

CORELESS MOTOR CO.,LTD BRUSHLESS DC MOTOR TECH INFO



CORELESS MOTOR CO.,LTD

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AGENDA



**Verification of
superiority of our
brushless DC motor**



**Difference from
conventional motors**



**Difference from other
coreless motors**



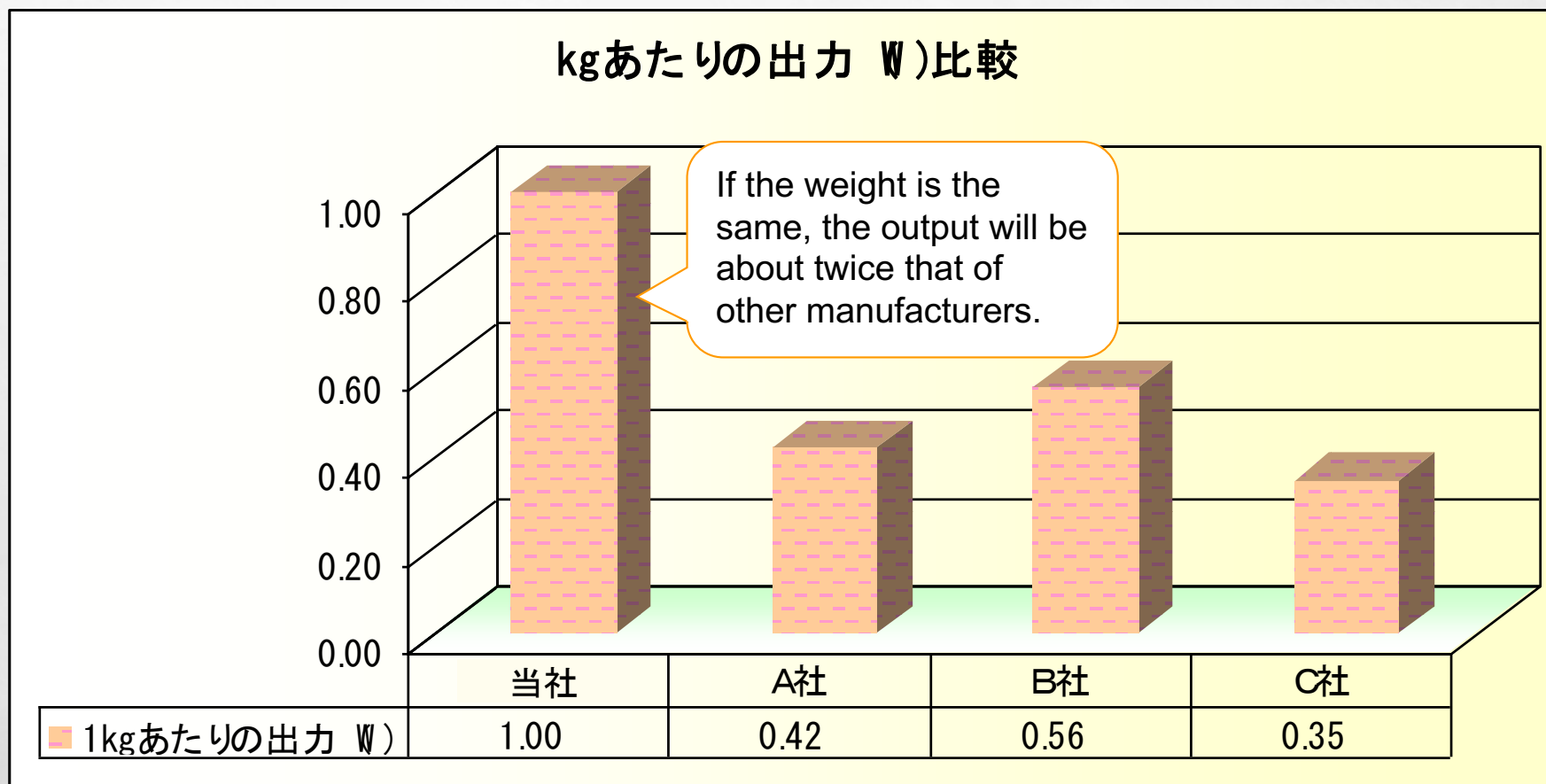
**Introduction of applied
technology of our
brushless DC motor**



VERIFICATION OF SUPERIORITY OF OUR BRUSHLESS DC MOTOR

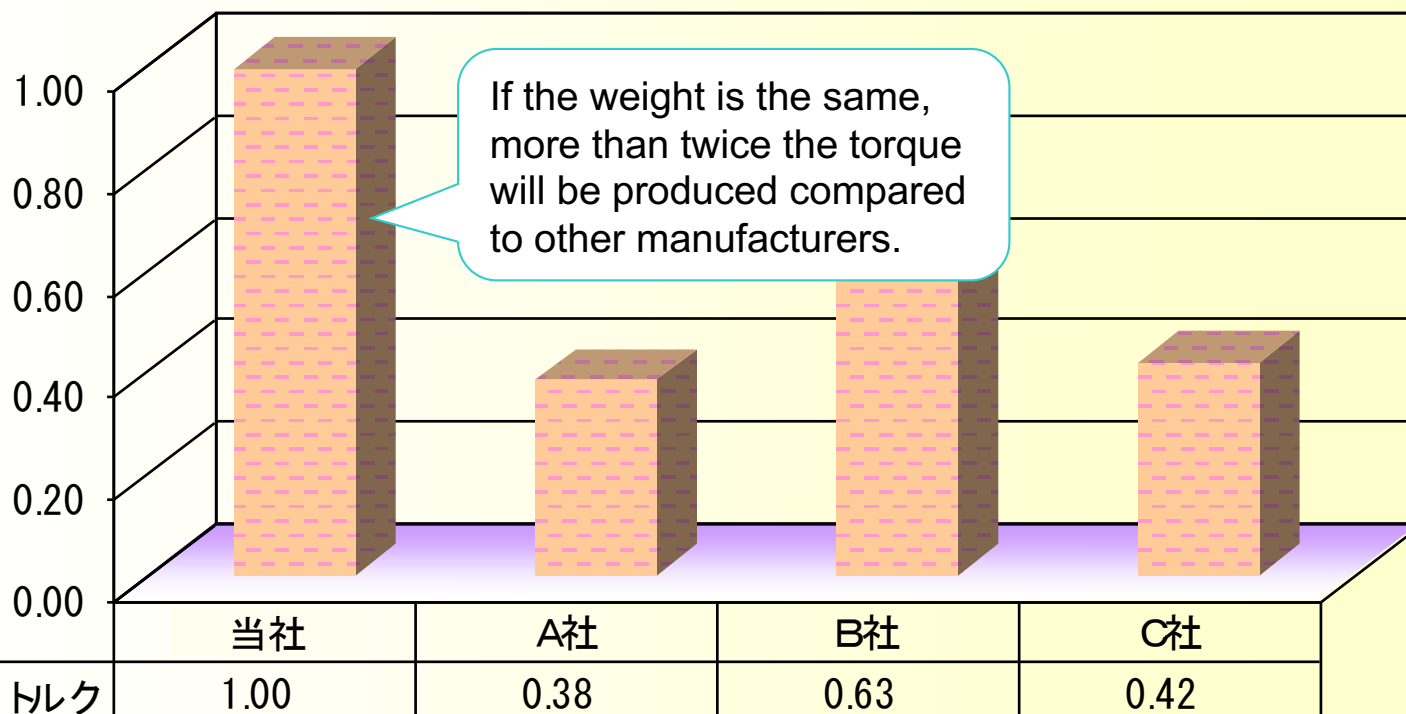
- **WE COMPARED OUR BRUSHLESS DC MOTOR WITH OTHER COMPANIES' BRUSHLESS DC MOTORS.**
 - **(24V, 200W BRUSHLESS DC MOTOR)**
 - **OUTPUT POWER PER KG (W) FOR COMPARISON**
 - **THE HIGHER THE OUTPUT PER KG, THE LIGHTER THE OUTPUT.**
 - **COMPARED IN TORQUE PER KG (NM)**
 - **THE HIGHER THE TORQUE PER KG, THE LIGHTER THE TORQUE**
 - **COMPARE BY OUTPUT (W) PER CURRENT (A)**
 - **THE HIGHER THE TORQUE PER CURRENT (A), THE SMALLER THE CURRENT OUTPUT.**

200W : OUTPUT / KG (W)



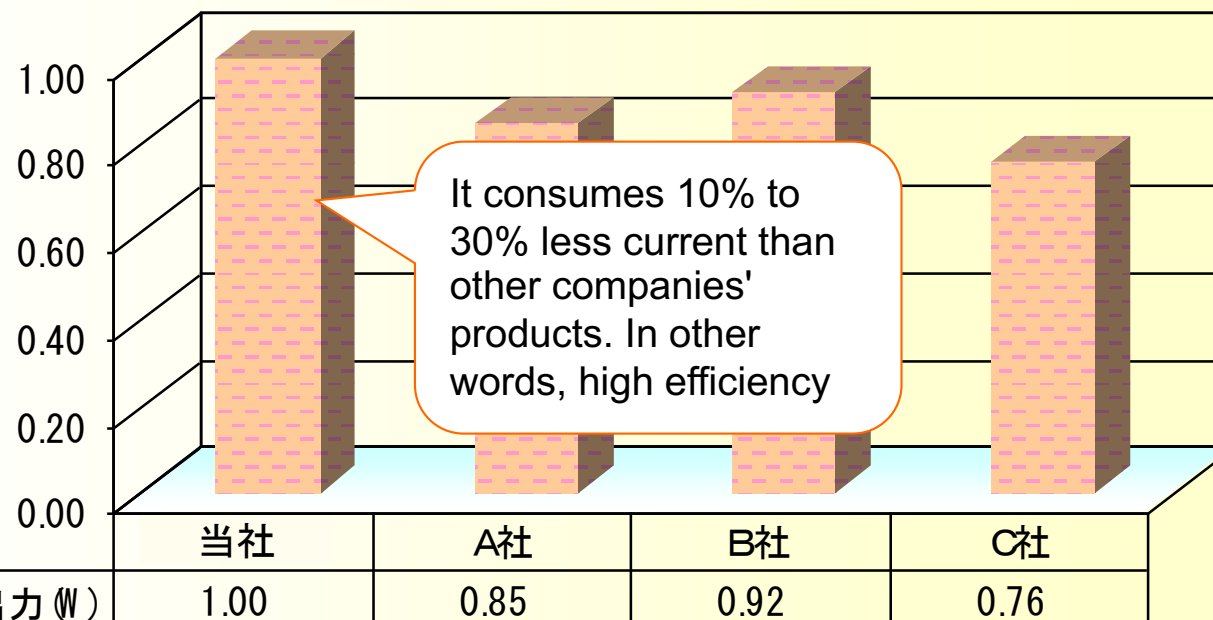
200W : TORQUE / KG (NM)

kgあたりのトルク(Nm)比較



200W : OUTPUT / CURRENT (A)

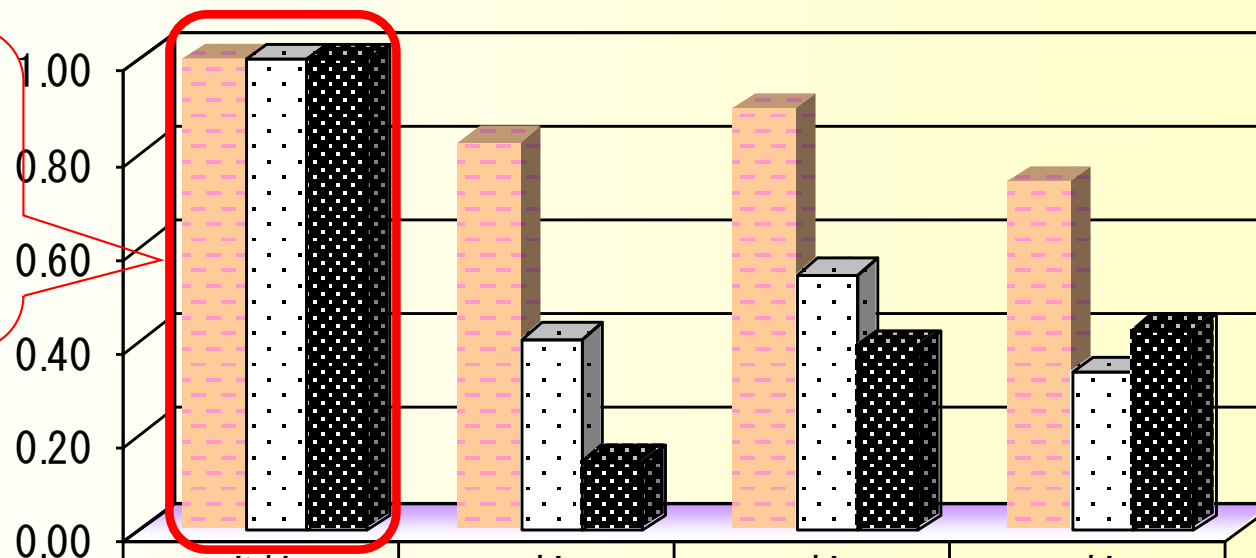
消費電流あたりの出力 (W)



200W : COMPREHENSIVE COMPARISON

200W 帯モータ総合比較

Compared to other manufacturers: Output: more than double
Torque: Double or more
Current consumption: 10% to 30% reduction



	当社	A社	B社	C社
消費電流あたりの出力 (W)	1.00	0.82	0.89	0.74
1kgあたりの出力 (W)	1.00	0.41	0.54	0.34
1kgあたりのトルク	1.00	0.15	0.39	0.43

WHY IT IS LIGHT AND CONSUMES LESS CURRENT

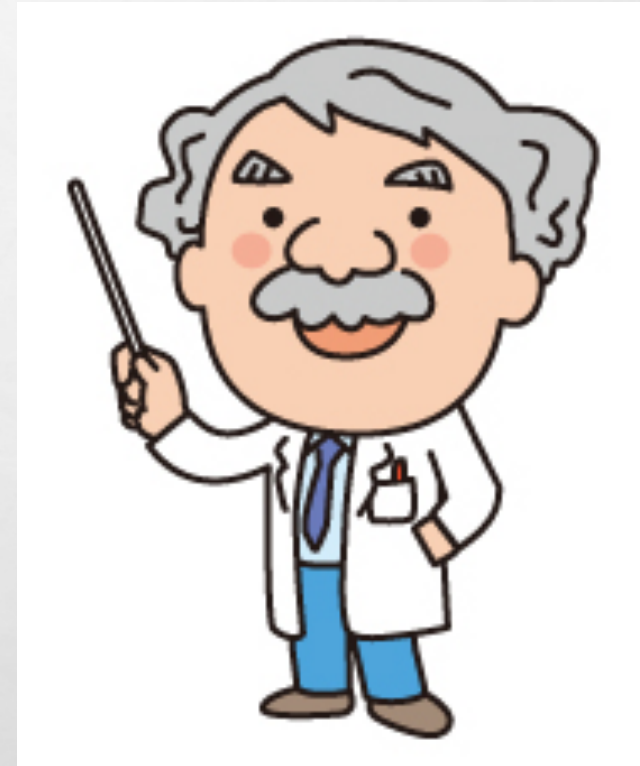
- **THIS IS BECAUSE IT IS A CORELESS MOTOR,
NOT A CORED MOTOR WITH AN IRON CORE.**

**Coreless motor
Efficient! So lightly
Low current
consumption !**



DISADVANTAGES OF CORED MOTORS

- 1. HEAVY (BECAUSE OF IRON CORE)**
- 2. PRESENCE OR ABSENCE OF COGGING**
- 3. EDDY CURRENT LOSS DURING HIGH SPEED ROTATION**
- 4. INEFFECTIVE**



DETAILS FROM THE NEXT PAGE . . .

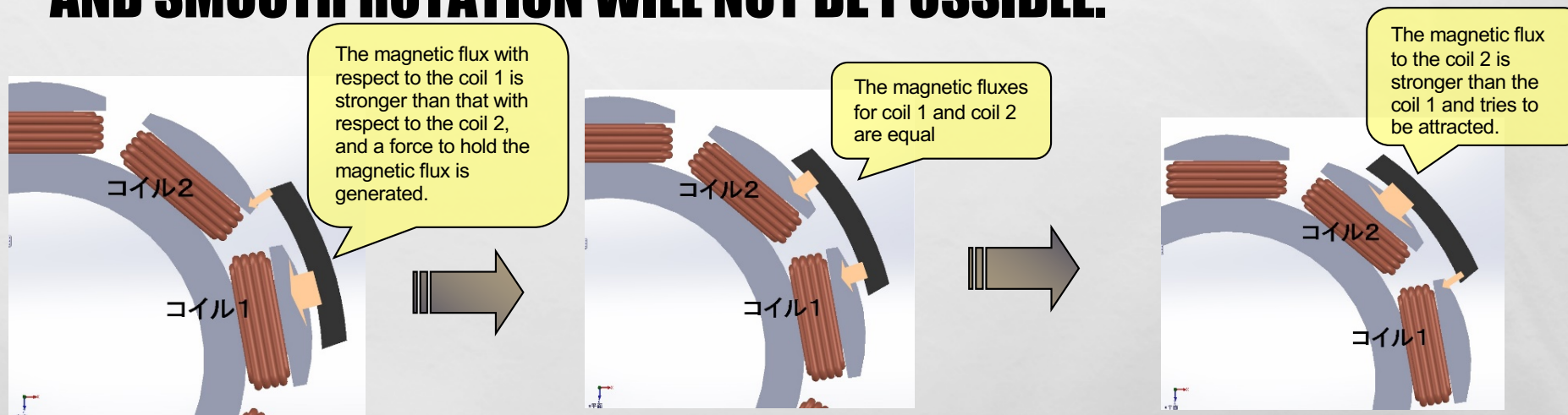


HEAVY DUE TO IRON CORE

- **SINCE THE CORED MOTOR HAS A COIL FORMED BY WINDING A COPPER WIRE AROUND AN IRON CORE, IT BECOMES HEAVY.**
- **THE MAGNETIC FLUX IS STRENGTHENED BY MOLDING THE CORE INTO THE IRON CORE.**

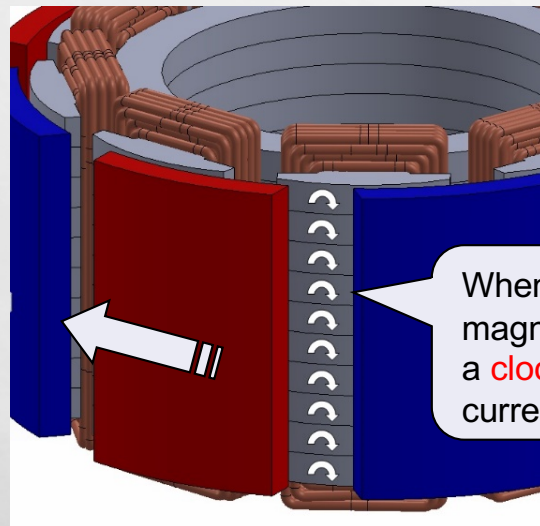
PRESENCE OR ABSENCE OF COGGING

- **WHEN THE IRON CORE AND THE MAGNET COME CLOSE TO OR AWAY FROM EACH OTHER, A TINGLING SENSATION IS CREATED. (COGGING TORQUE)**
- **IF THE COGGING TORQUE IS LARGE, UNEVEN ROTATION WILL OCCUR, AND SMOOTH ROTATION WILL NOT BE POSSIBLE.**

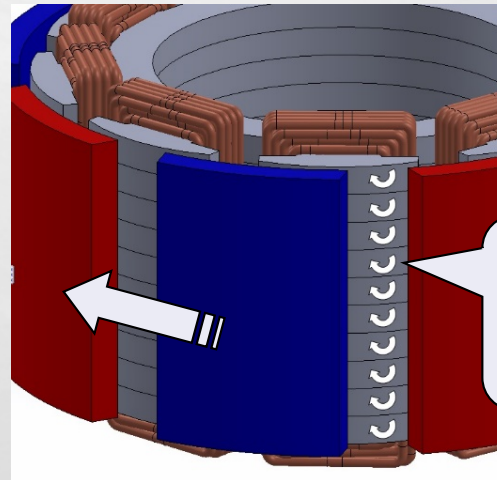


EDDY CURRENT LOSS DURING HIGH SPEED ROTATION

- THE MAGNETIC POLE CHANGES AS THE MAGNET ROTATES. WHEN THE MAGNETIC POLES CHANGE, EDDY CURRENTS FLOW INSIDE THE IRON CORE, WHICH IS A MAJOR CAUSE OF MOTOR HEAT GENERATION. EDDY CURRENT INCREASES AS THE ROTATION SPEED INCREASES.



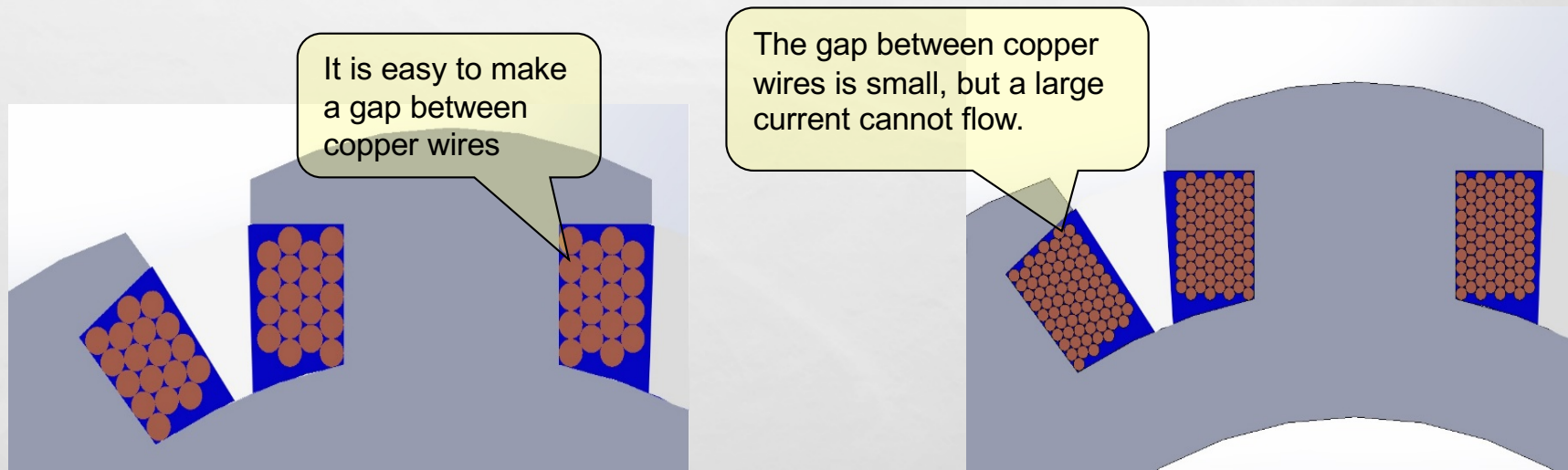
When the blue magnet approaches, a **clockwise** eddy current is generated.



This time, when the red magnet approaches, **counterclockwise** eddy current is generated.

INEFFECTIVE

- **SINCE THE MOTOR THAT CAN BE USED AT LOW VOLTAGE USES A THICK COPPER WIRE TO REDUCE THE RESISTANCE VALUE, THE SPACE FACTOR (THE RATIO OF COPPER TO THE SLOT AREA) IS LOW. THE LOWER THE SPACE FACTOR, THE LOWER THE MOTOR EFFICIENCY.**



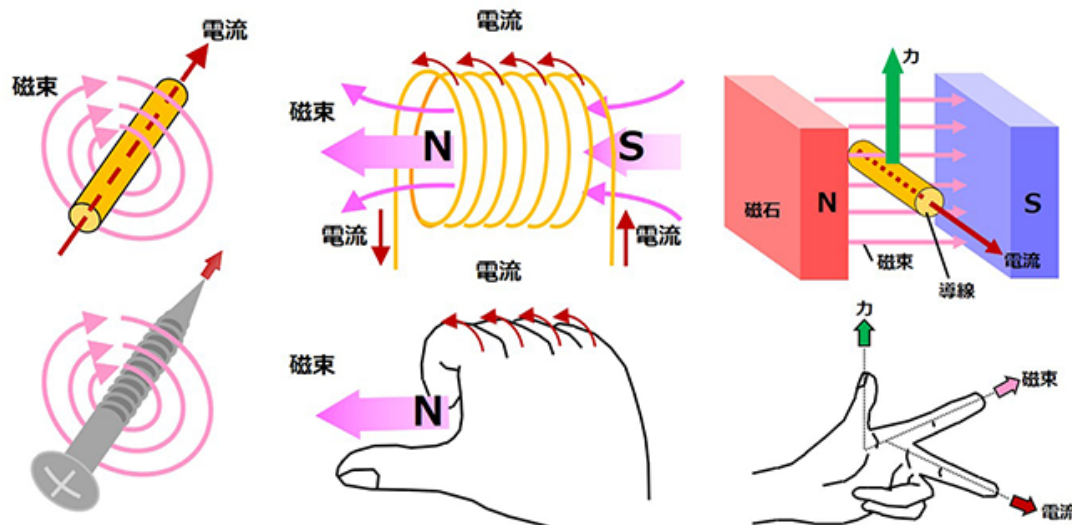
DISADVANTAGES OF CORELESS MOTORS

✓ **OUTPUT IS SMALL**

***DETAILS WILL BE EXPLAINED FROM THE NEXT PAGE.**



DRIVING PRINCIPLE OF CORELESS MOTOR



アンペール(アンペア)の右ネジの法則

$$H = \frac{I}{2\pi r} \quad [\text{A/m}]$$

H : 同心円上の磁界の強さ、
 I : 電流、 r : 半径

電流によりコイルに発生する磁束

$$H = \frac{n \cdot I}{2 \cdot r} \quad [\text{A/m}]$$

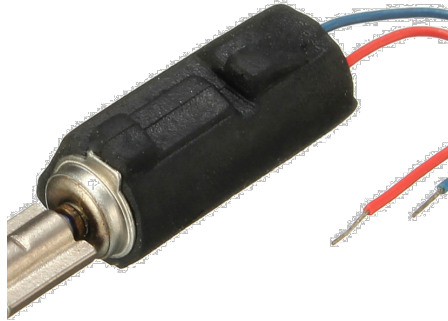
H : 中心の磁界の強さ、
 r : コイル半径、 n : 巻き数、
 I : 電流

フレミングの左手の法則

$$F = B \cdot I \cdot l \quad [\text{N}]$$

F : 力、 l : 導線の長さ、
 B : 磁束密度、 I : 電流

1. WHEN AN ELECTRIC CURRENT IS PASSED THROUGH A COPPER WIRE, A MAGNETIC FLUX IS FORMED (RIGHT-HANDED SCREW LAW)
2. WHEN A MAGNET IS PLACED THERE AND A MAGNETIC FIELD IS CREATED, THE MAGNETIC FLUX CREATED BY THE CURRENT IS DISTORTED
3. THE DISTORTED MAGNETIC FLUX FORCE IS GENERATED BY UNIFORMLY USING (FLEMING'S LEFT-HAND RULE)



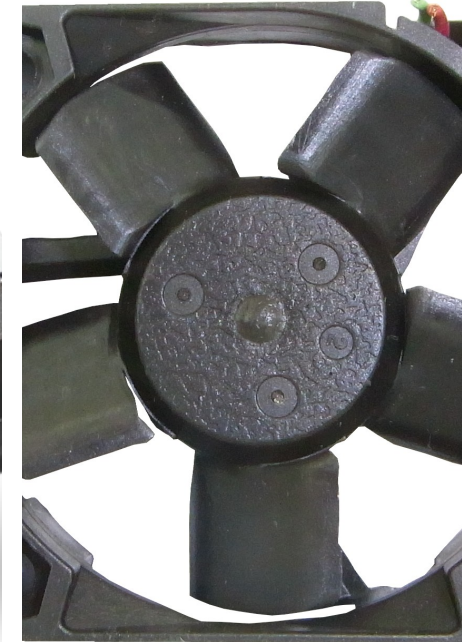
Vibration motor



Coin type vibration motor



Auto Focus motor



Fan motor

REPRESENTATIVE PRODUCTS MADE OF CORELESS MOTORS COMMON POINT: SMALL OUTPUT

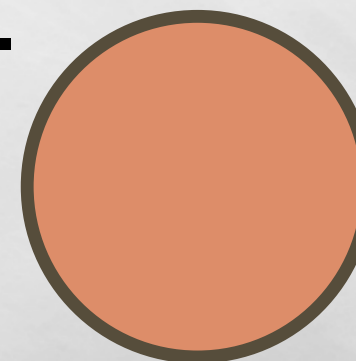


CORELESS MOTOR: ELECTRICAL REASON FOR LOW OUTPUT AND LOW TORQUE

- **SINCE A GENERAL CORELESS MOTOR USES A THIN COPPER WIRE, IT CANNOT CARRY A LARGE CURRENT. THE ALLOWABLE CURRENT OF A COPPER WIRE IS DETERMINED BY ITS CROSS-SECTIONAL AREA, AND THE SMALLER THE CROSS-SECTIONAL AREA, THE LARGER THE RESISTANCE VALUE, WHICH LEADS TO HEAT LOSS.**



**Coreless motor copper
wire cross section**



**Motor copper wire cross
section with iron core**

CORELESS MOTORS: MECHANICAL REASONS FOR LOW TORQUE

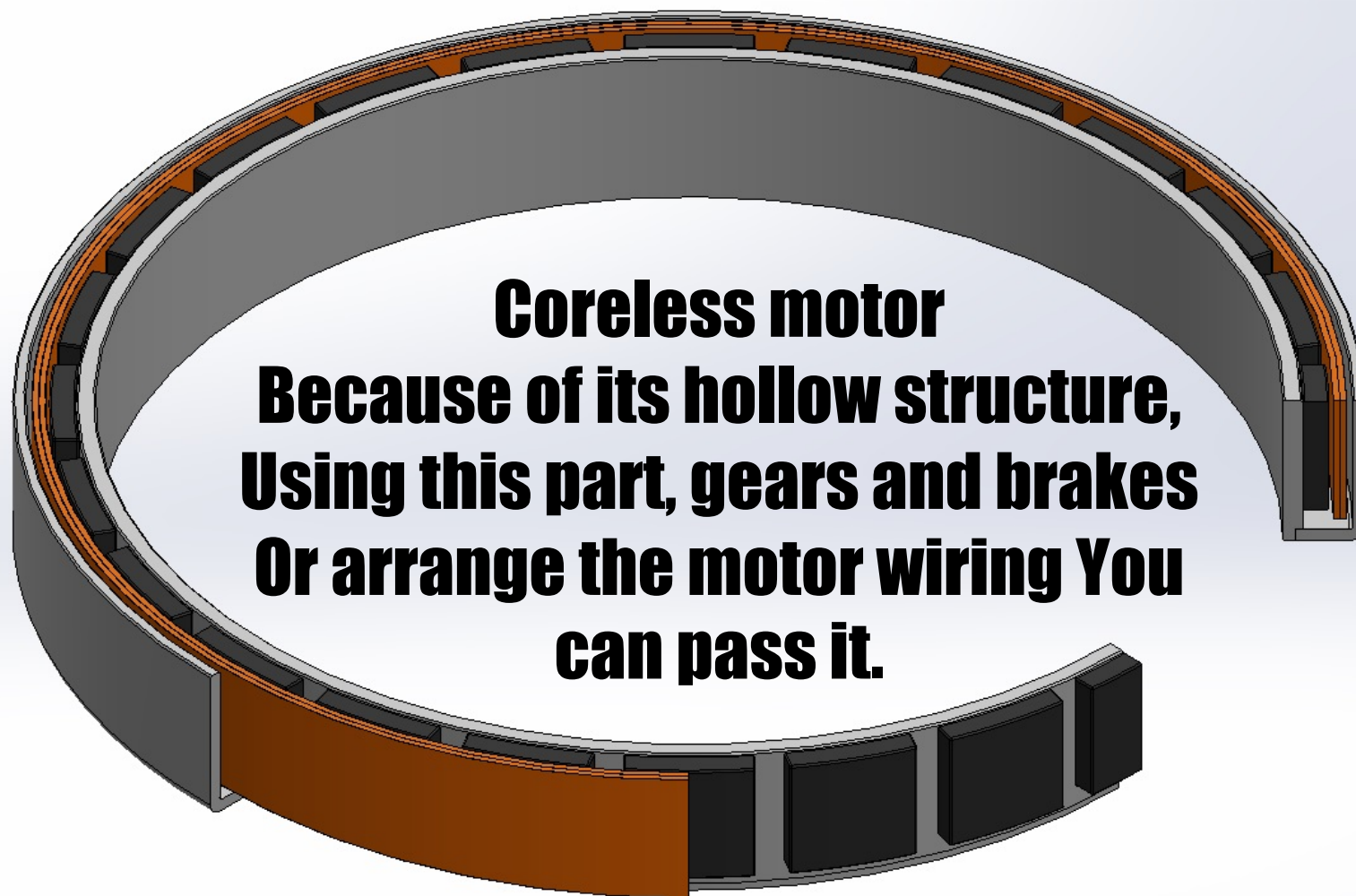
- **THE COIL FORMED OF THIN COPPER WIRE IS DAMAGED BY THE ANTI-TORQUE FROM THE MAGNET WHEN A STRONG TORQUE IS EXERTED.**
- **IT BECOMES MORE FRAGILE WHEN IT IS HOT AND SOFT**



NEXT-GENERATION CORELESS MOTOR

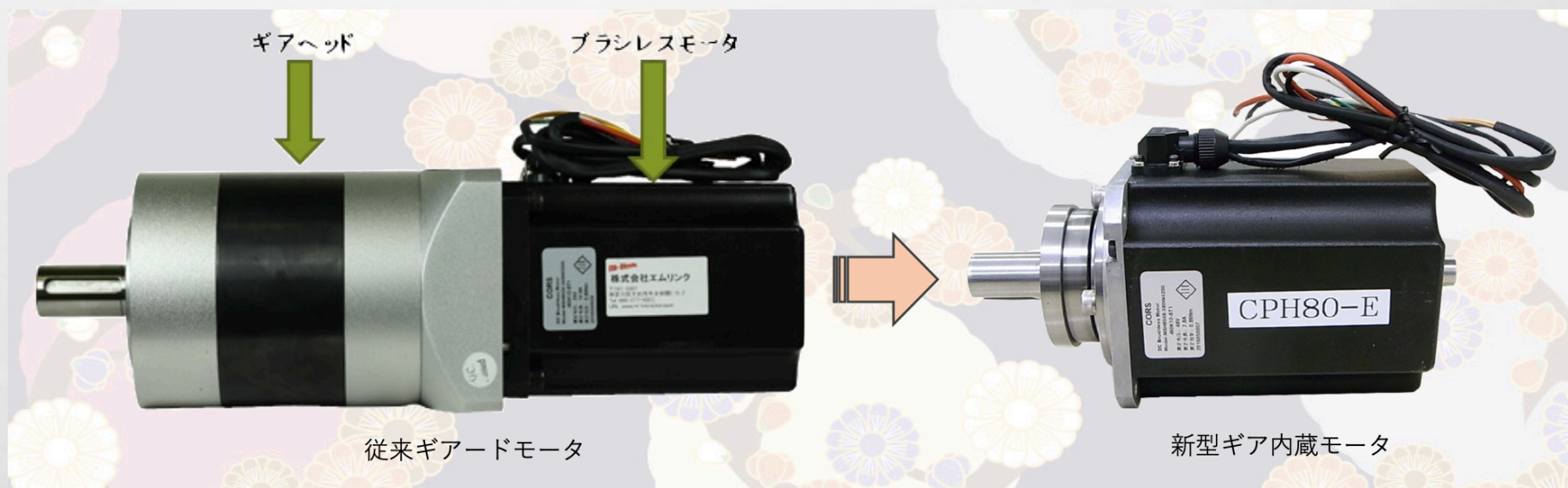
- **NEW METHOD OF CORELESS MOTOR
THAT DOES NOT USE COPPER WIRE**
- **CAN FLOW LARGE CURRENT**
 - **HIGH TORQUE**
 - **HIGH POWER OUTPUT**
- **COIL THAT WITHSTANDS HIGH
TORQUE**
 - **STRONG MECHANICAL RIGIDITY,
DIFFICULT TO DEFORM**

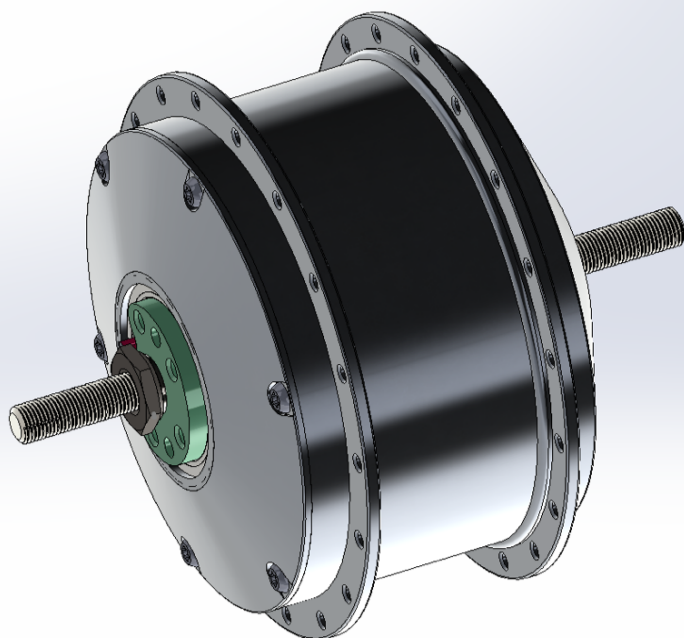
CORELESS MOTOR CHARACTERISTICS: HOLLOW STRUCTURE



GEAR-IN MOTOR

- BY UTILIZING A HOLLOW STRUCTURE AND ARRANGING THE GEAR MECHANISM INSIDE THE MOTOR, THE GEARED MOTOR BECOMES SURPRISINGLY COMPACT.





GEAR-IN WHEEL MOTOR

- **30% SMALLER AND LIGHTER**
 - **GEAR-IN STRUCTURE**
- **POWERFUL START-UP ACCELERATION**
 - **CORELESS HAS NO MAGNETIC SATURATION**
- **ACHIEVES SMOOTH DECELERATION**
 - **COGGING-LESS**
- **EXCELLENT IMPACT RESISTANCE**
 - **THROUGH SHAFT STRUCTURE**

THANK YOU FOR WATCHING

- PLEASE CONTACT THE PERSON IN CHARGE FOR FURTHER DETAILS.

