# MINIATURE COUPLINGS—MOL Series

**by Masahide Satoh***

## Introduction

Among the shaft-ends and the couplings (here I will refer those that correct alignment) that connect them in order to transmit power and rotation angle, miniature couplings, aimed chiefly at fields under 1kW, have accompanied the in-crease in recent years of precise positioning and automatic control devices, and have become widely used. The types tend to increasing year after year as well.

Miniature couplings are di-vided into major groups: flexible couplings which allow for parallel and angular misalignment, and rigid couplings which do not.

Rigid couplings can connect two shafts completely and is com-paratively inexpensive because of its simple structure. However, the two shafts must be sufficiently aligned. If there is any misalign-ment, you run the danger of having trouble with stress-induced vibra-tion, noise, and wear.

With flexible couplings, which can transmit power while allowing for misalignment, there are coup-lings that utilize their flexible elasticity and couplings that utilize structural slippage.

Among the former, there are some that use rubber and others that are made of coil or leaf springs. With this type of coupling, the flexible part elastically distorts to allow for misalignment. But at the same time, a load is placed on it in the direction of alignment. With miniature couplings, because they be easily bent with only your finger-tips, they could be installed even without any aligning. However, sufficient alignment is needed, be-cause the load generally increases when the size of the misalignment, the elastic part breaks down through degradation and fatigue, placing a load on the bearings and shortening life.

On the other hand, among the latter, some slip rotationally, some linearly, and some a compound of both. Because misalignment is al-lowed through slipping, some fric-tion does occur. But this is out-weighed by its allowance of large misalignments, saving dramatically

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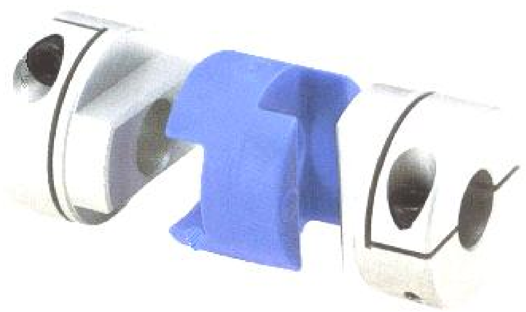
on the man-hours spent on aligning. The smaller the device, the more precise the demand for alignment, but there are not actually many cases in which alignment is extremely loose, either.

Based on this, I will outline the MOL series developed by NBK.

MOL Series

## Basic Principles

The MOL series is the so-called Oldham type coupling, allowing misalignment by the slipping mentioned above, and has diameters from ø16 to ø32. This coupling is made up of two hubs and a spacer, with the hub fitting in-to perpendicular recesses, one on each side of the spacer. The hubs slip within these straight recesses while maintaining contact with the spacer.



Hubs and Spacer

To decrease the slipping induced friction as much as possible, the spacer uses a special lightweight, wear-resistant polyacetal resin with a low friction coefficient. To de-crease the moment of inertia caused by spacer movement, the hubs are made of an aluminum alloy. Also, stability is maintained by wide and deep recesses, besides its short overall length and compact structure.

With flexible couplings, checking for parallel error during alignment is especially necessary. This is because of the very large load placed on the elastic part or the coupling, for, as shown in Figure 1, parallel error can be thought

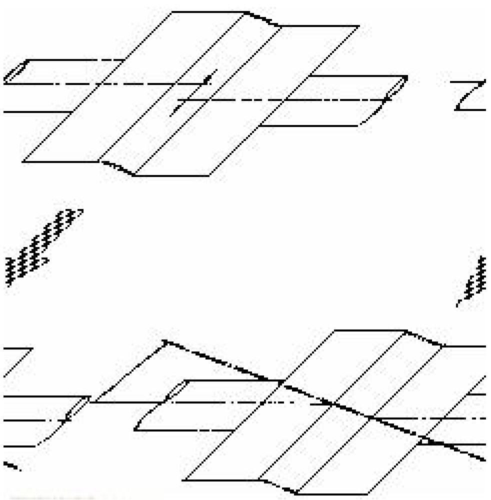


Figure 1

of as two angular errors in the opposite direction. Therefore, it is desirable to make the parallel error as small as possible.

In contrast, it is necessary to check for angular error with the Oldham type couplings, which slip to correct misalignment. Because the slipping portion is perpendicular to center, parallel misalignment is easily correctable through slipping. However, with angular misalignment, the slipping direction is un-fixed, the contact area between the hubs and the spacer decreases, and wear is promoted. Also, if shaft end-play occurs as well, it is conceivable that the spacer and the hubs could interfere with the area around the coupling and cause a moment of bending. As a measure against that, we have added projections to the spacer portion. These projections stabilize the slipping and decrease the moment of bending. (See Figure 2.)

Spacer Projections

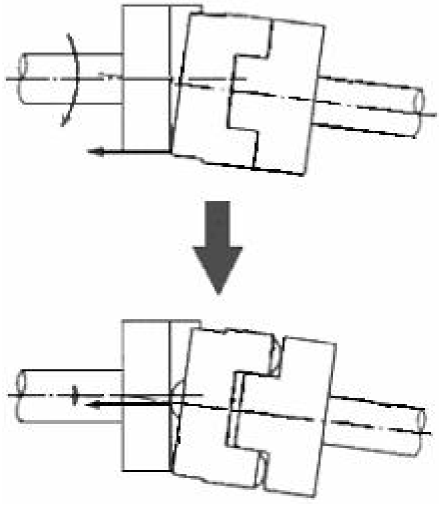


Figure 2

## Features

Large allowable misalignment. Through improving the ordinary Oldham coupling with a unique design, the MOL series can allow for large misalignments with-out any hindrance. Also, few parts mean few man-hours for assembly.

High torsional stiffness and torque. Because flexible couplings have some bend towards the twisting direction, various ideas are tried in order to gain torsional stiff-ness. In contrast, slipping coup-lings fundamentally have high torsional stiffness and torque. The MOL, too, has high torsional stiff-ness and high torque with its special torsionally stiff placental resin spacer.

Still more, the MOL has high responsiveness with zero backlash because of the hubs' and spacer's precise fit.

Slight misalignment-induced load. The MOL allows for some assembly error, and the load place on the coupling is low because friction is low. Consequently, it can be used in high-speed rotations with almost no vibration or noise.

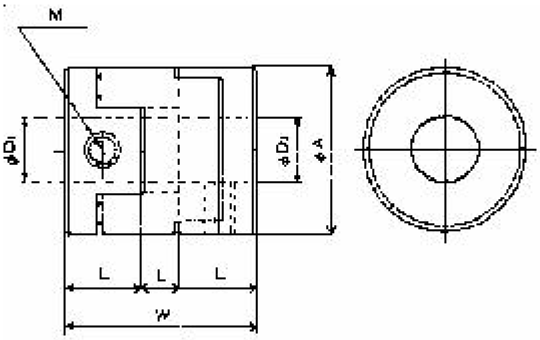
Electrically insulating. The spacer completely insulates the two aluminum hubs. Consequently, the MOL can be used in applications requiring on-conductiveness.

## Form and dimensions

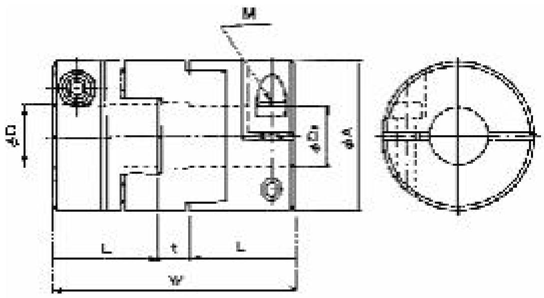
We have standardized four outer diameter sizes ranging from 16 mm to 32 mm with two shaft attachment types: setscrew and clamping. There are a total of 52 size combinations with the bore diameter. The measurement and performance specifications are shown in the table.

## Conclusion

As outlined above, the MOL series can overcome most of the demands placed on miniature couplings through its simple structure and unique design.




Setscrew Type, ,Clamping Type




**[Table]**

| Catalog Number | A | L | W | M | Rated Torque | Max. Rot. Frequency | Mass | Moment of Inertia | Static Tors. Stiffness | Errors of Ecc. | Errors of Ang. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (mm) | | | | (N·m) | ($min^{-1}$) | (g) | ($kg·m^2$) | (N·m /rad) | (mm) | (°ả |
| MOL-16 | 16 | 7 | 18 | M3 | 0.7 | 9500 | 7 | $3.2x10^{-7}$ | 31 | 1.0 | |
| MOL-20 | 20 | 9 | 23 | M4 | 1.2 | 7600 | 14 | $1.1x10^{-6}$ | 60 | 1.5 | |
| MOL-25 | 25 | 11 | 28 | M5 | 2 | 6100 | 27 | $3.0x10^{-6}$ | 140 | 2.0 | |
| MOL-32 | 32 | 13 | 33 | M6 | 4.5 | 4800 | 50 | $9.5x10^{-6}$ | 280 | 2.5 | |
| MOL-40 | 40 | 14 | 32 | M6 | 9 | 3800 | 80 | $2.3x10^{-5}$ | 540 | 3.0 | |
| MOL-50 | 50 | 17 | 38 | M8 | 18 | 3100 | 150 | $6.7x10^{-5}$ | 820 | 3.5 | |
| MOL-63 | 60 | 21 | 47 | M10 | 36 | 2400 | 300 | $2.2x10^{-4}$ | 1900 | 4.0 | |
| MOL-16C | 16 | 13 | 29 | M2.5 | 0.7 | 9500 | 12 | $5.8x10^{-7}$ | 31 | 1.0 | 3 |
| MOL-20C | 20 | 14 | 33 | M2.5 | 1.2 | 7600 | 19 | $1.5x10^{-6}$ | 60 | 1.5 | |
| MOL-25C | 25 | 17 | 39 | M3 | 2 | 6100 | 36 | $4.4x10^{-6}$ | 140 | 2.0 | |
| MOL-32C | 32 | 19 | 45 | M4 | 4.5 | 4800 | 69 | $1.4x10^{-5}$ | 280 | 2.5 | |
| MOL-40C | 40 | 23 | 50 | M5 | 9 | 3800 | 130 | $4.1x10^{-5}$ | 540 | 3.0 | |
| MOL-50C | 50 | 27 | 58 | M6 | 18 | 3100 | 230 | $1.2x10^{-4}$ | 820 | 3.5 | |
| MOL-63C | 63 | 33 | 71 | M8 | 36 | 2400 | 450 | $3.7x10^{-4}$ | 1900 | 4.0 | |

| Catalog Number | Stock Bores (D) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 4.5 | 5 | 6 | 6.35 | 7 | 8 | 9.525 | 10 | 11 | 12 | 14 | 15 | 16 | 18 | 20 | 25 |
| MOL-16 | • | • | • | • | • | • | | | | | | | | | | | | |
| MOL-20 | | • | • | • | • | • | • | • | | | | | | | | | | |
| MOL-25 | | | | • | • | • | • | • | • | • | | | | | | | | |
| MOL-32 | | | | | | | | • | • | • | • | • | • | | | | | |
| MOL-40 | | | | | | | | | | • | • | • | • | • | • | | | |
| MOL-50 | | | | | | | | | | | | | • | • | • | • | • | |
| MOL-63 | | | | | | | | | | | | | | | • | • | • | • |
| MOL-16C | | | • | • | • | | | | | | | | | | | | | |
| MOL-20C | | | | | • | • | • | • | | | | | | | | | | |
| MOL-25C | | | | | | • | • | • | • | • | | | | | | | | |
| MOL-32C | | | | | | | | • | • | • | • | • | • | | | | | |
| MOL-40C | | | | | | | | | | | | • | • | • | • | | | |
| MOL-50C | | | | | | | | | | | | | | | • | • | • | |
| MOL-63C | | | | | | | | | | | | | | | | • | • | • |