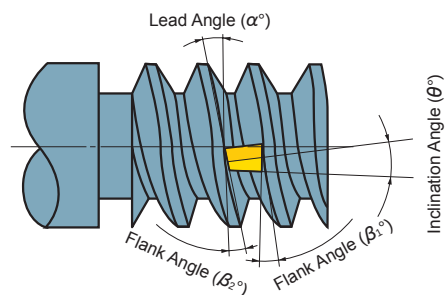


## SELECTING A SHIM FOR THE MMT SERIES

### FLANK ANGLE AND LEAD ANGLE

Lead angle ( $\alpha$ ) depends on a combination of thread diameter and pitch. Select a shim so that the lead angle of the thread can coincide with the flank angles of the thread and insert ( $\beta_1, \beta_2$ ). No need to change a shim for general threading with an MMT holder. When threading with a small diameter or large pitch, change the shim depending on the lead angle, referring to the table and graph below. When threading left hand threads, change to a shim with a negative inclination angle.



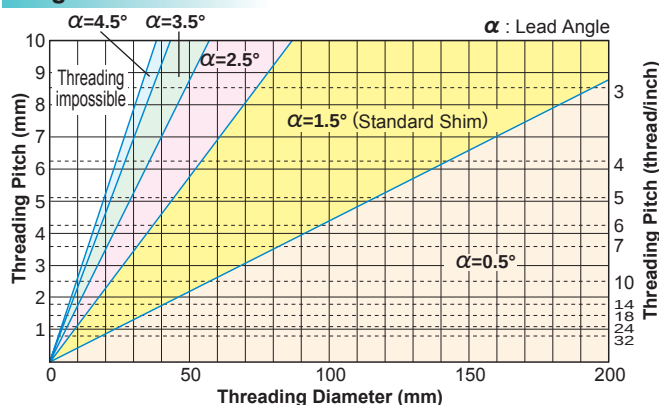
### SHIM REFERENCE TABLE (THREADING DIAMETER)

| Lead Angle<br>Pitch (mm) | Right Hand Thread (mm) |               |               |               |                |         | Left Hand Thread (mm) |                |         |
|--------------------------|------------------------|---------------|---------------|---------------|----------------|---------|-----------------------|----------------|---------|
|                          | Threading impossible   | 4.5°          | 3.5°          | 2.5°          | 1.5°           | 0.5°    | Threading impossible  | -1.5°          | -0.5°   |
| 0.5                      | ≤φ1.9                  | φ1.9 — φ2.2   | φ2.2 — φ2.8   | φ2.8 — φ4.3   | φ4.3 — φ11.4   | ≥φ11.4  | ≤φ4.3                 | φ4.3 — φ11.4   | ≥φ11.4  |
| 0.75                     | ≤φ2.9                  | φ2.9 — φ3.2   | φ3.2 — φ4.3   | φ4.3 — φ6.5   | φ6.5 — φ17.1   | ≥φ17.1  | ≤φ6.5                 | φ6.5 — φ17.1   | ≥φ17.1  |
| 1                        | ≤φ3.8                  | φ3.8 — φ4.3   | φ4.3 — φ5.7   | φ5.7 — φ8.7   | φ8.7 — φ22.8   | ≥φ22.8  | ≤φ8.7                 | φ8.7 — φ22.8   | ≥φ22.8  |
| 1.25                     | ≤φ4.8                  | φ4.8 — φ5.4   | φ5.4 — φ7.1   | φ7.1 — φ10.9  | φ10.9 — φ28.5  | ≥φ28.5  | ≤φ10.9                | φ10.9 — φ28.5  | ≥φ28.5  |
| 1.5                      | ≤φ5.7                  | φ5.7 — φ6.5   | φ6.5 — φ8.5   | φ8.5 — φ13.0  | φ13.0 — φ34.2  | ≥φ34.2  | ≤φ13.0                | φ13.0 — φ34.2  | ≥φ34.2  |
| 1.75                     | ≤φ6.7                  | φ6.7 — φ7.6   | φ7.6 — φ9.9   | φ9.9 — φ15.2  | φ15.2 — φ39.9  | ≥φ39.9  | ≤φ15.2                | φ15.2 — φ39.9  | ≥φ39.9  |
| 2                        | ≤φ7.6                  | φ7.6 — φ8.6   | φ8.6 — φ11.4  | φ11.4 — φ17.4 | φ17.4 — φ45.6  | ≥φ45.6  | ≤φ17.4                | φ17.4 — φ45.6  | ≥φ45.6  |
| 2.5                      | ≤φ9.5                  | φ9.5 — φ10.8  | φ10.8 — φ14.2 | φ14.2 — φ21.7 | φ21.7 — φ57.0  | ≥φ57.0  | ≤φ21.7                | φ21.7 — φ57.0  | ≥φ57.0  |
| 3                        | ≤φ11.4                 | φ11.4 — φ13.0 | φ13.0 — φ17.0 | φ17.0 — φ26.0 | φ26.0 — φ68.4  | ≥φ68.4  | ≤φ26.0                | φ26.0 — φ68.4  | ≥φ68.4  |
| 3.5                      | ≤φ13.3                 | φ13.3 — φ15.1 | φ15.1 — φ19.9 | φ19.9 — φ30.4 | φ30.4 — φ79.8  | ≥φ79.8  | ≤φ30.4                | φ30.4 — φ79.8  | ≥φ79.8  |
| 4                        | ≤φ15.2                 | φ15.2 — φ17.3 | φ17.3 — φ22.7 | φ22.7 — φ34.7 | φ34.7 — φ91.2  | ≥φ91.2  | ≤φ34.7                | φ34.7 — φ91.2  | ≥φ91.2  |
| 4.5                      | ≤φ17.1                 | φ17.1 — φ19.4 | φ19.4 — φ25.6 | φ25.6 — φ39.1 | φ39.1 — φ102.6 | ≥φ102.6 | ≤φ39.1                | φ39.1 — φ102.6 | ≥φ102.6 |
| 5                        | ≤φ19.0                 | φ19.0 — φ21.6 | φ21.6 — φ28.4 | φ28.4 — φ43.4 | φ43.4 — φ114.0 | ≥φ114.0 | ≤φ43.4                | φ43.4 — φ114.0 | ≥φ114.0 |

(Note) Back turning in the case of left hand threads.

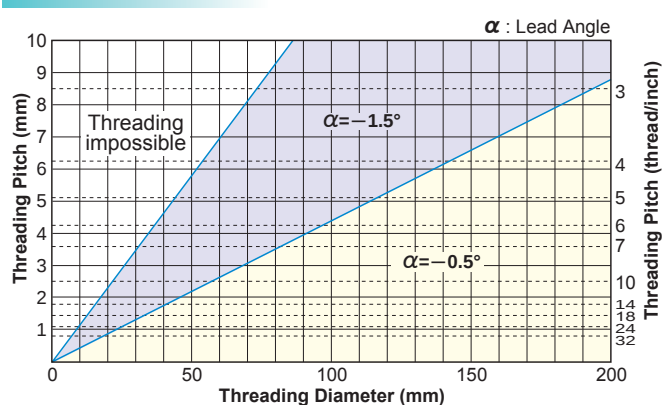
### SHIM REFERENCE GRAPH

#### Right Hand Thread



(Note) When a thread lead angle ≤ the tool flank angle, change the shim to prevent side interference with the insert.  
(Refer to the table below for the calculation of thread lead angle and tool flank angle.)

#### Left Hand Thread



When replacing a shim, check if the difference between the thread lead angle and shim inclination angle is within:

2.5° — 0.5° where thread helix angle is 60° (55°)

2° — 1° where thread helix angle is 30° (29°)

★ Inclination angle of a standard shim is 0°.

★ The holder has a 1.5° lead angle.

### CALCULATION OF THREAD LEAD ANGLE

$$\tan \alpha = \frac{l}{\pi d} = \frac{nP}{\pi d}$$

$\alpha$  : Lead angle  
 $l$  : Lead  
 $n$  : Number of threads  
 $P$  : Pitch  
 $d$  : Effective diameter of thread

### EXAMPLE OF SELECTING A SHIM

- When the thread lead angle is 2.2°
  - In the case when the thread helix angle is 60°  
(2.2° lead angle) — (2.5° — 0.5°) = -0.3° — 1.7° shim inclination angle is appropriate. Threading with a standard shim (0° inclination angle) is possible. But, replacing with a shim with a 1° inclination angle is recommended, refer to Standard Shim List on pages G012 and G013.
  - In the case when the thread helix angle is 30°  
(2.2° lead angle) — (2° — 1°) = -0.2° — 1.2° shim inclination angle is appropriate. Replacing with a shim with a 1° inclination angle is recommended, referring to Standard Shim List on pages G012 and G013.

### RELIEF ANGLE OF AN INSERT SET ON A HOLDER

| Thread Helix Angle | Internal Relief Angle | External Relief Angle |
|--------------------|-----------------------|-----------------------|
| 60°                | 8.8°                  | 5.8°                  |
| 55°                | 7.9°                  | 5.2°                  |
| 30°                | 4.1°                  | 2.7°                  |
| 29°                | 4°                    | 2.6°                  |

• Relief angles ( $\beta_2, \beta_1$ ) of an insert become small when the thread helix angle of a trapezoidal, round, or other thread is small. Take care when selecting a shim.