loaded Performance Test System



High-Pressure underwater Motor Test Chamber



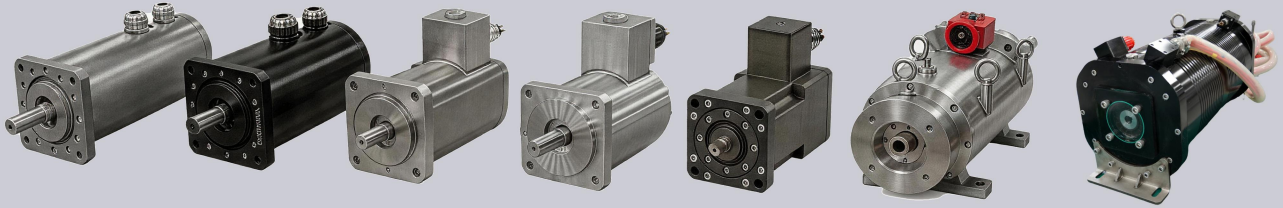
Ultrasonic Flaw Detector



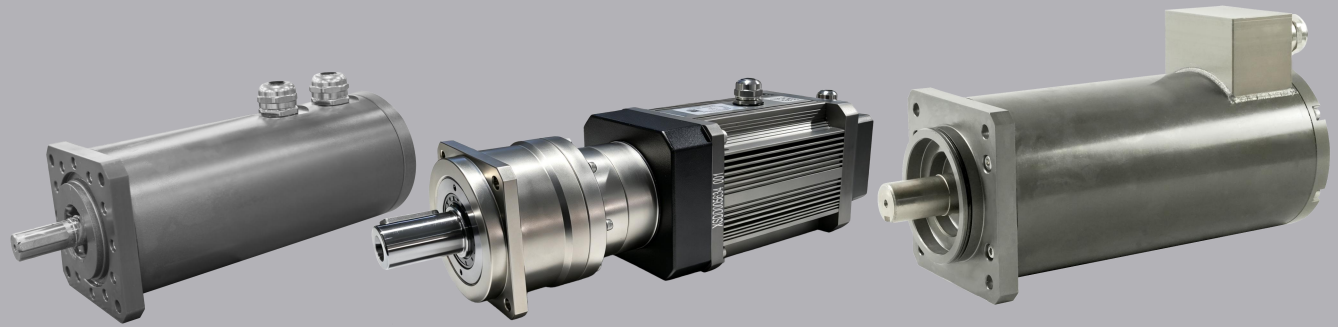
Burst Test Machine

03

Underwater / underwater Motor Products



03-1 Dry Sealed Motor (Depth 0–20 m)



WHEATSTONE DEEP-WATER MOTOR SERIES

DRY-TYPE SEALED MOTOR

SUITABLE FOR USE AT A DEPTH OF 1 M UNDERWATER

Customization available upon request

Rated power:	0.5–60 kW
Rated speed:	1000–3000 RPM
Rated torque:	0.5–300 N·m
Rated voltage:	24–380 V
Depth:	1 m

IP67 IP68 IP69K



Dry Sealed Type — 1 m Underwater









Item	Motor Parameters
Motor Model	80ST-J02430-S1
Rated Torque	2.4NM
Rated Speed	3000RPM
Rated Voltage	AC220V
Motor Pressure Resistance	Withstands water pressure at 1 m depth
Insulation Class	F 155°C
Rated Current	3.6A

Dry Sealed Type — 20 m Underwater

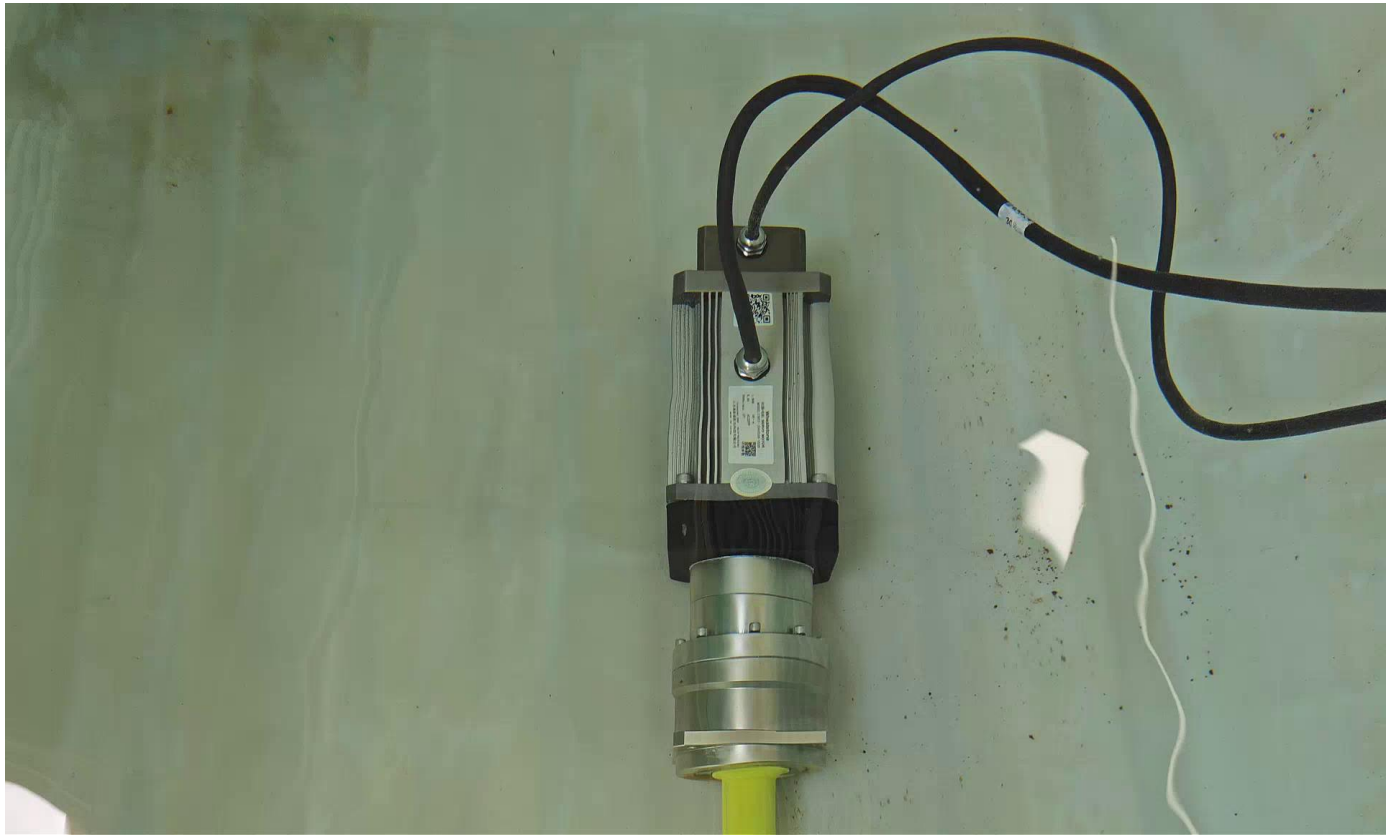




Item	Motor Parameters
Motor Model	130ST-J06030B-SS20 (with gearbox)
Rated Torque	6NM
Rated Speed	3000RPM
Rated Voltage	AC220V
Pressure Resistance Rating	0.2MPa
Insulation Class	F 155°C
Rated Current	8.4A

Underwater Testing of Dry Sealed Motor

Wheatstone

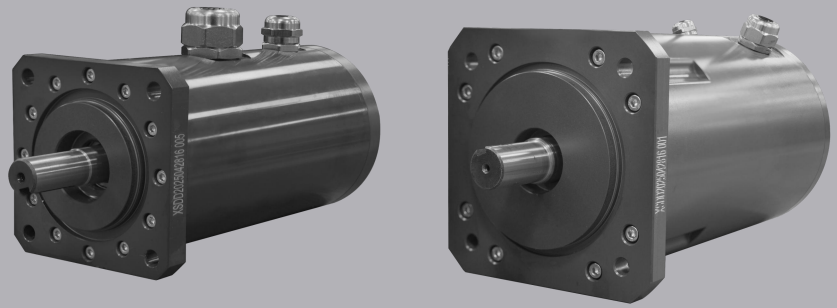


Dry Sealed Type — 10 m Underwater



Item	Motor Parameters
Motor Model	90ST-X02024-48V-S10-F60
Rated Torque	2N.m
Rated Speed	2400rpm
Rated Voltage	DC48V
Motor Pressure Resistance	Withstands water pressure at 10 m depth
Insulation Class	H 180℃
Reduction Ratio	1:60
Rated Current	13A

03-2 Dry Oil-Filled Motor (Depth20–200 m)



WHEATSTONE DEEP-WATER MOTOR SERIES

SUITABLE FOR USE AT A DEPTH OF 50 M UNDERWATER

Customization available upon request

Rated power:	0.5–60 kW
Rated speed:	1000–3000 RPM
Rated torque:	0.5–300 N·m
Rated voltage:	24–380 V
Depth:	50 m

IP67 **IP68** **IP69K**



Dry Sealed Oil-Filled Type — 50 m Underwater



80ST-X00630B-SS



80ST-X02415B-SS

Motor Model	L(mm)
80ST-X00630B-SS	160
80ST-X02415B-SS	200

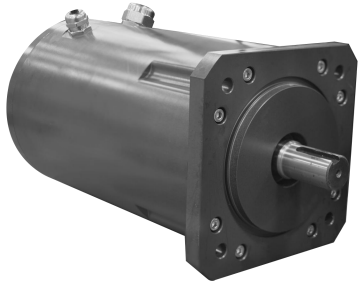
Item	Motor Parameters
Motor Model	80ST-X00630B-SS/ 80ST-X02415B-SS
Rated Torque	0.6NM/2.4NM
Rated Speed	3000RPM/1500RPM
Rated Voltage	AC220V
Motor Pressure Resistance	Withstands water pressure at 50 m depth
Insulation Class	F 155°C
Rated Current	2.4A/2.3A

Dry Sealed Oil-Filled Type — 50 m Underwater









Motor Model	L(mm)
130ST-X06030B-SS	235.5

Item	Motor Parameters
Motor Model	130ST-X06030B-SS
Rated Torque	6NM
Rated Speed	3000RPM
Rated Voltage	AC220V
Motor Pressure Resistance	Withstands water pressure at 50 m depth
Insulation Class	F 155°C
Rated Current	7.3A

03-3 Stator Potted Pressure-Resistant Motor

S3A: Stator potted pressure-resistant type (depth within 1000 m)
S3B: Stator potted pressure-resistant type (depth >1000 m)





Oil-Filled Type — 600 m Underwater



Item	Motor Parameters
Motor Model	90ST-H09030-100V-SS600
Rated Torque	9NM
Rated Speed	3000RPM
Rated Voltage	DC100V
Pressure Resistance Rating	6MPa
Insulation Class	H 180℃
Rated Current	64A

Wheatstone
JIANGSU WHEATSTONE

LIGHTWEIGHT PRESSURE-RESISTANT AC SERVO MOTOR

Application: Underwater Exploration Robot

MOTOR FEATURES:

- **INSULATION DESIGN:** Special insulation materials and structures protect internal electrical components from breakdown or leakage under high pressure.
- **PRESSURE RESISTANCE:** Withstands pressure up to 22.5 MPa and operates safely in an oil-filled environment.
- **SAFE AND RELIABLE:** Rigorous design and testing ensure stable operation under high pressure, protecting equipment and personnel.
- **HIGH ADAPTABILITY:** Suitable for high-pressure applications; voltage and power can be customized for specific requirements.

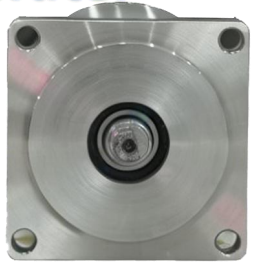


MOTOR SPECIFICATIONS:

MODEL: 60ST-H00625-300V-NY						
Rated Power	Rated Voltage	Rated Current	Rated Speed	Rated Load	Protection Rating	Operating Temperature
150 W	300 V	0.65 A	2500 RPM	0.6 N·m	IP65	−10°C to 50°C

Oil-Filled Type — 2250 m Underwater





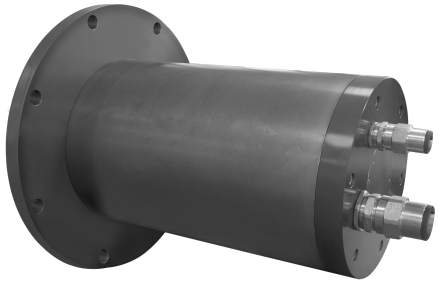




Item	Motor Parameters
Motor Model	60ST-H00625-300V-NY
Rated Torque	0.6NM
Rated Speed	2500RPM
Rated Voltage	DC300V
Pressure Resistance Rating	22.5MPa
Insulation Class	H 180℃
Rated Current	0.65A

Stator Potted Pressure-Resistant Type — 3000 m Underwater

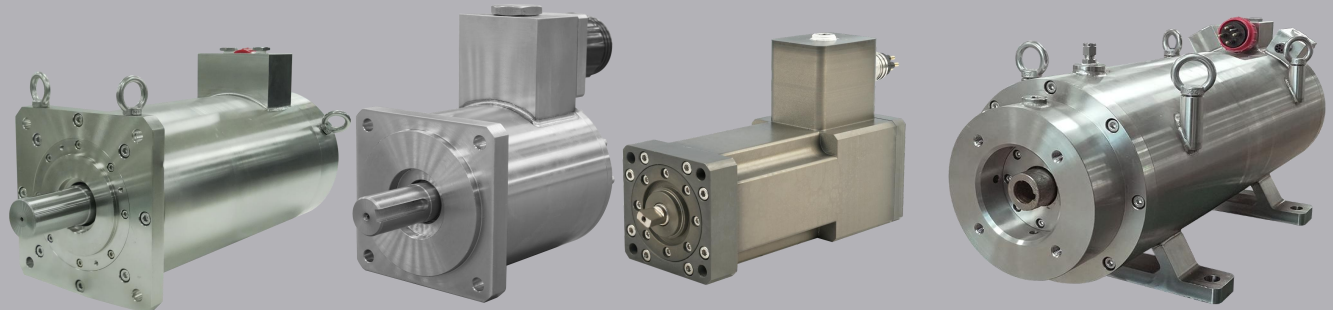




Item	Motor Parameters
Motor Model	230ST-X48030-196V-NY
Rated Torque	48N.m
Rated Speed	3000rpm
Rated Voltage	DC196V
Motor Pressure Resistance	0-10MPa
Insulation Class	F 155°C
Protection Rating	IP56

04-4 Oil-Filled Motor

S4A: Oil-filled type (depth within 1000 m)
S4B: Oil-filled type (depth >1000 m)



Oil-Filled Type — 200 m Underwater









Item	Motor Parameters
Motor Model	180ST-X32030-380V-SS200-A0D12
Rated Torque	32NM
Rated Speed	3000RPM
Rated Voltage	AC380V
Pressure Resistance Rating	Withstands 2 MPa water pressure
Insulation Class	H 180℃
Rated Current	24A

WHEATSTONE DEEP-WATER MOTOR SERIES

SUITABLE FOR USE AT A DEPTH OF 450 M UNDERWATER

Customization available upon request

Rated power:	0.5–60 kW
Rated speed:	1000–3000 RPM
Rated torque:	0.5–300 N·m
Rated voltage:	24–380 V
Depth:	450 m

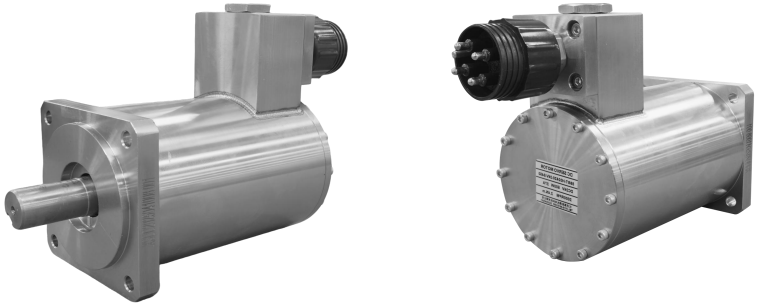
IP67 **IP68** **IP69K**



Oil-Filled Type — 450 m Underwater



86ST-H01630-24V-S450



86ST-H02420-24V-S450

Motor Model	L(mm)
86ST-H01630-24V-S450	99
86ST-H02420-24V-S450	129

Item	Motor Parameters
Motor Model	86ST-H01630-24V-S450 86ST-H02420-24V-S450
Rated Torque	1.6NM/2.4NM
Rated Speed	3000RPM/2000RPM
Rated Voltage	DC24V
Motor Pressure Resistance	Withstands 4.5 MPa
Insulation Class	F 155°C
Rated Current	24.5A/27A

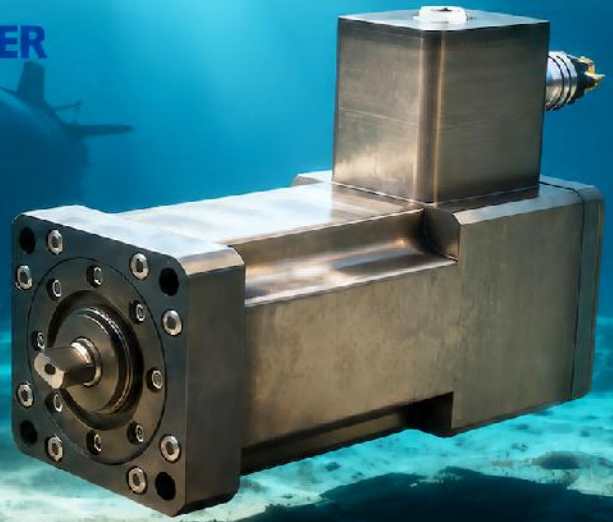
WHEATSTONE DEEP-WATER MOTOR SERIES

SUITABLE FOR USE AT A DEPTH OF 650 M UNDERWATER

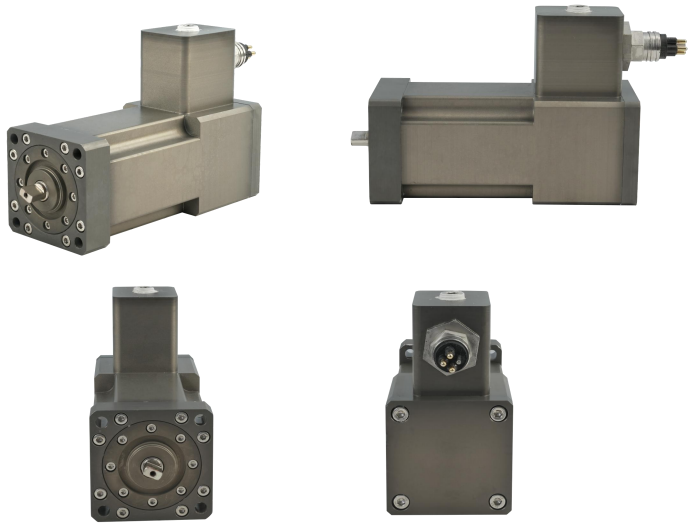
Customization available upon request

Rated power:	0.5–60 kW
Rated speed:	1000–3000 RPM
Rated torque:	0.5–300 N·m
Rated voltage:	24–380 V
Depth:	650 m

IP67 IP68 IP69K



Oil-Filled Type — 650m Underwater



Motor Model	L(mm)
60ST-H00630-48V-650	152

Item	Motor Parameters
Motor Model	60ST-H00630-48V-650
Rated Torque	0.6NM
Rated Speed	3000RPM
Rated Voltage	DC48V
Motor Pressure Resistance	Withstands 6.5 MPa
Insulation Class	F 155°C
Rated Current	6A

Operating environment: 650 m seawater depth; airborne noise < 50 dBA

WHEATSTONE DEEP-WATER MOTOR SERIES

SUITABLE FOR USE AT A DEPTH OF 850 M UNDERWATER

Customization available upon request

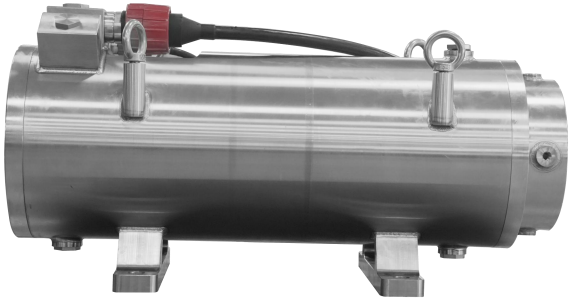
Rated power:	0.5–60 kW
Rated speed:	1000–3000 RPM
Rated torque:	0.5–300 N·m
Rated voltage:	24–380 V
Depth:	850 m

IP67 IP68 IP69K



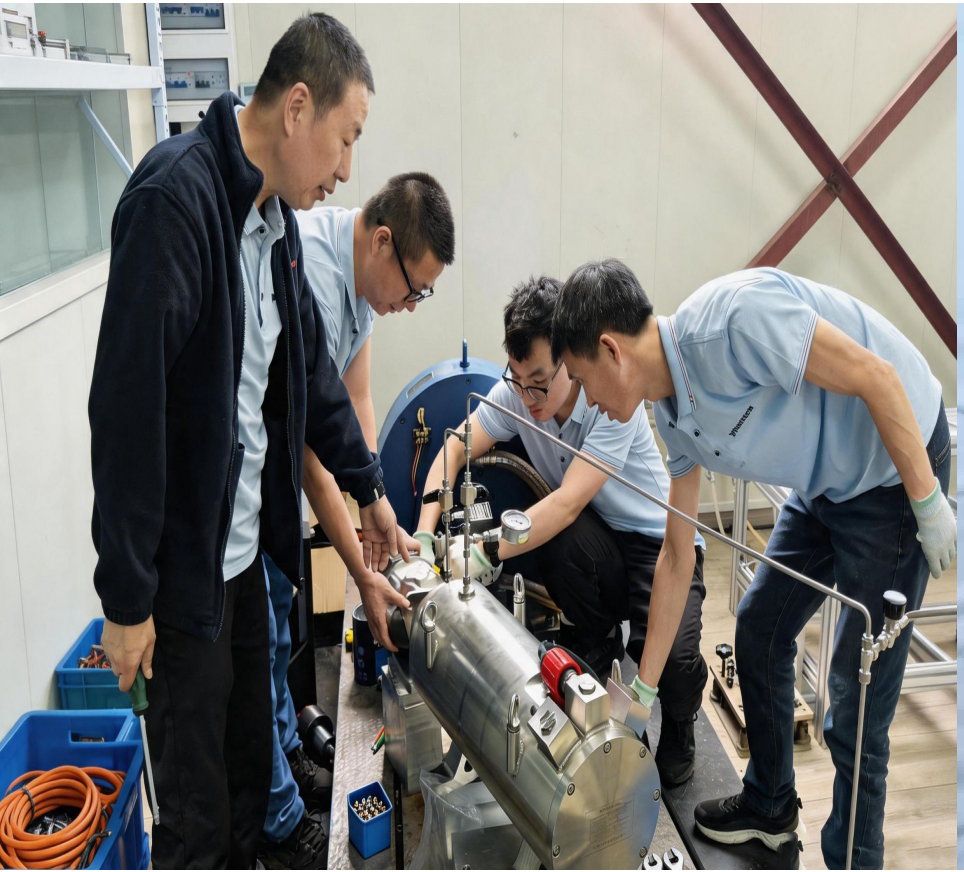
Oil-Filled Type — 850 m Underwater





Item	Motor Parameters
Motor Model	220ST-H16A15-670V-SS850
Rated Torque	165NM
Rated Speed	1450RPM
Rated Voltage	DC670V
Pressure Resistance Rating	Withstands 8.5 MPa water pressure
Insulation Class	H 180℃
Rated Current	44A

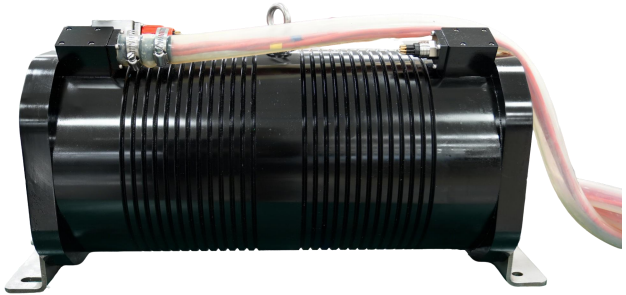
850 m Test Site of Oil-Filled Motor





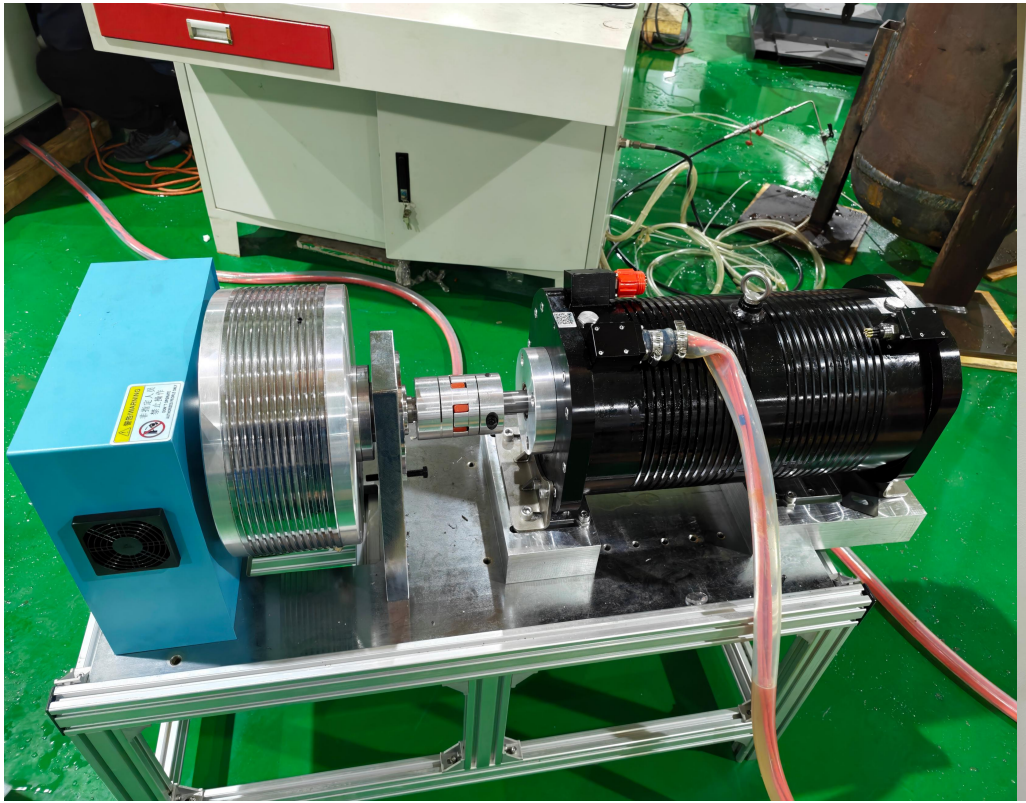
underwater Induction Motor





Item	Motor Parameters
Motor Model	Y254-310-2P1450-20KW-3000V-SS1000
Rated Torque	130NM
Rated Speed	1445RPM
Rated Voltage	AC3000V
Pressure Resistance Rating	10MPa
Insulation Class	H 180℃
Rated Current	5.2A

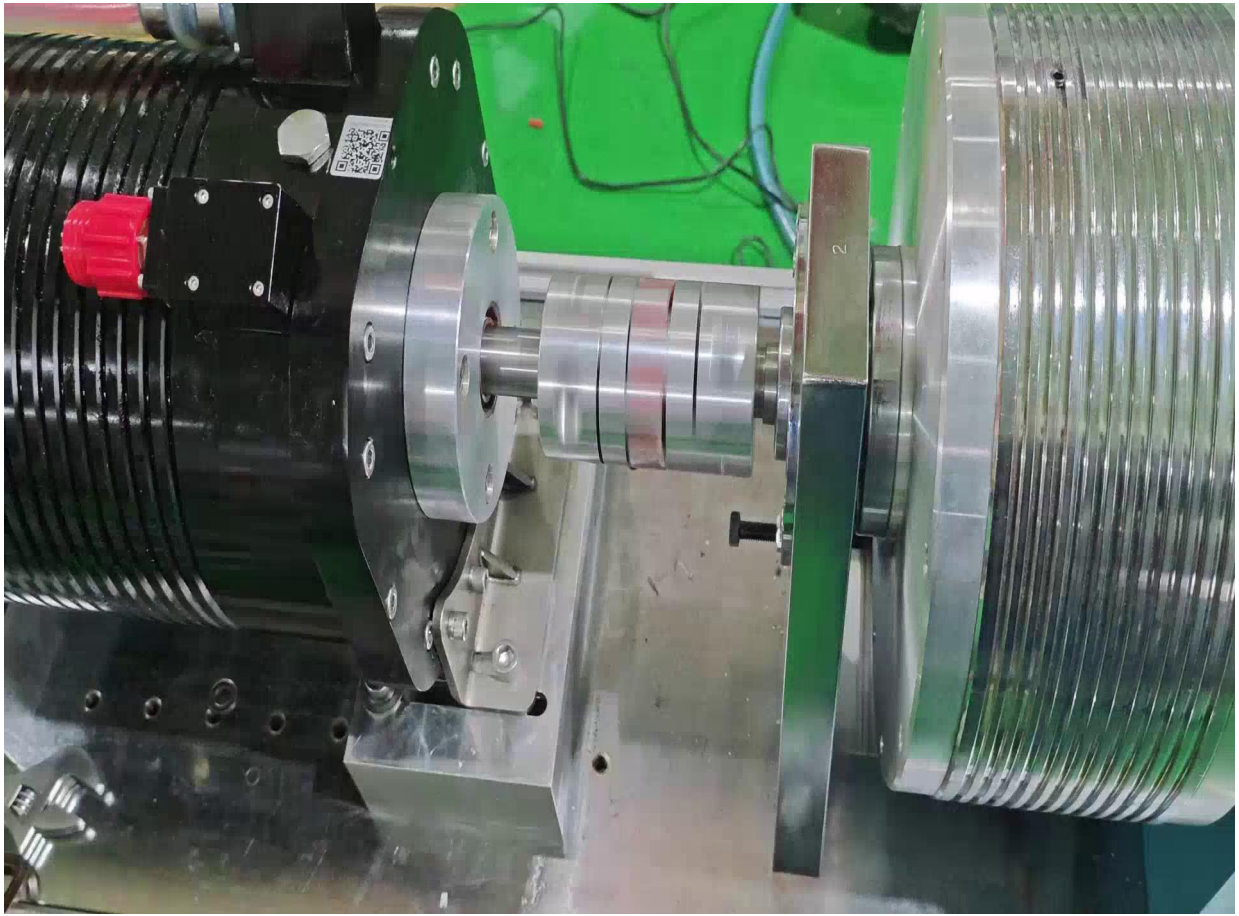
underwater Induction Motor Test Site



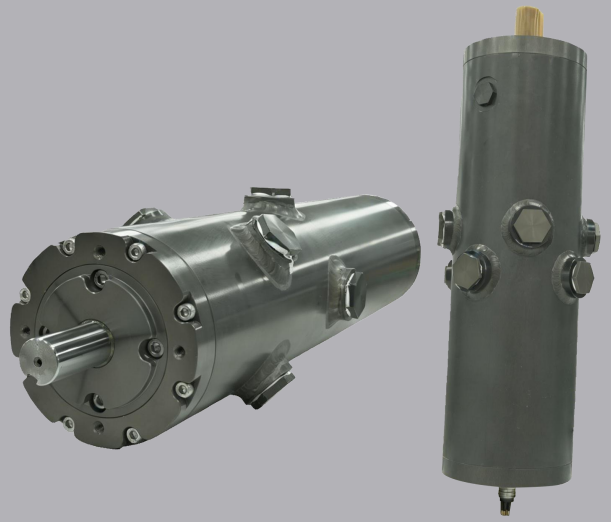


underwater Induction Motor Field Test





03-5 underwater Integrated Gear Motor



90-Frame underwater Integrated Gear Motor



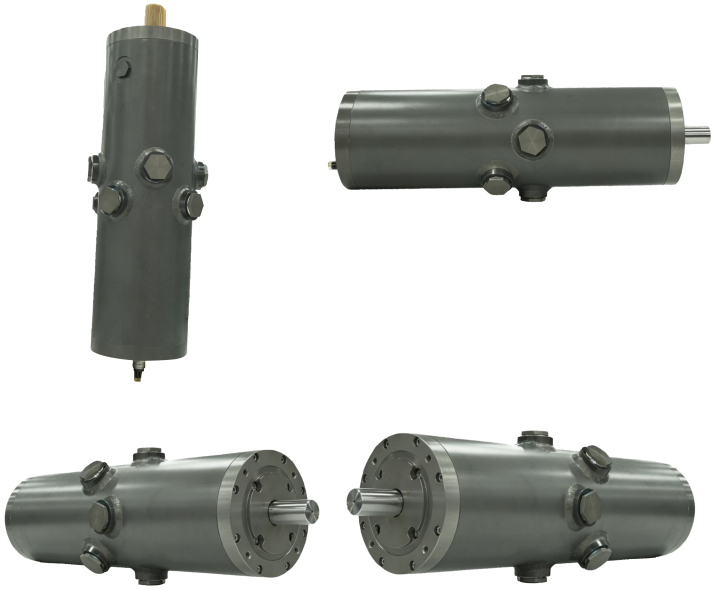






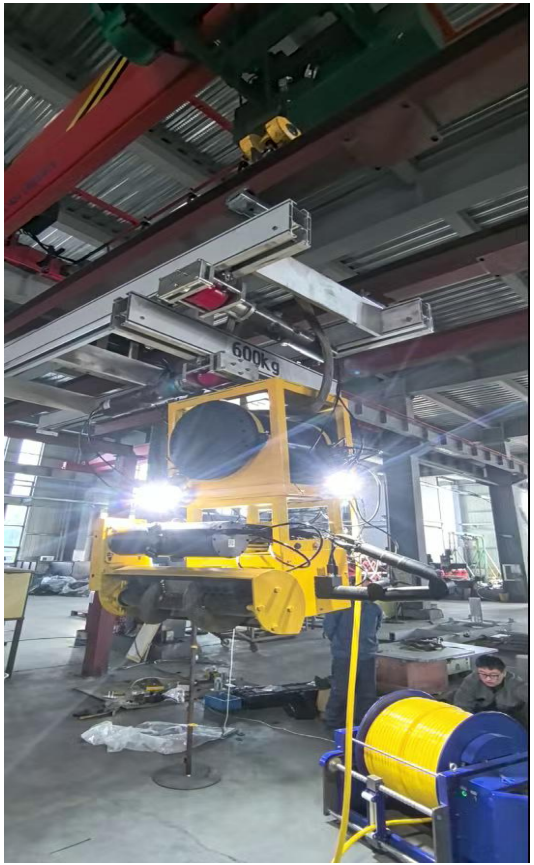
Item	Motor Parameters
Motor Model	90ST-X02030B-YTJ-SS200
Rated Torque	2NM
Rated Speed	3000RPM
Rated Voltage	AC220V
Pressure Resistance Rating	2MPa
Insulation Class	H 180℃
Rated Current	2.6A

130-Frame underwater Integrated Gear Motor

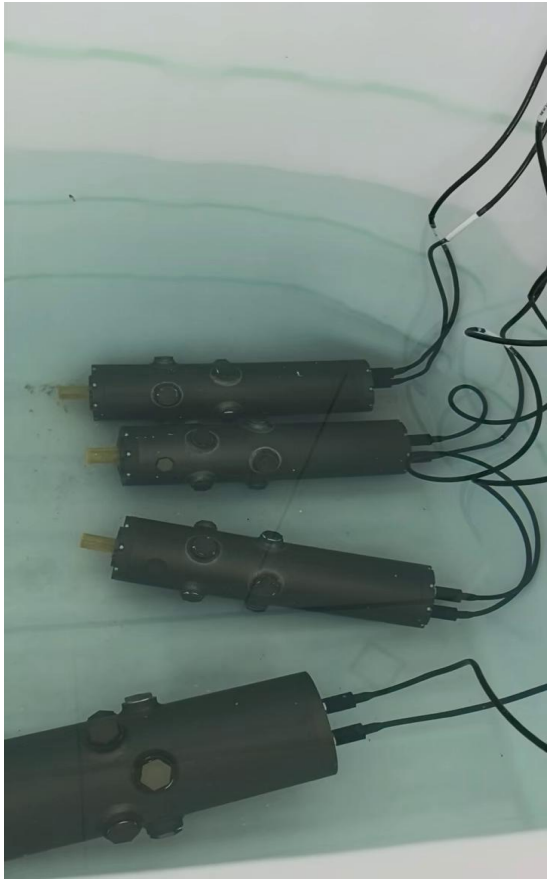


Item	Motor Parameters
Motor Model	130ST-X03330B-YTJ-SS200
Rated Torque	3.3NM
Rated Speed	3000RPM
Rated Voltage	AC220V
Pressure Resistance Rating	2MPa
Insulation Class	H 180℃
Rated Current	4.5A

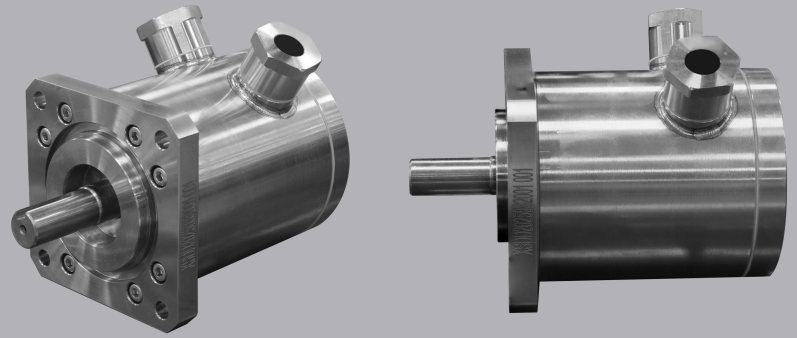
Installation Site of underwater Integrated Gear Motor



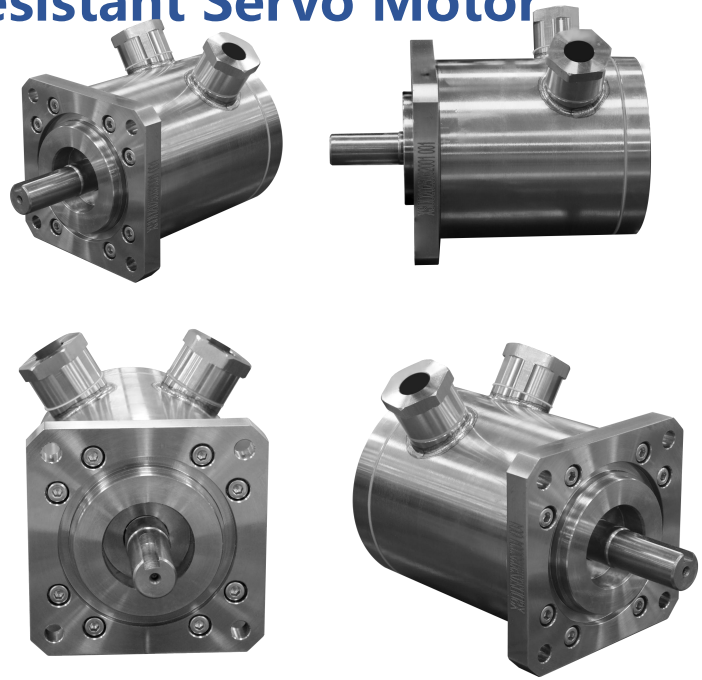
Commissioning of underwater Integrated Gear Motor



03-6 Underwater Radiation-Resistant Motor



Underwater Radiation-Resistant Servo Motor

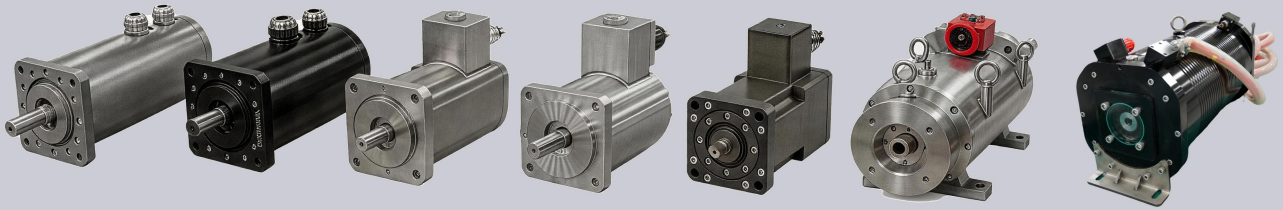


Meets requirements for use at 3000 m underwater

Item	Motor Parameters
Motor Model	80ST-X00330-F
Rated Torque	0.3NM
Rated Speed	3000RPM
Rated Voltage	AC220V
Protection Rating	IP68
Insulation Class	H 180℃
Cumulative Radiation Dose	10^7Gy
Rated Current	0.75A

04

Underwater / underwater Motor Application Cases



Application Scenario: Deep-Sea Scientific Research and Marine Engineering



Autonomous Underwater Vehicle (AUV)

Equipped with a underwater propulsion motor, it successfully descended to a depth of 6000 m, accurately detecting geological features of hydrothermal vent areas in the South China Sea.



Submarine Cable Burial ROV

Equipped with a deep-sea AC motor that withstands extreme water pressure at 4000 m, enabling efficient burial and maintenance of submarine cables.



Podded Propulsion for LNG Vessels

Integrated podded propulsion motor technology reduces the vessel's turning radius by 50% and improves overall propulsion system efficiency by 12%.



Underwater Welding Robot

Equipped with a high-torque underwater servo motor, it performs automated repair of damaged pipelines on offshore platforms at complex water depths of up to 5 m.

Application Scenario: Industrial Applications and Ecological Monitoring



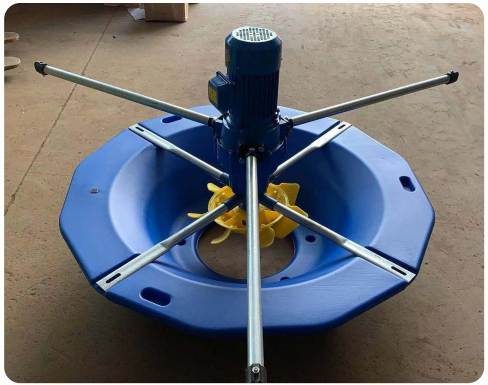
underwater Mining Vehicle

Provides drive and hydraulic system power for deep-sea polymetallic nodule mining vehicles, operating stably for long periods at a water depth of 1000 m.



Municipal Wastewater Treatment

Submersible pump motors handle wastewater containing corrosive particles, with protection rating up to IP68 and overall energy consumption significantly reduced by 25%–30%.



Marine Ranch

Stably drives aerators, circulation pumps and feed dispensers, perfectly meeting the requirements of low speed, high torque and high reliability in marine environments.

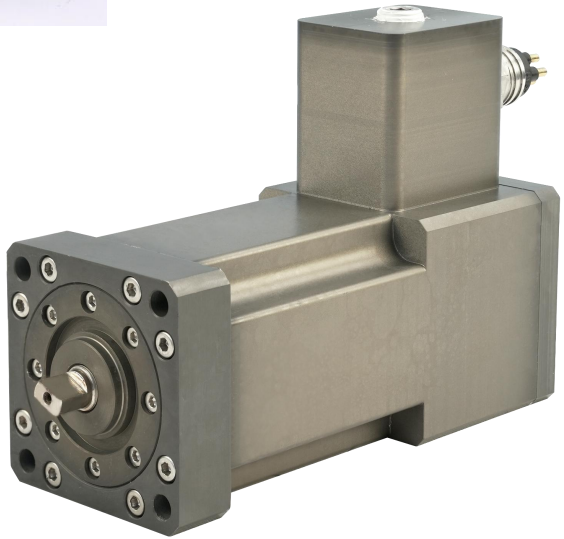
Case 1: Underwater Thruster Motor

Wheatstone



1. Motor application: underwater thruster
2. Maximum operating water depth: 2000
3. Motor power & outer diameter: 5 kW, o diameter Φ140 mm
4. Motor type: oil-filled (filled with high-in oil)
5. Medium: seawater
6. Installation space: built-in end cap

ITEM	RECOMMENDED SOLUTION
RECOMMENDED TYPE	Bladder-Type Pressure Compensator
KEY DESIGH POINTS	The bladder is installed inside the rear end cover of the motor. One end communicates with the motor's internal oil-filled chamber, while the other contacts external seawater through a passage hole. A metal guard surrounds the bladder to prevent mechanical damage. The interior is filled with highly insulating oil, such as transformer oil or silicone oil.
SELECTION PARAMETERS	Effective bladder compensation volume ≥ 10%–15% of the motor's internal oil volume; bladder material: seawater-resistant nitrile rubber or fluoroelastomer; bladder wall thickness: 1–2 mm; operating pressure: 20 MPa.
MATERIAL COMBINATION	Housing: 316L stainless steel; bladder: seawater-resistant nitrile rubber / fluoroelastomer; dynamic seal: silicon carbide mechanical seal assembly.

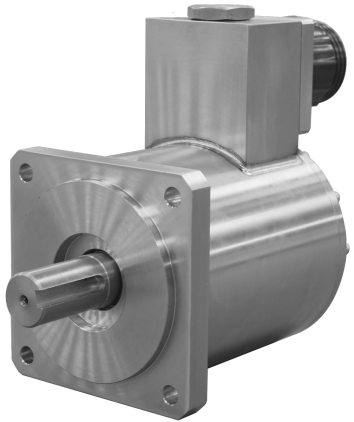


Case 2: Deep-Well Pump / Submersible Pump Motor

Wheatstone

1. Motor application: deep-well pump
2. Maximum operating water depth: 500 m
3. Motor power & outer diameter: 30 kW, outer diameter Φ180 mm
4. Motor type: oil-filled (filled with transformer oil)
5. Medium: fresh water
6. Installation space: built-in end cap





ITEM	RECOMMENDED SOLUTION
RECOMMENDED TYPE	Piston-Type Pressure Compensator
KEY DESIGN POINTS	The piston is installed inside the lower end-cover chamber of the motor, with the cylinder integrated into the motor end cover. An O-ring seals the piston-to-cylinder interface. The outer side of the piston contacts the external medium, while the inner side communicates with the oil-filled chamber. Piston stroke is calculated from motor-oil thermal expansion and depth variation.
SELECTION PARAMETERS	Effective piston stroke ≥ compensation required for thermal expansion of the motor's oil-filled chamber plus depth variation; piston diameter: 60–80 mm; O-ring material: oil-resistant nitrile rubber; seal compression ratio: 15%–20%; operating pressure: 5 MPa.
MATERIAL COMBINATION	Cylinder: 304 stainless steel; piston: 316L stainless steel or aluminum alloy; O-ring: nitrile rubber; housing: 304 stainless steel.

Case 3: Deep-Sea Robotic Arm Joint Motor

Wheatstone

1. Motor application: robotic arm joint
2. Maximum operating water depth: 6000 m
3. Motor power & outer diameter: 800 W, outer diameter Φ120 mm
4. Motor type: oil-filled (oil-immersed)
5. Medium: seawater
6. Installation space: built-in end cap + external auxiliary balancer (series combination)



ITEM	RECOMMENDED SOLUTION
RECOMMENDED TYPE	Series-Combined Sealed Piston Compensator
KEY DESIGN POINTS	The piston is installed inside the cylinder. A rectangular straight-through labyrinth seal serves as the primary seal, while a star-shaped sealing ring serves as the main seal. The labyrinth seal significantly throttles fluid pressure, creating favorable sealing conditions for the main seal. The labyrinth ring is internally fitted with a sealing-ring support and a dynamic seal.
SELECTION PARAMETERS	Piston diameter: 80–100 mm; effective compensation volume ≥ 20% of the motor's internal oil volume for deep-sea high differential-pressure conditions; contact stress of the main seal must exceed the hydrostatic pressure; operating pressure: 60 MPa.
MATERIAL COMBINATION	Piston: nickel bronze / high-strength stainless steel; cylinder: titanium alloy; primary seal: PEEK + metal labyrinth seal; main seal: fluoroelastomer star-shaped sealing ring.



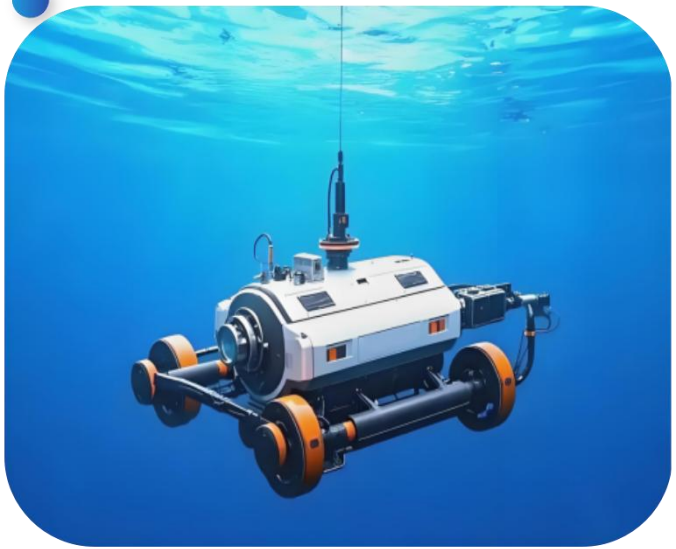
Deep-Sea Motor Application Series





- Deep-sea motors designed for underwater environments
- Special waterproof sealing treatment
- Suitable for underwater robots and other equipment
- High efficiency and high torque characteristics
- Corrosion resistance with special materials
- Operable in extreme deep-sea environments
- Play an important role in multiple fields

Underwater Brushless DC Motor Applied in — Underwater Robots



Adoption of underwater brushless DC motors

This is mainly because the underwater environment places extremely high demands on motor reliability and sealing. The mechanical brushes of brushed motors produce sparks during rotation, which not only easily cause failures in humid environments but also generate electromagnetic interference that affects the robot's control system. By contrast, brushless motors have no mechanical brushes and offer the following significant advantages:

High reliability and long service life	Low noise and high energy efficiency	Excellent sealing performance
Eliminates brush wear and greatly reduces maintenance requirements	Quieter operation and high energy conversion efficiency, critical for battery-powered underwater robots	Motor windings are typically sealed using potting compounds and similar processes, effectively withstanding underwater pressure and preventing damage from water leakage

Underwater Motors Applied in — Mobile Parts of Underwater Industrial Robots

High efficiency: efficiency can exceed 90%, 15%–25% higher than conventional hydraulic (or pneumatic) drives, with high long-term operational safety and accurate movement speed and distance;

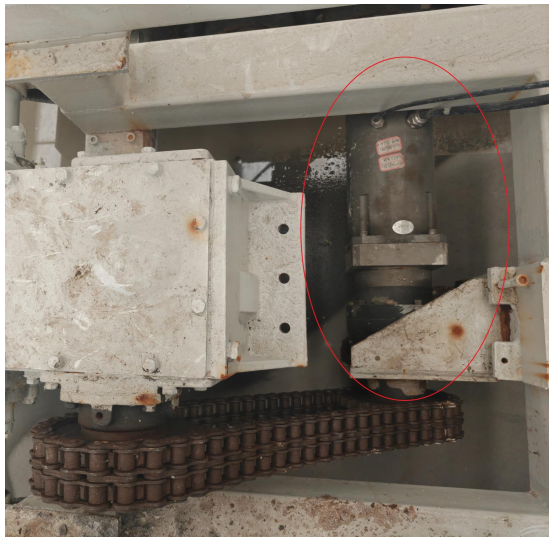
Quiet and smooth: replaces air motors, fundamentally eliminating bubbles and noise. Its smooth operation also ensures motion reliability.

Space saving: compared with hydraulic motors (or air motors), the motor is small in size and high in output power, with a more compact overall structure.









Applied in — Underwater

Oil-filled motors are the most commonly used solution for underwater hydraulic systems. The motor interior is not evacuated but filled with special insulating oil.



Working Principle

A flexible bladder connects the internal oil to the external ambient pressure, achieving pressure self-balancing. No matter how deep it descends, the pressure inside and outside the motor remains essentially equal, so the housing

Adaptability Extremely

Can easily operate at depths of 3000 m and even 11000 m, the most elegant solution to the deep-sea high-

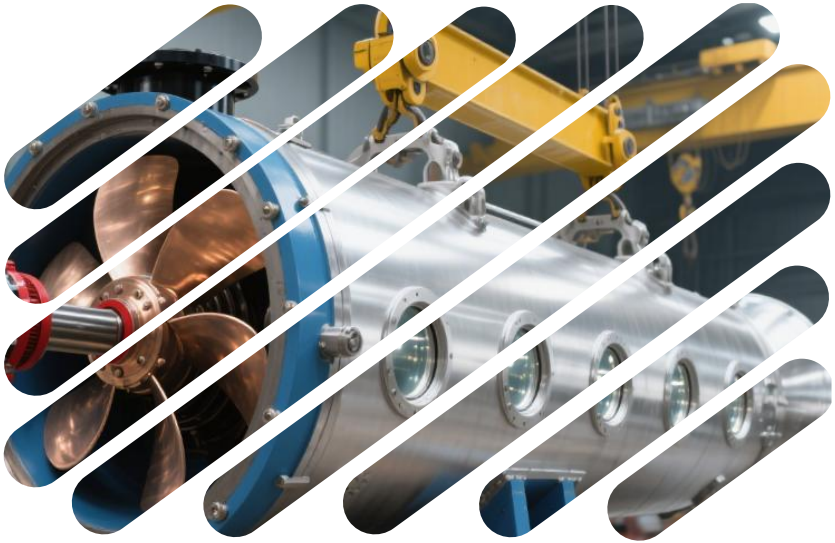
Efficient Heat Dissipation

The circulating oil inside quickly removes heat from the windings, allowing higher power density in a

High Reliability

The oil serves as coolant, lubricant and insulating medium, eliminating any possibility of seawater

Motor Applied in — Marine



Excellent Maneuverability	Very High Efficiency	Compact Size Light Weight
Thrust is steplessly adjustable from 0 to 100% with precise control; low grid impact: the soft-start feature significantly reduces voltage impact on the vessel's	Maintains high efficiency across the entire speed range, especially at low-speed high-torque conditions, delivering considerable fuel or electrical energy	Compared with induction motors of the same power, permanent magnet motors can be made more compact, a major advantage for engine