

MRF Damper

FMR-70S-403

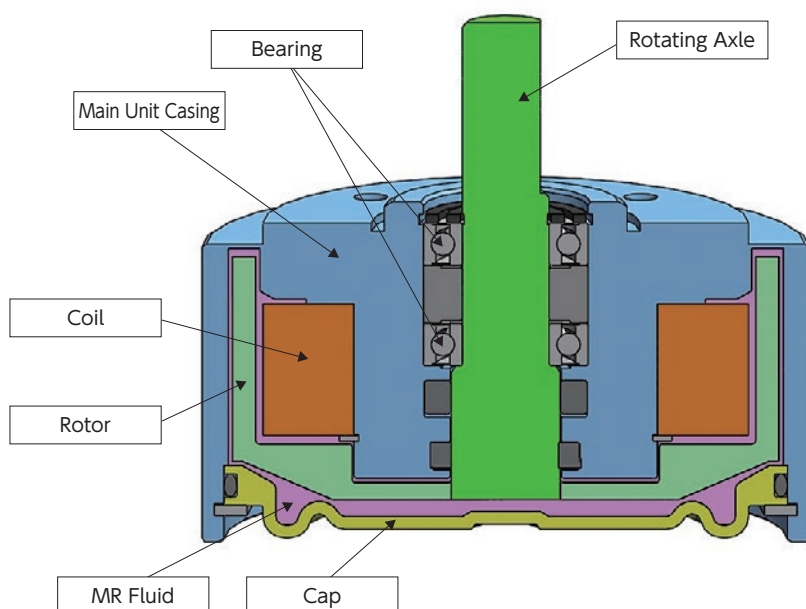


Characteristics

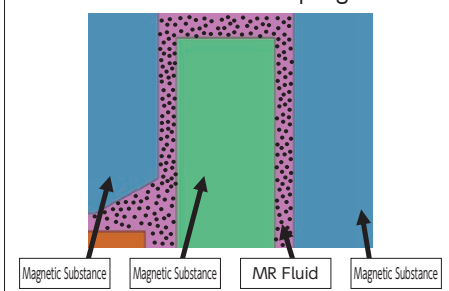
Electrically controlled	: Enabled electrically controlling the torque by using MR fluid (magnetic viscous fluid)
High response	: excellent electrical response makes realize a high response
Flexible mounting ways	: No restriction on the mounting direction
Not required Pre-conditioning operation	: Using MR fluid on friction part, it realized less humid effect and no requirement of pre-conditioning
Smooth motion	: Small differences between the static friction and dynamic friction allows a smooth actuation
Long life	: Our original sealing structure realizes a long life cycle
Seamless torque change	: Available a seamless torque control steplessly
Less susceptibility of temperature affect	: Comparing to a standard rotary damper, small effect by temperature
Less susceptibility of the rotational speed affect	: Comparing to a standard rotary damper, small effect by the rotating speed

Basic Structure and Action

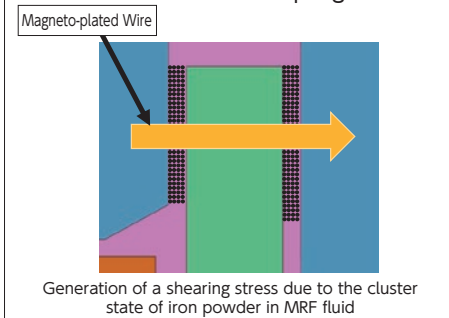
The basic structure of MRF damper is shown below.



No current on coil No torque generation



Current on coil With torque generation



Behavior

The rotating shaft is supported with the bearings for providing the freedom of rotation in the main unit casing.

A coil is implemented in the main unit casing, and a rotor having the shape of a cup is mounted on the rotating shaft.

There is a gap between the internal surface of the main unit casing and the external surface of the rotor. The MR fluid is filled in this gap.

When a current is supplied to the coil, a magnetic field line runs through the gap between the main unit casing and rotor, and a magnetic force flows in the MR fluid. When a magnetic force flows in the MR fluid, the iron powder is linked like a chain and the friction force of iron powder generates a force to restrict the rotation between the main unit casing and rotor.

What is the MR Fluid?

The MR (magneto-rheological) Fluid is a functional fluid that can be instantly reversibly changed between free liquid and semi-solid state by varying the applied magnetic field. The MR Fluid is featured with the wide shearing stress variation range based on the yield point determined by the semi-solid fluid due to the formation of chain type clusters of iron powder particles induced by the application of magnetic field in the dispersed micron size magnetic iron powders in the carrier fluid differently from general magnetic fluid.



MR Fluid



MR Fluid A magnet in the proximity

Main Applications

The applications for robots, welfare devices, logistics, amusements, operation levers, switchgears and the torque controls for vibration control devices are expected.

Precautions for Use

Be sure to carefully read the owner's manual delivered with the product before using.

●Products specification might be changed without notice.

Specifications

Type	Rated Torque N·m	Coil (23°C)				Allowable slipping efficiency W
FMR-70S-403	4	Voltage V	Current A	Resistance Ω	Capacity W	10 ^{*1}
	Maximum Operating Speed rpm	Mounting Posture	Direction of Rotation	Mass kg	Moment of Inertia kg·cm ²	
	50	No restriction	Both directions	0.83	1.16	

Temperature Range for Use: 0°C to 40°C The heat is generated from coil and the slipping friction during operation. The surface temperature of the product during operation shall not exceed 70°C.

* For a continuous slipping application, the friction heat shall be taken into consideration. The operation shall be within the allowable slipping efficiency range.

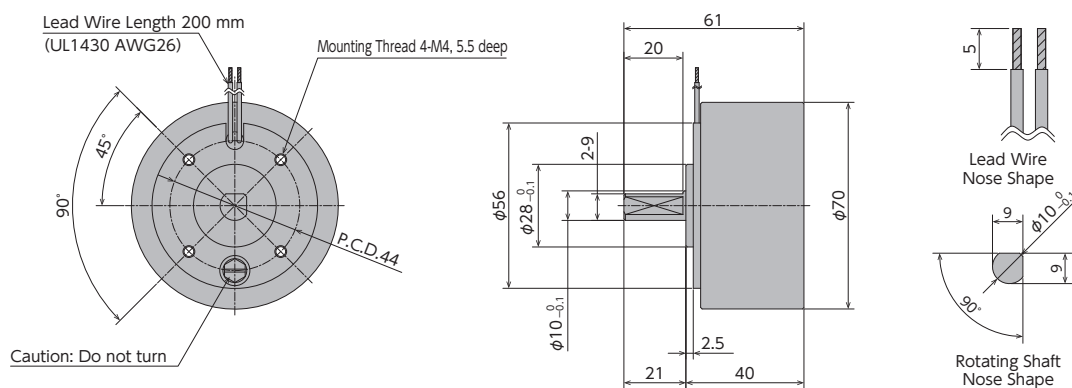
Calculation

Allowable slipping efficiency = $2 \times \pi / 60 \times n \times T_c$

n : Rotating Speed (rpm)

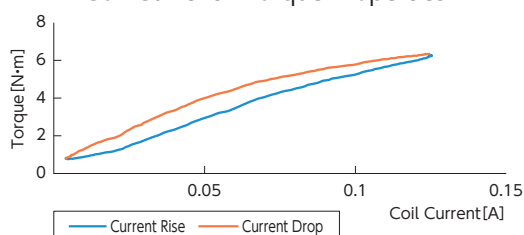
Tc : Slipping Torque (N-m)

	Material	Surface Treatment
Main Unit Casing	Metal (SUM)	Non-Electrolytic Nickel Plating
Rotating Shaft	Metal (SUM)	Nitriding
Cap	Polyacetal (POM)	—

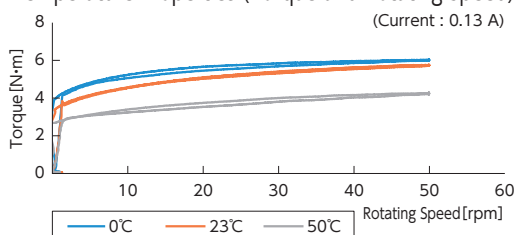


Test Data

Coil Current - Torque Properties

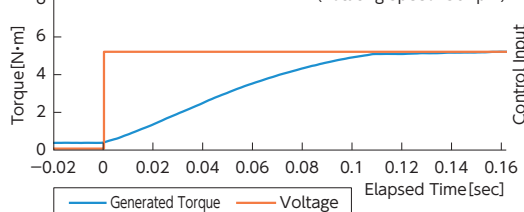


Temperature Properties (Torque and Rotating Speed)



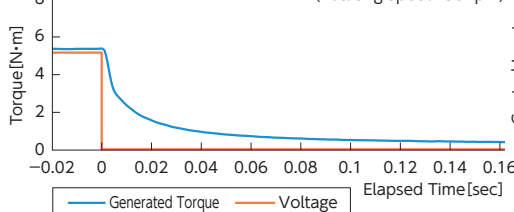
Response - Voltage Rise

(Rotating Speed: 50 rpm)



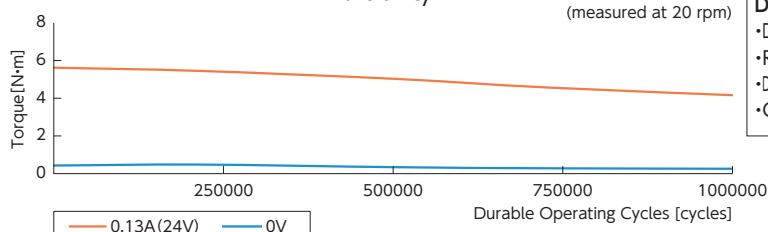
Response Performance - Voltage Drop

(Rotating Speed: 50 rpm)



Durability

(measured at 20 rpm)



Durability Test Conditions

- Damper Mounting Posture: Shaft Upwards
- Rotating Speed: 50 rpm
- Durability Operation : Continuous Single Directional Rotation
- Current: 0.065 A (12 V)

Read these instructions before use

This owner's manual contains various safety cautions regarding the proper handling of this product, and preventing danger to the operator as well as damage to the plant and the machine. Please read this manual thoroughly before using the product.



Warning

Definition of Warning

"Warning" applies to situations in which death or serious injuries may occur to the user, etc. if the potential dangers of the products are not avoided.

The decision on the suitability of MRF damper shall be made by an engineer of the equipment or a person who determine the specification.

●Because of the wide variety of conditions of use, the decision on the suitability of MRF damper shall be made by an engineer of the equipment or a person who determine the specification, after the performance verification and life test as necessity.

Do not use the MRF damper outside the range of specification.

- Do not use outside the range of specification for such like operating temperature range, rated voltage and current of the coil, the rated torque, the allowable slip rate, maximum rotational speed.
- There is a risk to receive injury or to make damage for MRF damper and/or peripheral devices.
- There is a risk of Electric shock, burns or fire.
- Due to oil leakage or deterioration of parts, there is a possibility that the durability of the product is significantly decreased.
- Refer to the product page of MRF damper for details.
- When used, it generates heat by energization and or the slip friction of the coil. If the temperature of MRF damper surface is high, adjust the condition and make its surface under 70 °C and prevent the generation of heat.

Implementation of Safety Measures for the Purposes Below.

●Implement the safety measures if used under the following conditions and environment, and consult our company for a judgment on the feasibility check beforehand. Also please take countermeasures against waterproofing, humid proofing as well as the designing of fail-safe, redundant and etc. for the purpose to keep the reliability of safety of the device as user's responsible task.

- 1) The use in the environment other than those standard specifications clearly indicated in the catalog or owner's manual, outdoors, or place exposed to the direct sunlight.
 - 2) Nuclear related devices, devices directly or indirectly related to the running of rail or ship, devices related to aviation or space, military devices, medical devices, devices contacting the potions and foods, combustion equipment, amusement devices that are related to the influence on human and properties, emergency shut off circuit, press machinery, the use for the devices or purposes to which especially the safety is required because of the expected serious influence on the human and properties.
- Environment and the next safety exhibit can not be secured, please do not use the following devices that are required extremely high reliability and safety.
- 1) environment in which there is a possibility of ignition or explosion, or in water or a very high humid.
 - 2) device in relate to the nuclear power, aviation, space, military, life supporting medical equipment, combustion etc.

When you touch the MRF dampers, confirm the power supply of the coil and the peripheral devices are switched off and the temperature of MRF damper is cooled down.

●There is a risk of Electric shock, burns or fire if to mount or dis-mount the MRF damper during the operation of peripheral device or powering the MRF damper.

Ensure the connection of coil lean of MRF damper.

●There is a risk of operation failure, electrical shock or leak if the connection of the leads is incomplete electrically or mechanically.

Do not throw into a fire

As the products contain oil, throwing them into a fire may cause them to ignite, resulting in injuries.



Caution

Definition of "Caution"

"Caution" applies to situations in which minor injuries or property damage may result if the operation or maintenance procedures are not strictly followed.

Do not operate without sufficient mounting strength

- Operating with insufficient mounting strength may damage the main machine and cause injuries.
- Ensure sufficient mounting strength of load torque x safety factor

Do not pull or hang the MRF damper by the leads.

- There is a risk of injury by the fall of MRF damper. Also there is a risk that the leads shall cut and results operational failure or electrical shock or short-circuit.
- Hold the MRF damper when mounting or dis-mounting.
- After the installation, make sure to fix the leads not to contact with MRF damper or with peripheral devices.

Do not rotate the screw on top of MRF damper

●Screw on top of MRF damper is the sealing for oil filling. Do not rotate it otherwise it may cause oil leakage or quality deterioration.

Usage environment

- This product cannot be used in a vacuum or under high pressure as well as in the circumstance where is impact. It may cause damage to the MRF damper or Peripheral equipment
- Do not use in an environment where chips, cutting oil, water, etc. can come in contact with the linear damper. This will result in a malfunction due to an oil leak caused by damage.
- Do not leave or use under the circumstance where is a high humid.

Do not discard oil more than is necessary

- Discarding the oil contained in MRF dampers more than is necessary will pollute the environment.
- Dispose the oil according to laws concerning waste management and cleaning.

Radial/Thrust load to the shaft

●Applying load to the rotating shaft (gear) in a radial/thrust direction may cause an oil leak, torque problems, and damage to the main unit (or to the gear, or cause the gear to become disengaged, if the gear is used).

Do not repair, disassemble or modify the MRF damper

- MRF damper is not corresponded with repairing. In the even of failure and deterioration of performance, please replace it with a new one.
- It is contained the excitation coil and oil in inside of MRF damper. For safety reason, do not repair, disassemble or modify by yourself.
- If the remodeling to MRF damper (additional machining, painting, welding, hardening, etc.) has been carried out, we do not guarantee the MRF damper as well as peripheral equipment.
- Any damage or loss won't be indemnified if the customer performed the repairing, disassembly and modification of MRF damper.

Replacing time of MRF damper

- Product reliable cycles are depended on the using circumstances and conditions; therefore, we cannot determine the life cycle however if there is phenomena such like below please consider that it is the time to replace to the new one.
 1. When the necessary torque is no longer performed even though given rated current.
 2. When the torque started to be appeared without giving eclectic current.
 3. When various torque started to be appeared under a same circumstance.
 4. When abnormal noise, vibration or oil leakage are started to be appeared.
- In particular, high reliability and safeties is required, regardless the phenomenon such like above, we strongly recommend to replace to the new one periodically.

Over-tightening of mounting screws

- Over-tightening the mounting screws when installing a MRF damper may cause damage to the main unit.
Based on the types and sizes of the screws used, please apply an appropriate tightening torque to tighten the screws.
- Use a proper sized screw as the screwing hall of MRF damper is M4 x 5.5 depth. As for tighten torque, make sure under 550N.cm.

Dispose

- In case to dispose the MRF damper, follow the local rules and dispose as industrial waste.