Pascal

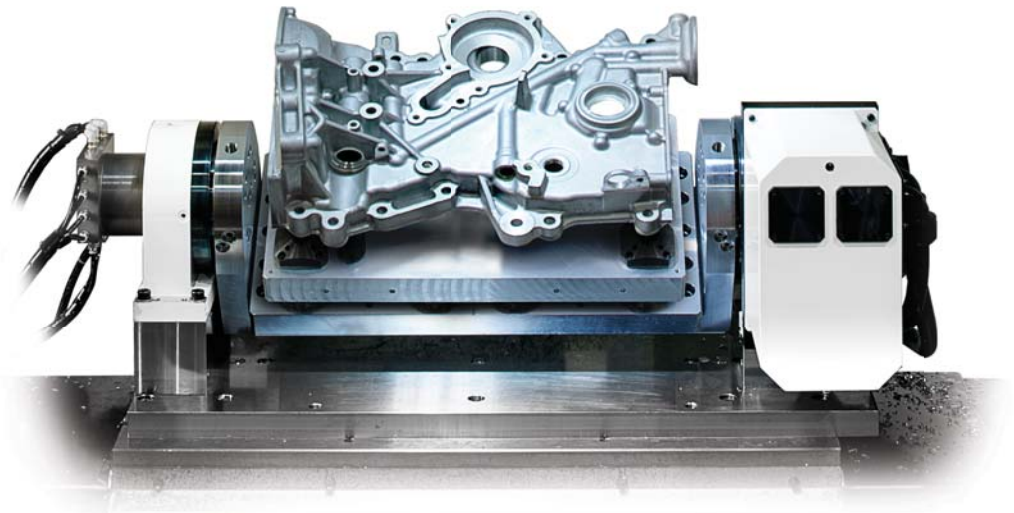
# Roller gear index table

Roller gear mechanism

Roller gear index table model MDF130

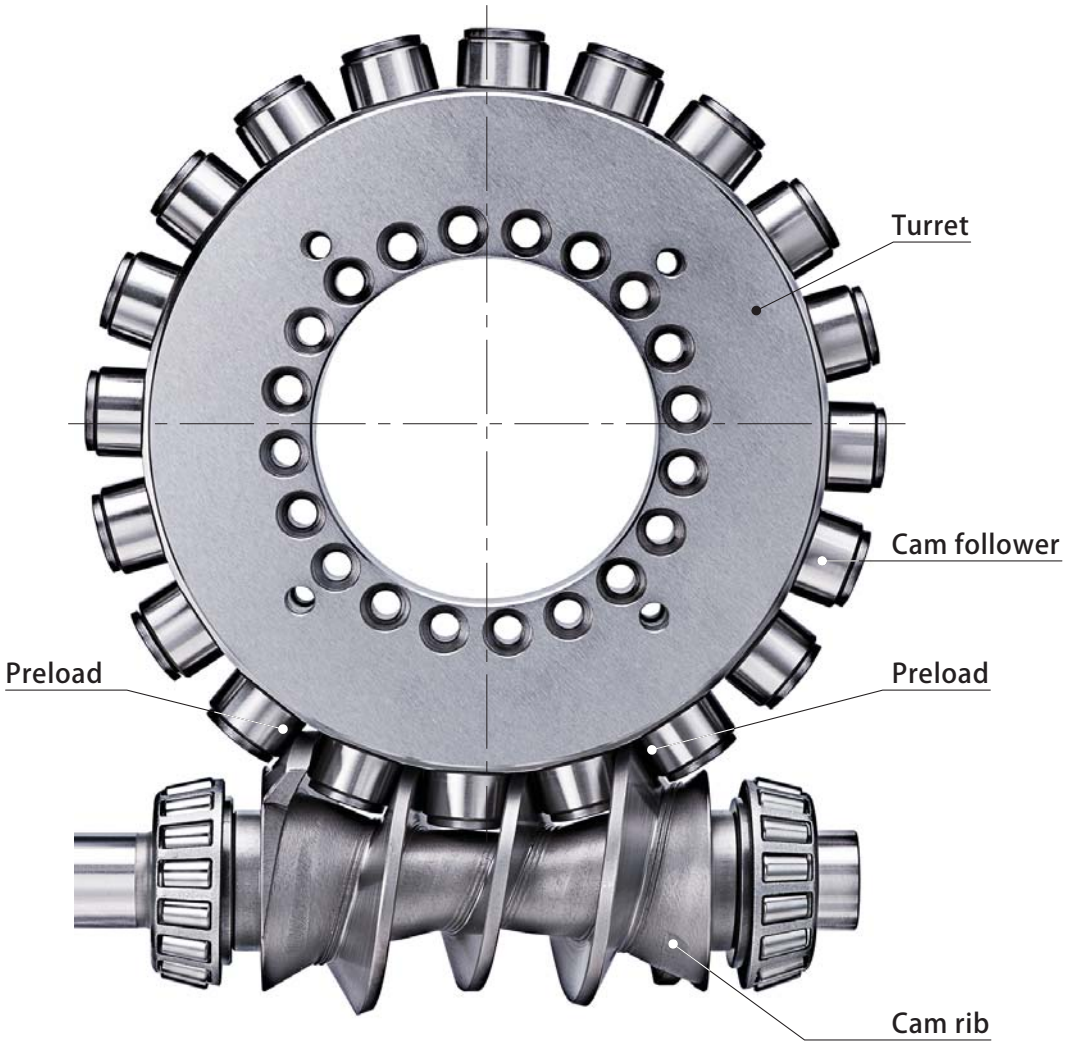
# Roller gear index table model MDF130



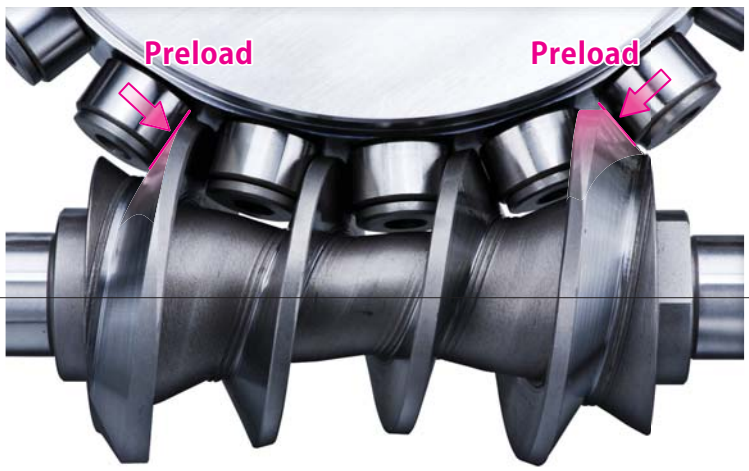


# Roller gear drive for high-speed indexing of heavy jigs

- Because the roller gear cam and turret are processed with high precision, stabel preload can be applied to the cam mechanism and there is no backlash. The high-speed indexing can be performed under high load conditions that could not be realized with a worm gear index table.




Preload mechanism

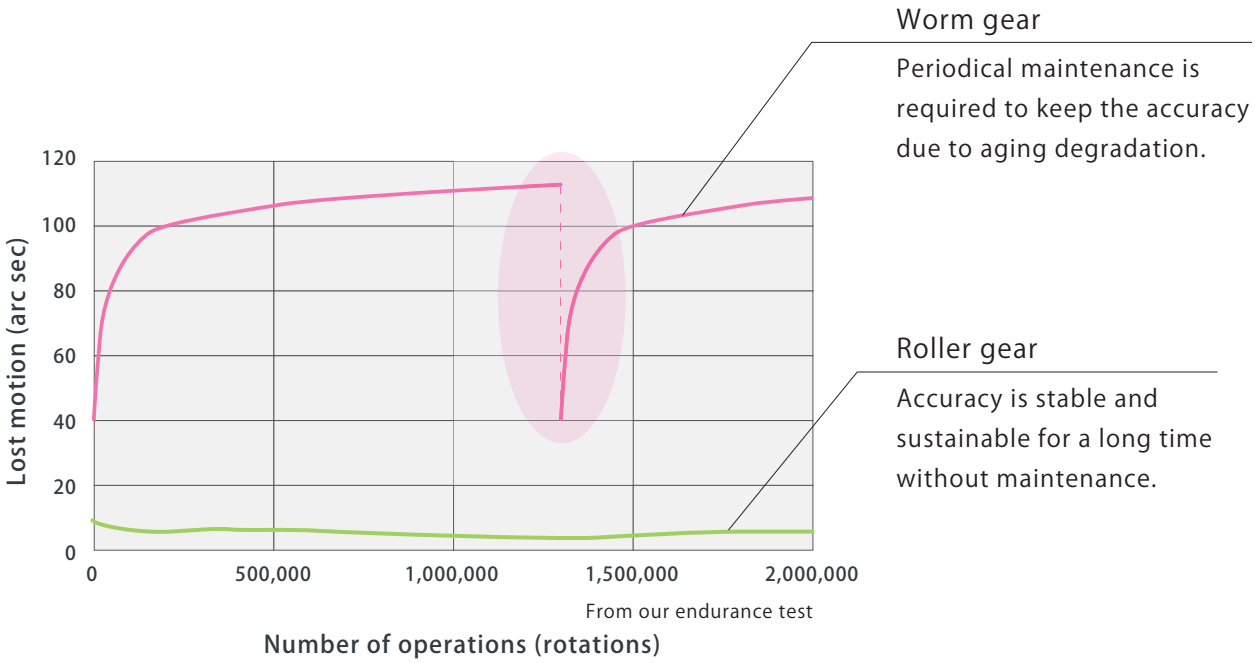



Lock torque of the servo motor can be transmitted at all times, by means of preload and the braking force (clamping force) is applied to the turret shaft thereby no external brake is required.

# Maintenance free even in high speed and high load operation

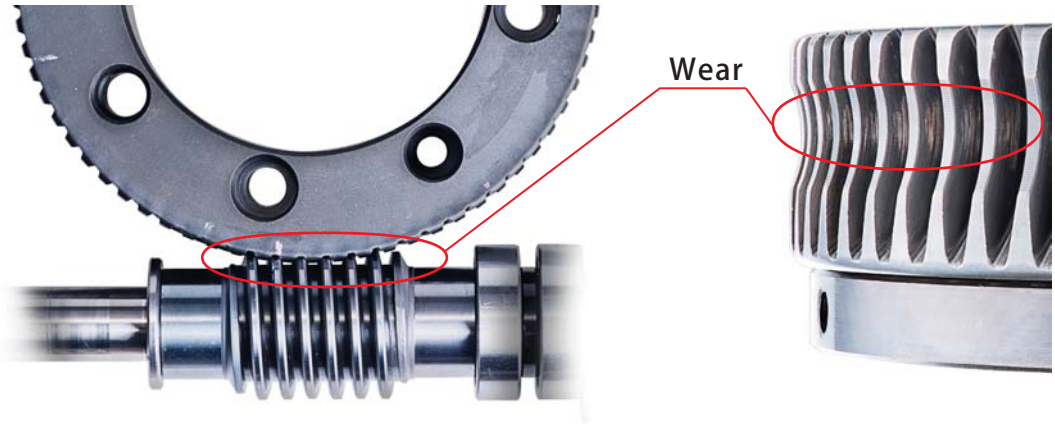
Roller gears are rolling transmission and there is no wear and accuracy is stable even at high load and high speed. The high-quality machining enables a stable production without maintenance for a long term.

On the other hand, worm gears are slip transmission and it causes the increase of backlash as the worm wears due to high load and high speed rotation, therefore periodical inspection and backlash adjustment must be performed to avoid machining defect or degrading indexing accuracy.




## Big problem of worm gears

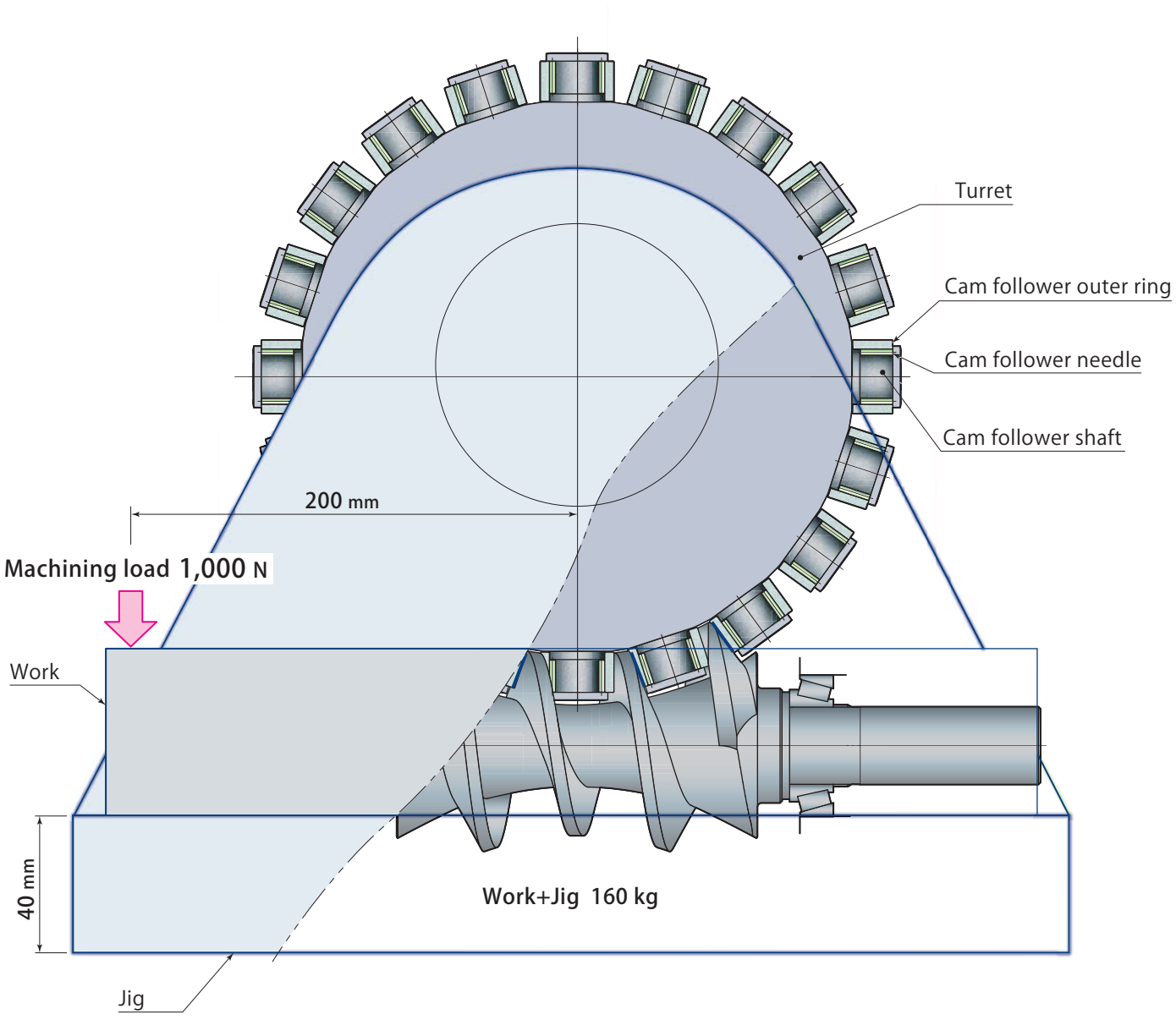
Because worm gears are in sliding contact, wear occurs when a large load is applied or index speed is increased and backlash adjustment is required at an early stage. Accuracy issues also arise.



The high torque characteristics and servo lock function of the roller gear index table can increase cutting conditions even at machining points far away from the rotation center and improve productivity and machining accuracy.

## Example under the machining load torque 200N•m

**Allowable torque Max 346 N•m**



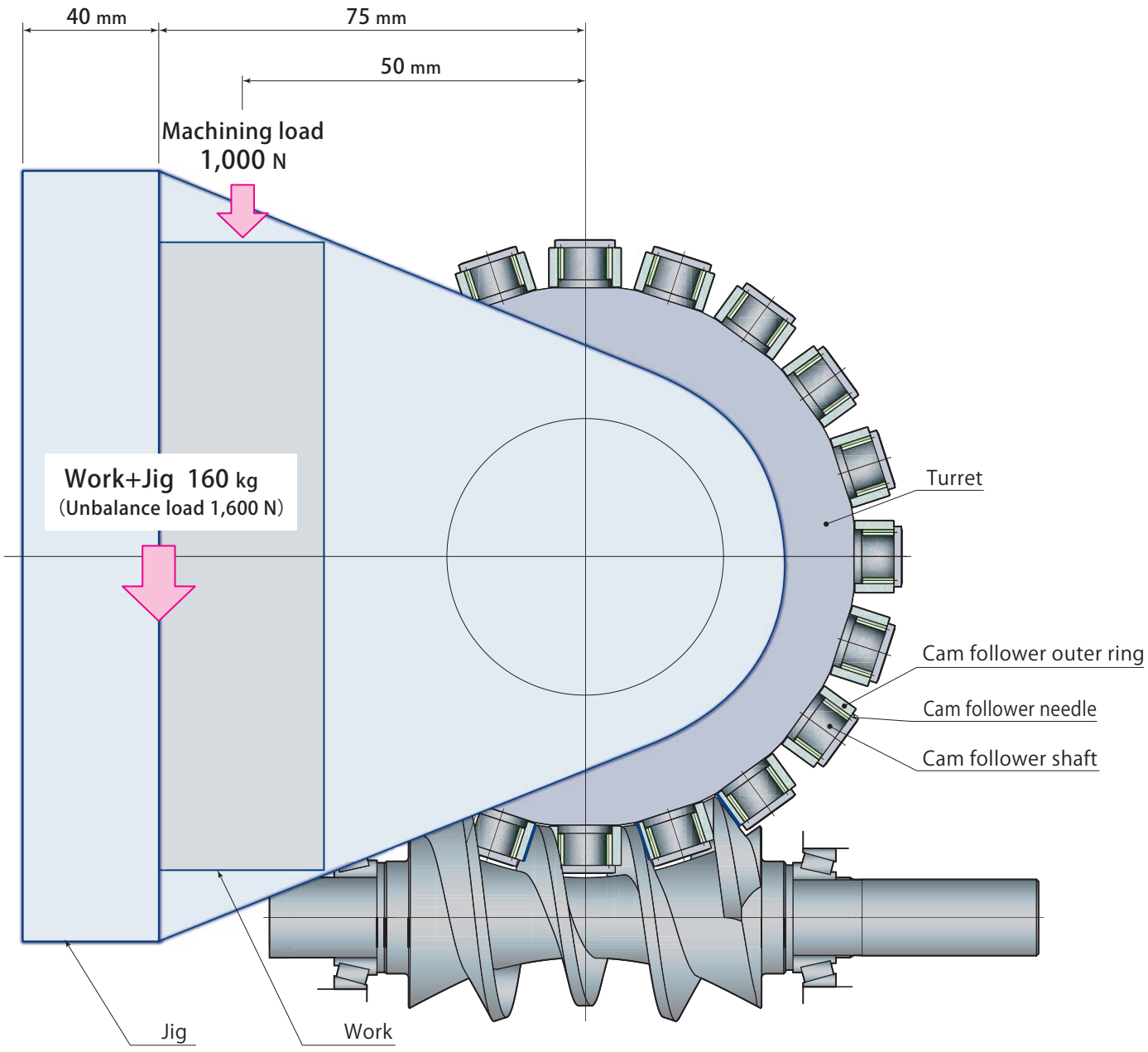
## cutting with high efficiency.

● The brakeless and high-torque roller gear index table can withstand the machining load even when the unbalanced load of 90° indexed high-rigidity and heavy jig is large and provide high productivity.

### Example under the total load torque 170N•m

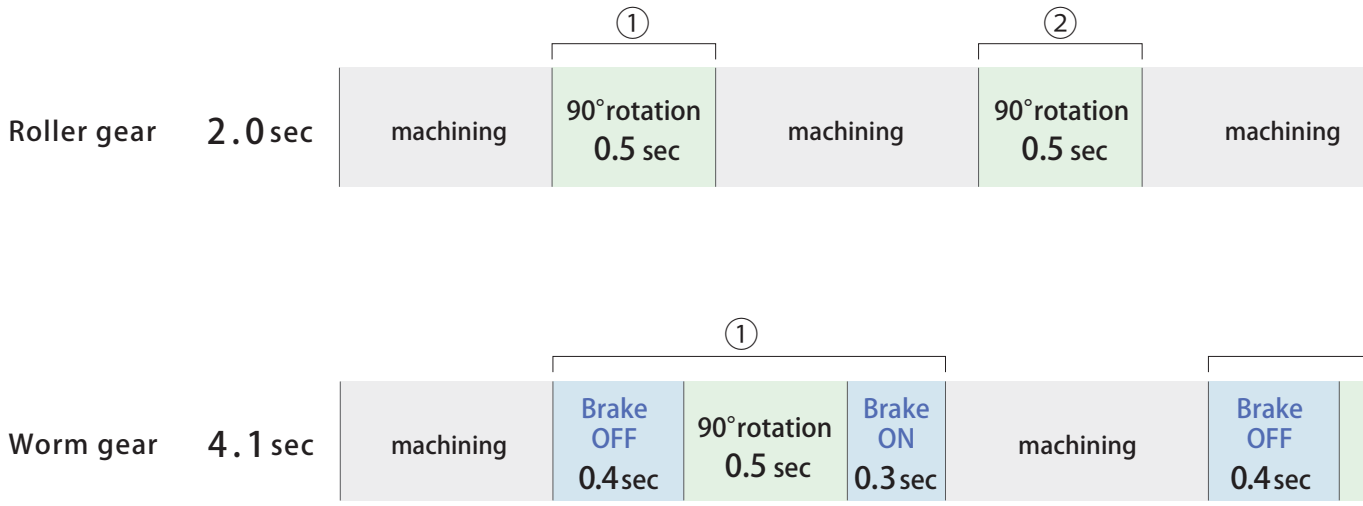
**Machining load torque 50 N•m unbalance torque 120 N•m**

**Allowable torque Max 346 N•m**



# The preloaded high-precision roller gear index table model MDF

- The roller gear of the speed reduction mechanism without backlash can maintain the servo lock function even with a heavy load and can perform a brakeless machining.
  There is no ON / OFF action by the brake, and the time loss during indexing is “0”, resulting in extremely high productivity.
  Also, the index point is not displaced when the brake is on, and accuracy does not deteriorate.
  In addition, the risk of machine down is reduced because there is no factor for air brake failure, which causes a problem in high humidity areas where the factory air environment is poor.

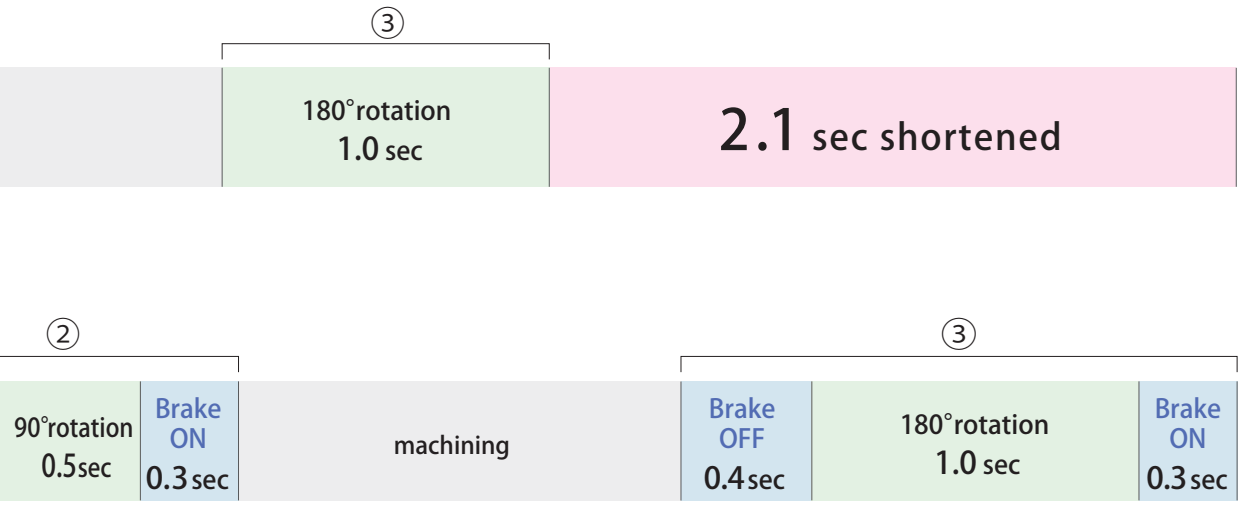



## Performance example　Significant reduction in tact time

- A worm gear index table with a table diameter of ø260mm was used and the jig was too large to increase the index speed.
- Compact, high torque and high speed roller gear index table model MDF130 has reduced tact time by 11% (3.3 seconds), enabling production efficiency improved a great deal.

## 130 enables brakeless operation and high productivity.

● As shown in the figure below, the worm gear index table requires the braking the rotating shaft and it takes 0.4 seconds to brake OFF x 3 times = 1.2 seconds it takes 0.3 seconds to brake ON x 3 times = 0.9 seconds thereby it takes total 2.1 seconds to conduct 1 operation required, however, as for roller gears, the brake ON / OFF action will be naught. In other words, 2.1 sec. differnce between the two will work later significantly for the production efficiency. This time difference is surely more than the initial cost difference between the roller gear and the worm gear.

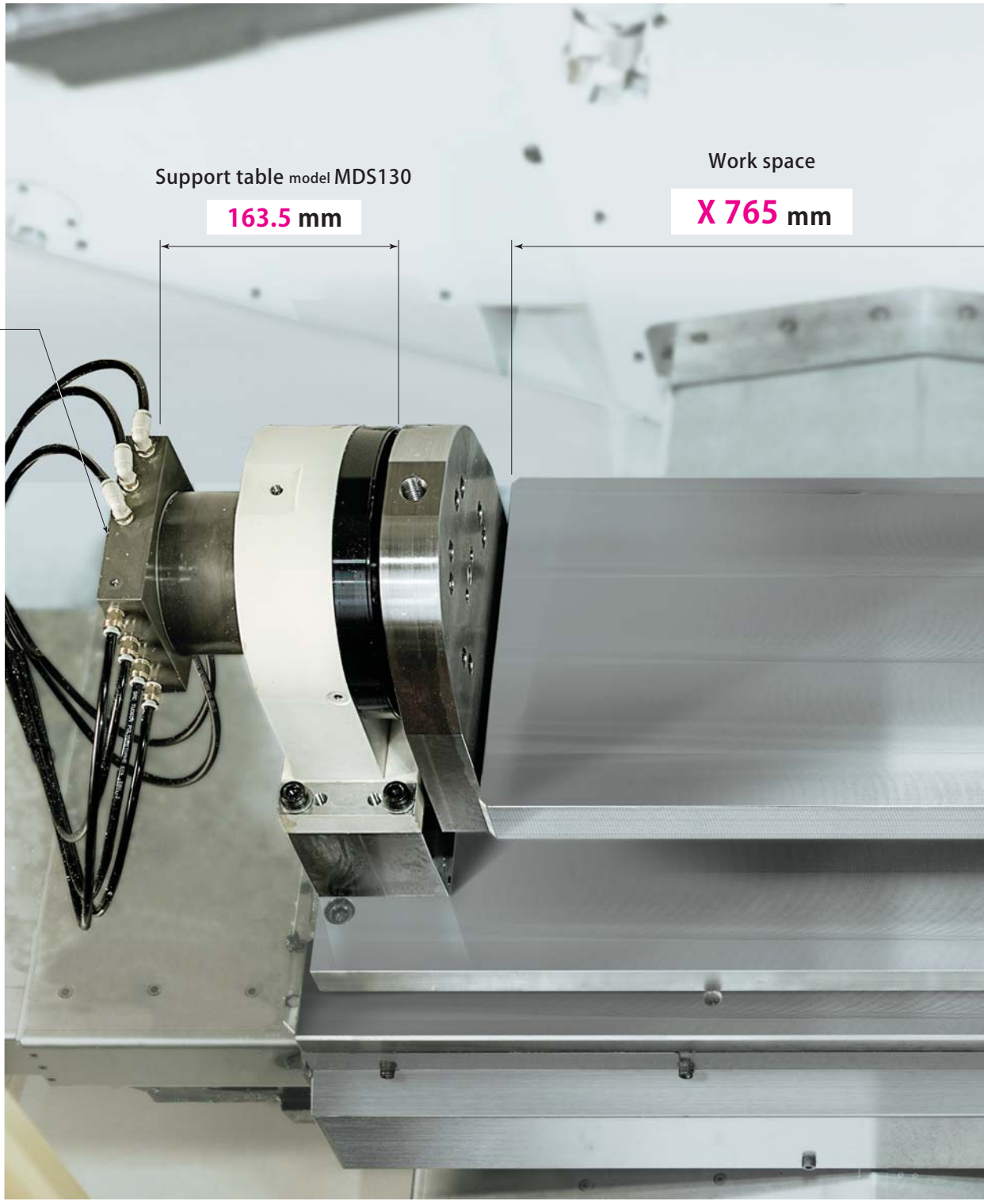



| | Process 1 | Operating hours | Machine operation rate | Production time (30,000 pieces per month) |
|---|---|---|---|---|
| Worm gear | 30.0 sec | 2 shifts,8-hour workingper shift=16 hours 80% (16 hours × 80% = 46,080 sec.) | | 312 hours |
| Roller gear | 26.7 sec | 2 shifts,8-hour workingper shift=16 hours 80% (16 hours × 80% = 46,080 sec.) | | 278 hours |

**2.1 days for 1 month (20 days)** **25.2 days for 1 year can be shortened**

## model MDF130 integrating high torque roller gear in a compact

- Large sized workpiece or two piece machining is feasible even on #30 machining center with table sizing X axis 850 mm and Y axis 410 mm, enabling 765 mm by 400 mm workpiece setting space.



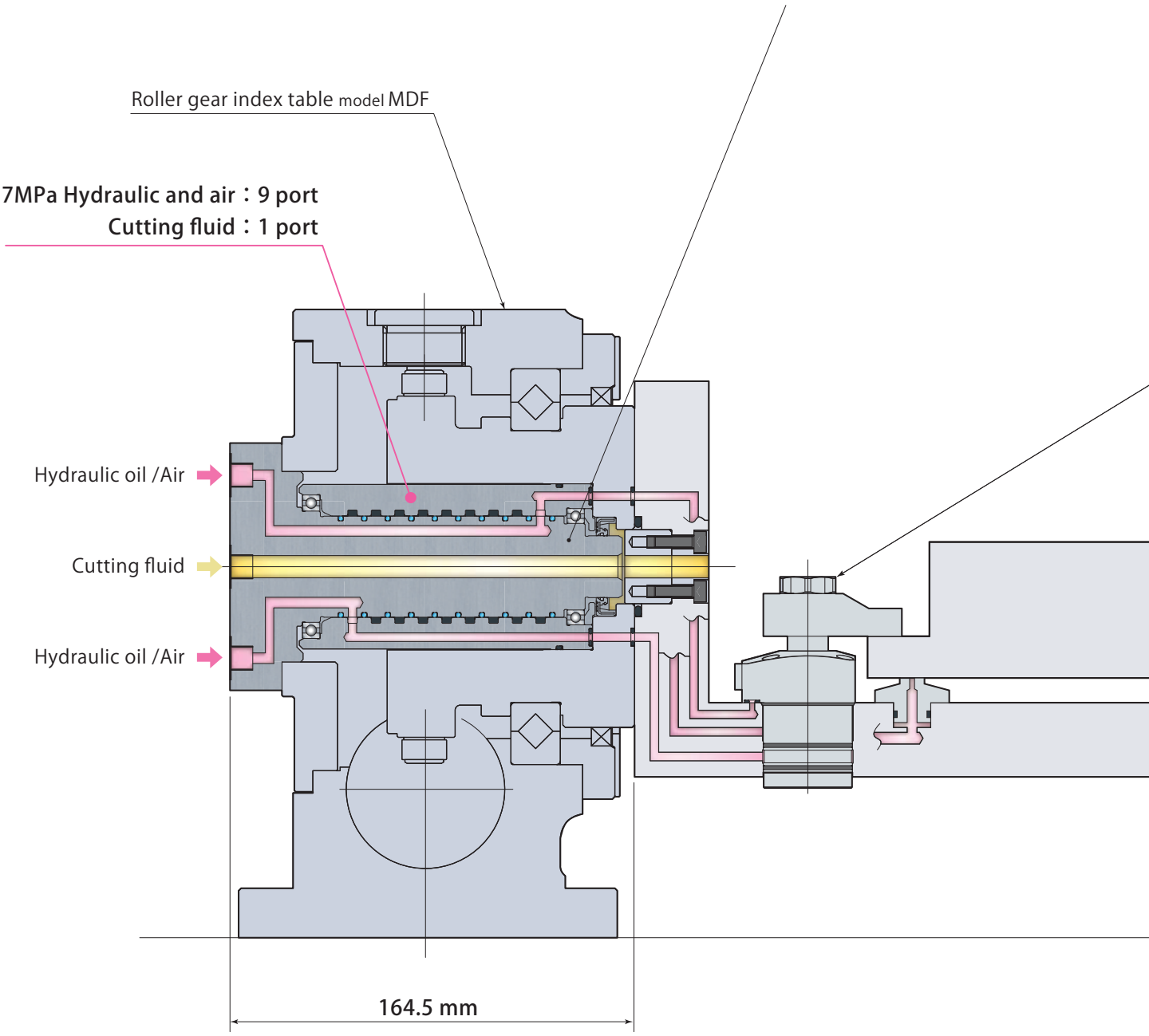
## body can realize dramatically improve productivity.

- The compact roller gear index table model MDF130 with a body width of 164.5 mm and the support table model MDS130 with a width of 163.5 mm achieves the selection of a smaller machining center.

# 7MPa rotary joint 18 ports plus 2 ports for cutting fluid allows

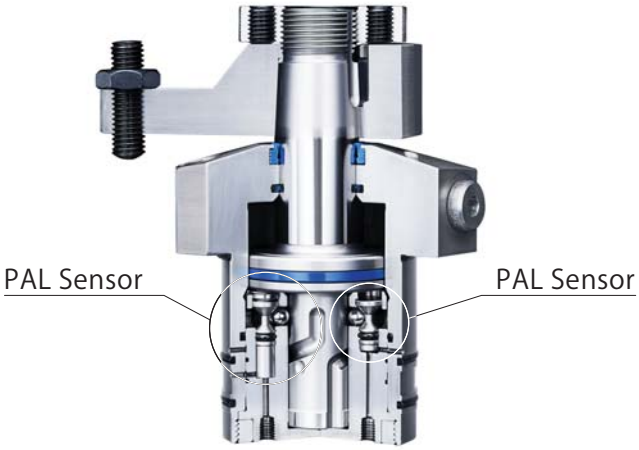
- 18-port rotary joint allows to select sensor model work clamp, enabling the user to have workpiece transfer robot (loader) synchronized with the jig which helps to eliminate down time when exchanging the workpinces, Combining feasure of high speed indexing and the 18-port rotary joint can generate a synergy effect to imporove total productivity.

Pascal is a manufacturer of high quality rotary joints.
20,000 units have been delivered in 20 years.

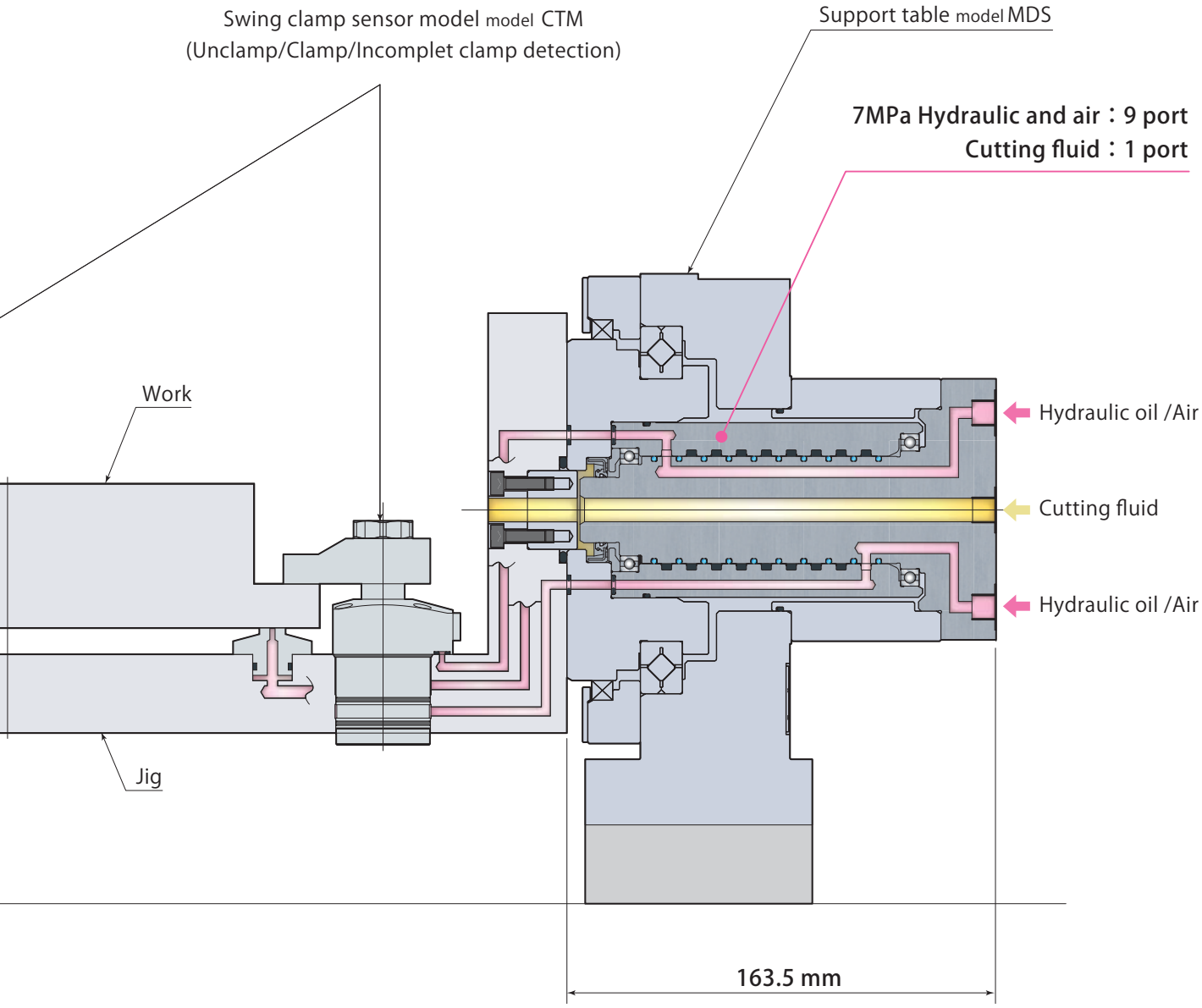


## a sensor model work clamp and productivity increase

- The coolant through the center makes it easy to eliminate the metal chips being deposited on the jig.




Swing clamp sensor model model CTM
(Unclamp/Clamp/Incomplet clamp detection)

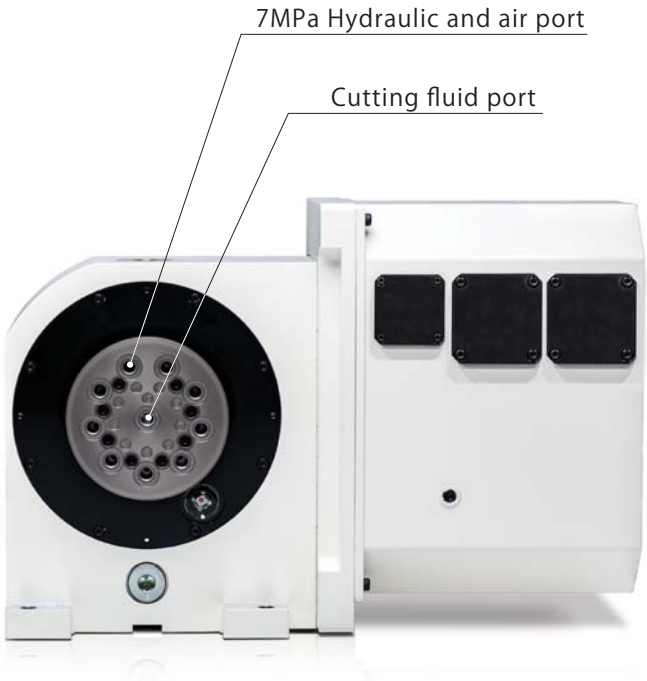


## Roller gear index table model MDF130

Rotary joint

7MPa Hydraulic and air 9 port
Cutting fluid 1 port

164.5 mm



## center to machine large-size workpieces.

### Support table model MDS130

Rotary joint

No port

93.5 mm

Rotary joint

7MPa Hydraulic and air 3 port
Cutting fluid 1 port

106.5 mm

Rotary joint

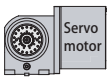
7MPa Hydraulic and air 9 port
Cutting fluid 1 port

163.5 mm

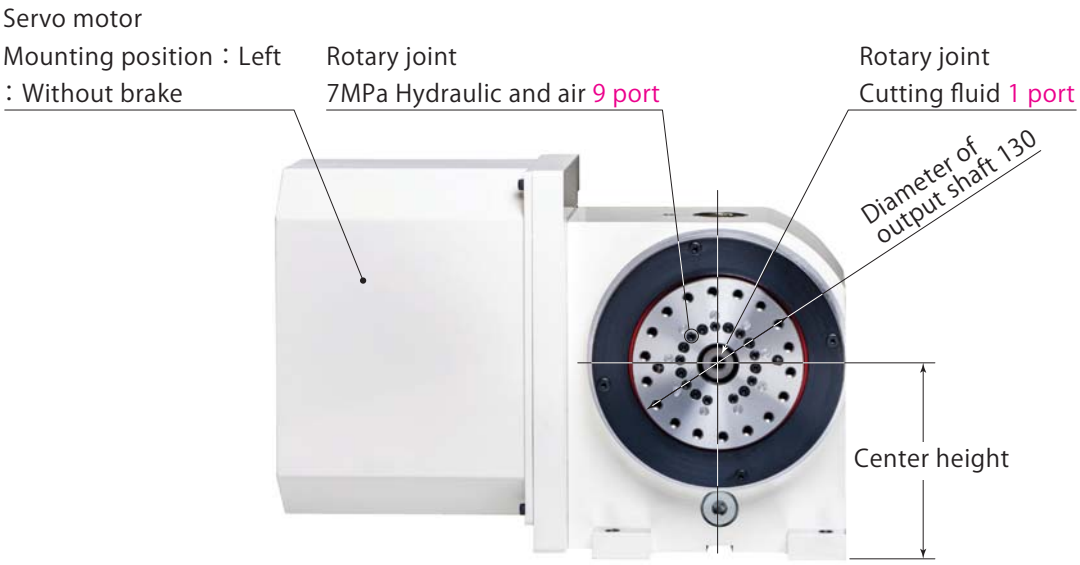
7MPa Hydraulic and air port

Cutting fluid port

## Specifications

| | Servo motor mounting position | | Rotary joint | Piping port of rotary joint | | Servo motor brake |
|---|---|---|---|---|---|---|
| MDF130A | L : Left  | — | R : Built-in | : G thread | F | B : Servo motor with brake |
| | R : Right  | | : None | C : Rc thread | | : Without brake |

Example：MDF130AL-RF




- For the hydraulic connection, Rc port is applied, a sealing tape is normally used for the piping but bits of the table may cause internal leakage of a rotary joint or malfunction of the actuator. Model MDF introduces G port which accepts the fittings with bonded seal being composed with a metal ring and rubber thereby no bits or debris that causes internal leakgae is produced when piping.
- A servo motor without a brake cannot hold the table stop position when the servo is OFF. If it is necessary to hold the table stop position when the servo is OFF, choose a servo motor with a brake. (The servo motor brake is just for holding position in place and cannot support machining load.)

| Model | | | MDF130A □-R□F□ | MDF130A □-F |
|---|---|---|---|---|
| | | | Hydraulic and air 9 port Cutting fluid 1 port | No rotary joint |
| Mass | | kg | 50 | 45 |
| Output shaft diameter | | mm | ø130 | |
| Center height | | mm | 150 | |
| Inner diameter of output shaft (mouth) | | mm | ø30H7 | |
| Total reduction ratio | | | 1/60 | |
| Max. rotation speed | | rpm | 50 (Motor rotational speed 3000rpm) | |
| Servo motor | | | FANUC αiF4/5000-B | |
| Index accuracy | | arc sec | ±20 | |
| Repeatability | | arc sec | 10 ＊ | |
| Lubrication | | | Oil bath | |
| Operating temperature | | ℃ | 0–40 | |
| Allowable loading capacity (When rotating) | | | | |
| Work load | Without Support table | kg | 80 | |
| | With Support table | kg | 160 | |
| Moment of inertia | | kg·m$^2$ | 1.88 | |
| Allowable loading capacity (When machining) | | | | |
| Radial load | | kN | 6 | |
| Loaded torque | | N·m | 346 | |
| Loaded moment | | N·m | 600 | |

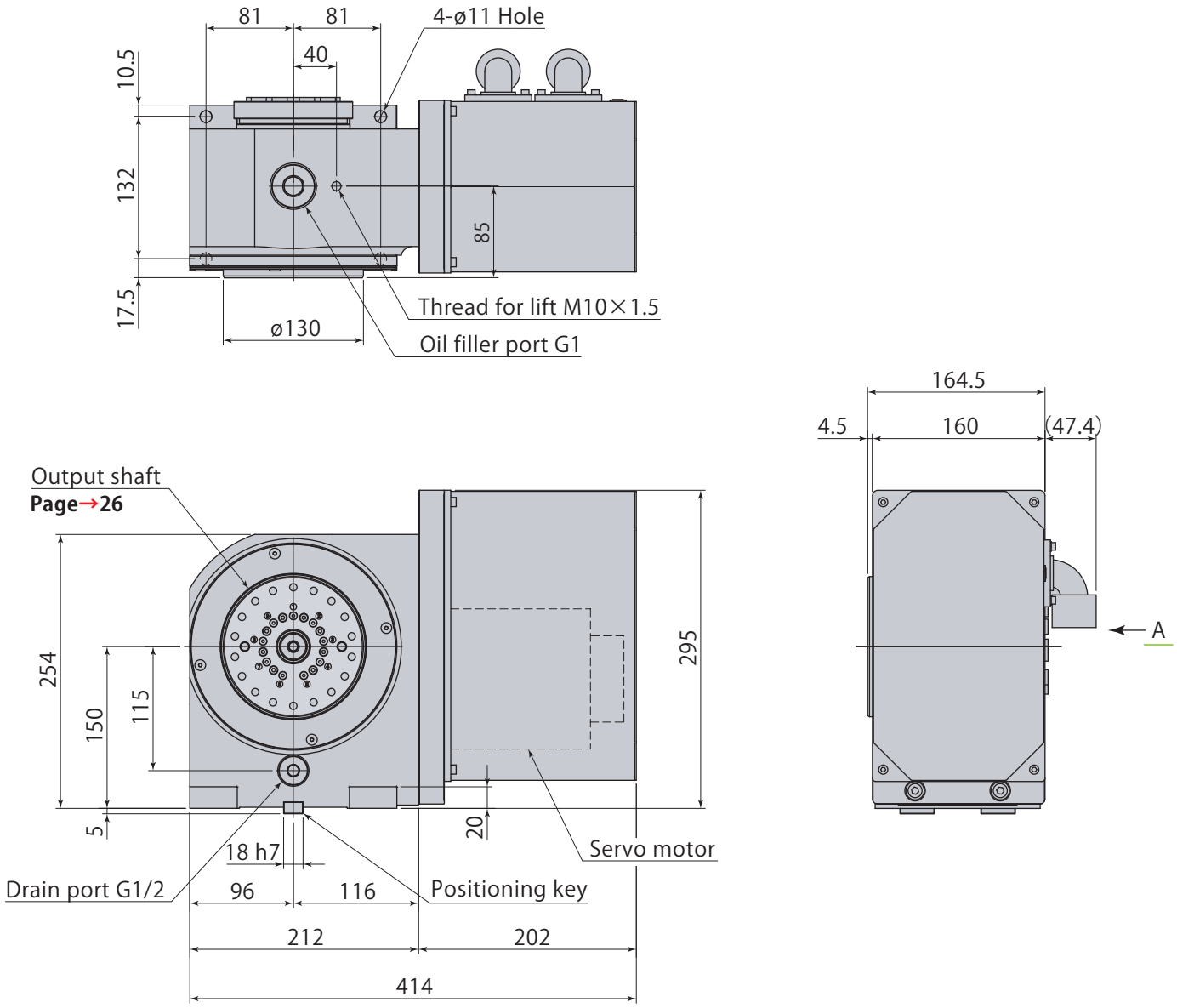
＊: The figure indicates 0.0048mm displacement at the point of 100mm off from output shaft.

### Specifications of rotary joint

| Ports | | | Hydraulic and air 9 port Cutting fluid 1 port |
|---|---|---|---|
| Hydraulic and air | Number of circuits | | 9 ports |
| | Working fluid | | General mineral based hydraulic oil (ISO-VG32 equivalent) / Air |
| | Max. working pressure | MPa | 7 |
| | Piping port | | G1/8（Rc1/8 for Rc threaded type） |
| Cutting fluid | Number of circuits | | 1 circuit (in the center) |
| | Max. working pressure | MPa | 0.3 |
| | Piping port | | G1/8（Rc1/8 for Rc threaded type） |

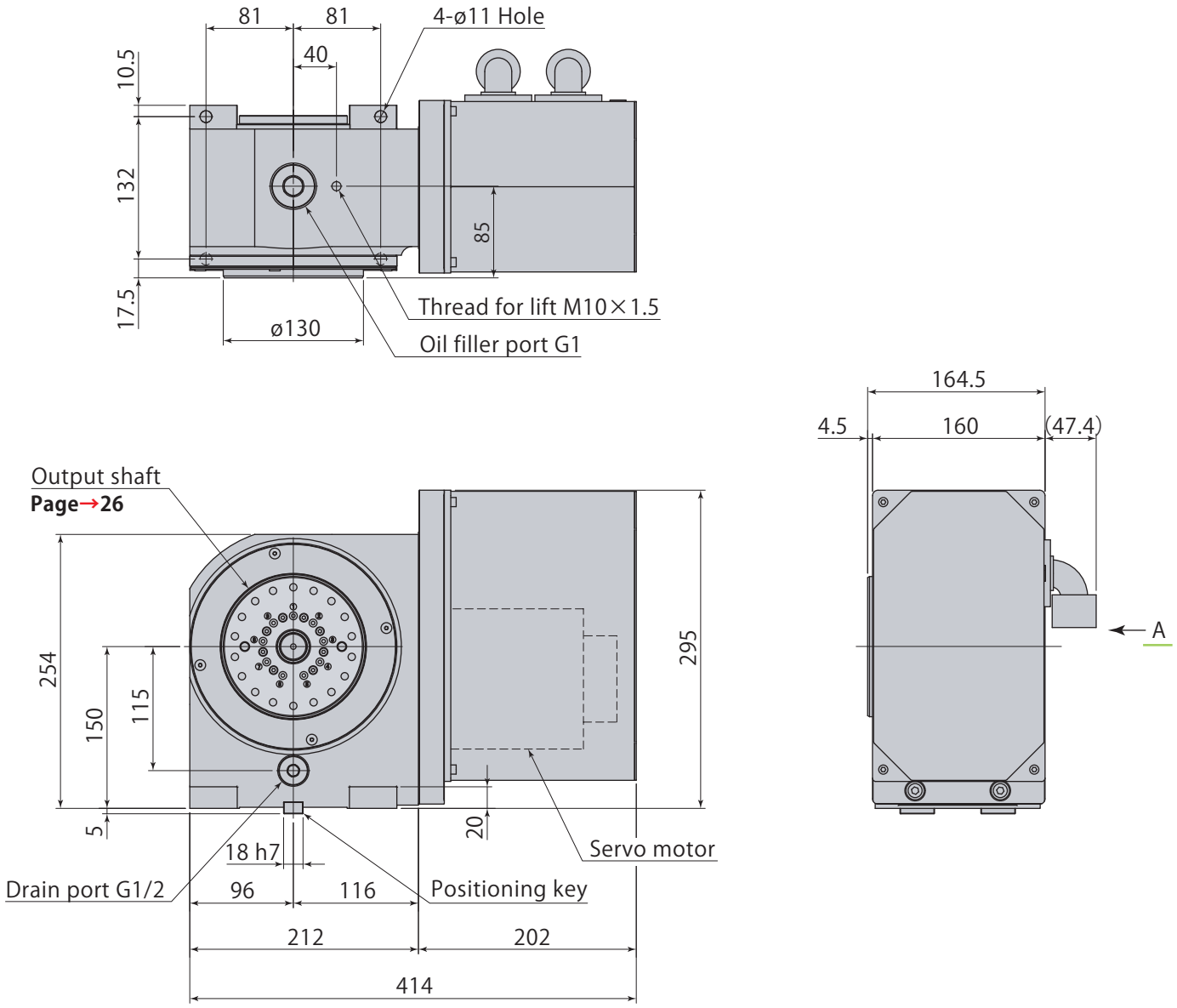
- In case that air is used for rotary joint, use of lubricator is recommendable.
- In case that working fluid is used, leakage of oil film to the adjacent circuit occurs inside the rotary joint. When both the working fluid and air are used, provide a drain circuit between the hydraulic circuit and air circuit. (In case of the air circuit which allows leakage of oil film, there is no need to provide a drain circuit.)
- Supply the cutting fluid which is filtered to connecting port of cutting fluid.
- Purge air to prevent intrusion of cutting fluid into the inside of motor cover. Supply dried clean air to connecting port of air purge. (Reccomendation purge pressure 0.02MPa and flow volume 15L/min.) And make sure to open the exhaust port of air purge.
- The value for the allowable moment of inertia indicates when table rotates Max. number of rotation at unbalanced torque 0. The lower the table rotation speed is set, the larger the allowable moment of inertia becomes.
- The radial load, loaded torque and loaded moment are included in work load.
- The loaded torque shall be 40% of time duty and less than 30 sec.

model MDF130AR-R(C)F



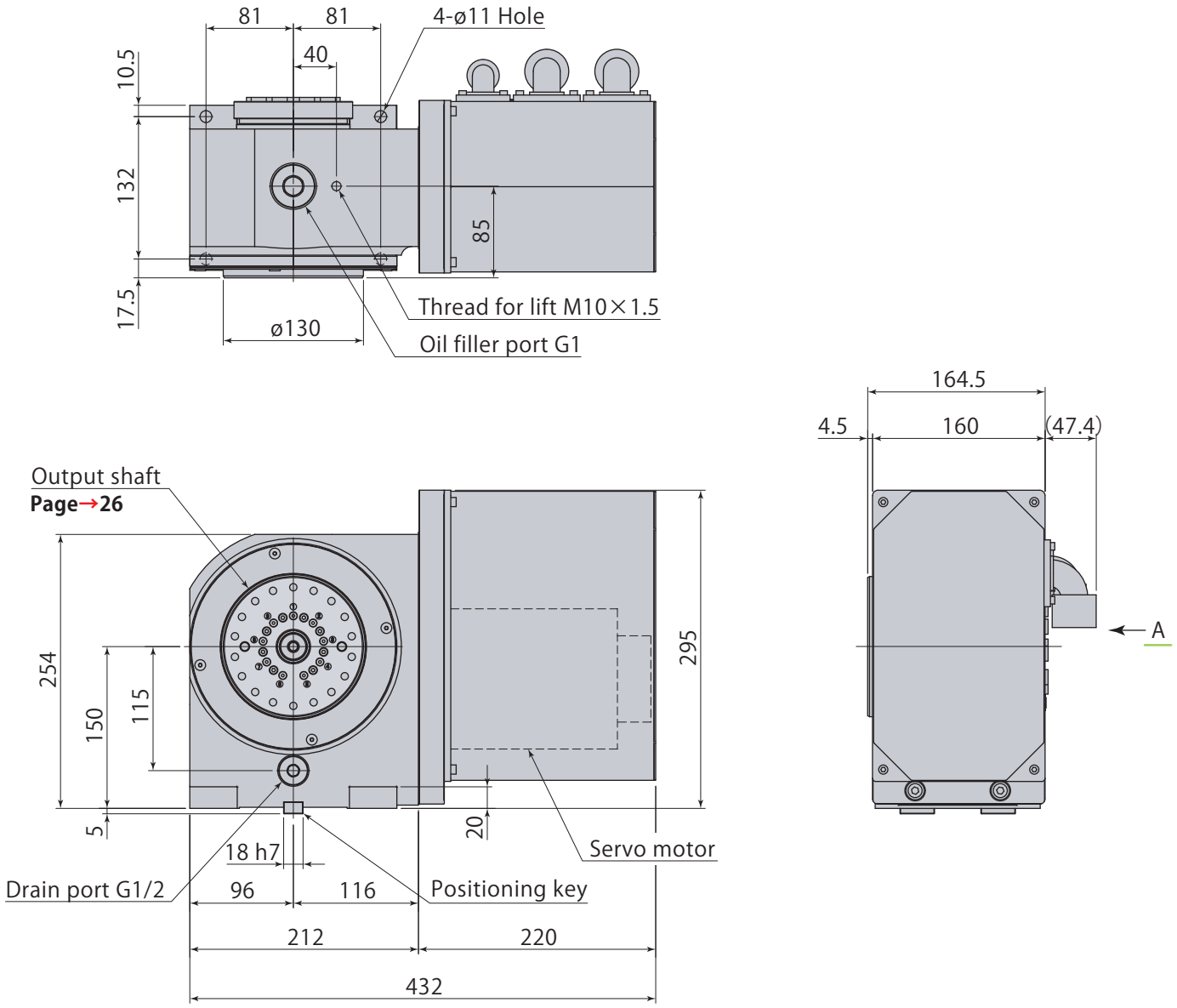

View A

model **MDF130AR-F**

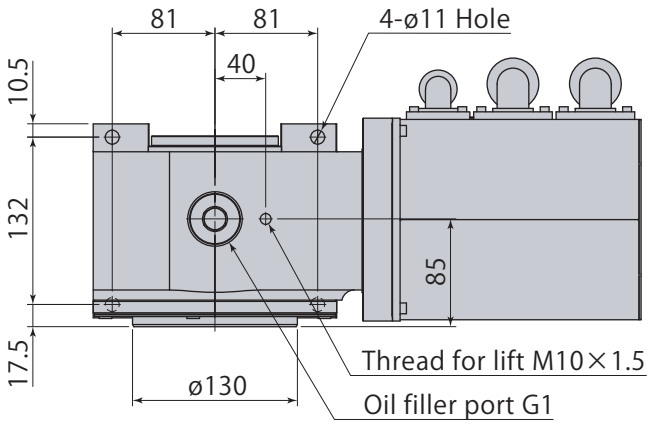


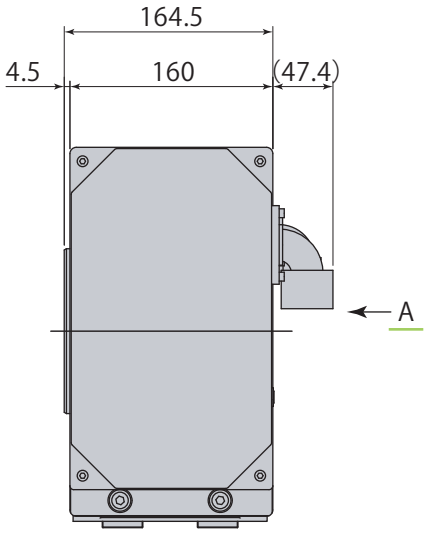

View A

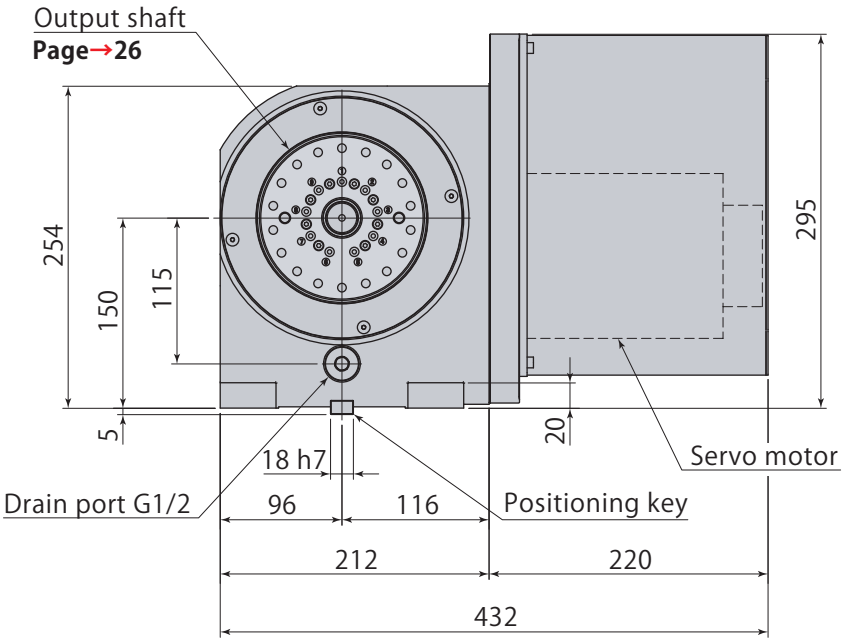
model **MDF130AR-R(C)FB**

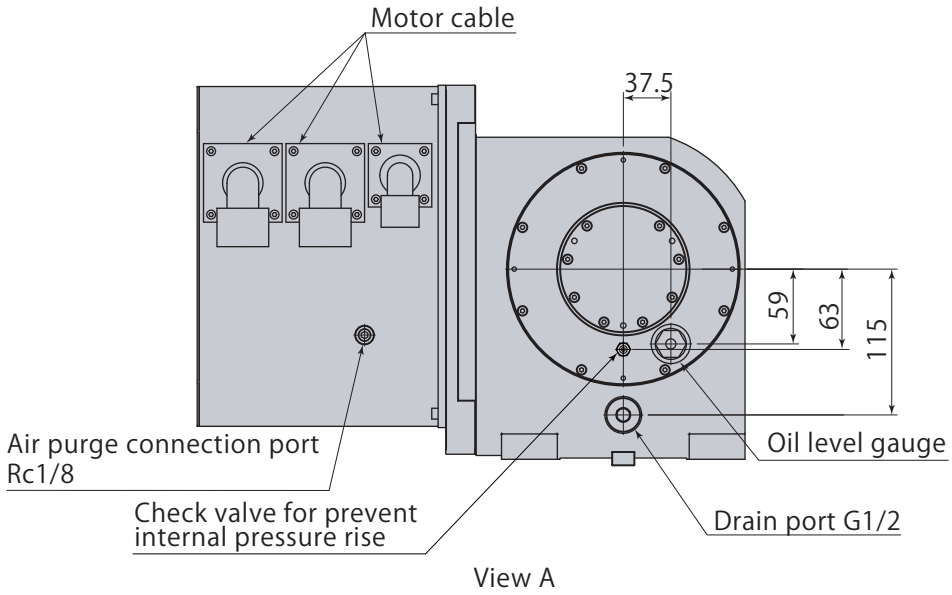


model **MDF130AR-FB**



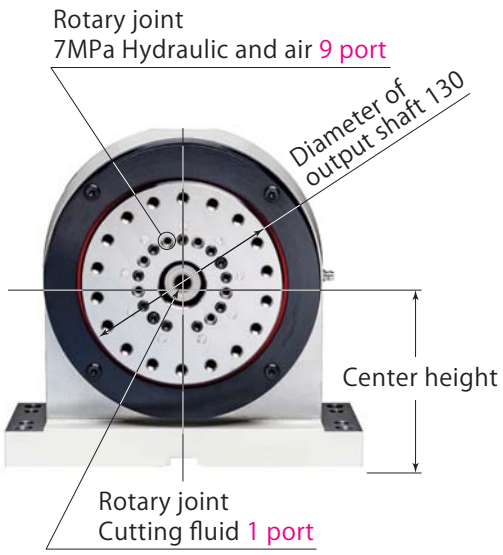

View A

## Specifications

MDS130 —

| Rotary joint | Piping port of rotary joint | Rotary joint Hydraulic oil and Air |
|---|---|---|
| R : Built-in | : G thread | 9 : 9 port |
| : None | C : Rc thread | 3 : 3 port |

Example：MDS130-R9




- For the hydraulic connection, Rc port is applied, a sealing tape is normally used for the piping but bits of the table may cause internal leakage of a rotary joint or malfunction of the actuator. Model MDF introduces G port which accepts the fittings with bonded seal being composed with a metal ring and rubber thereby no bits or debris that causes internal leakgae is produced when piping.

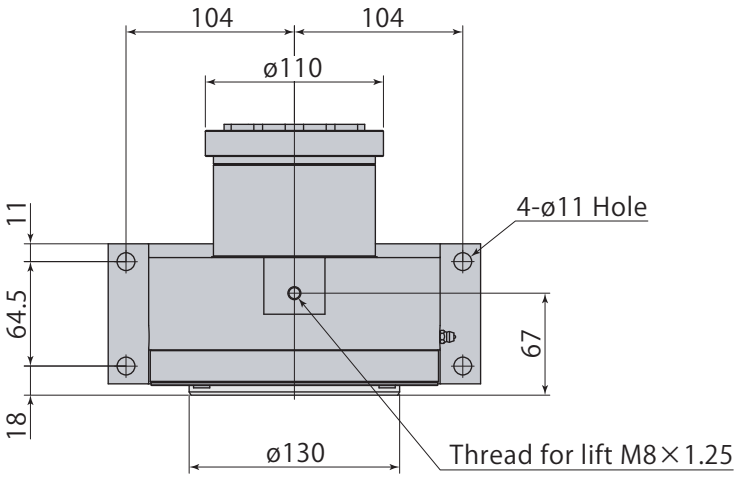
| Mode | | MDS130-R□9 Hydraulic and air 9 port Cutting fluid 1 port | MDS130-R□3 Hydraulic and air 3 port Cutting fluid 1 port | MDS130 No rotary joint |
|---|---|---|---|---|
| Mass | kg | 17 | 14 | 12 |
| Output shaft diameter | mm | ø130 | | |
| Center height | mm | 120 | | |
| Inner diameter of output shaft (mouth) | mm | ø30H7 | | |
| Lubrication | | Grease lubrication | | |
| Operating temperature | ℃ | 0–40 | | |

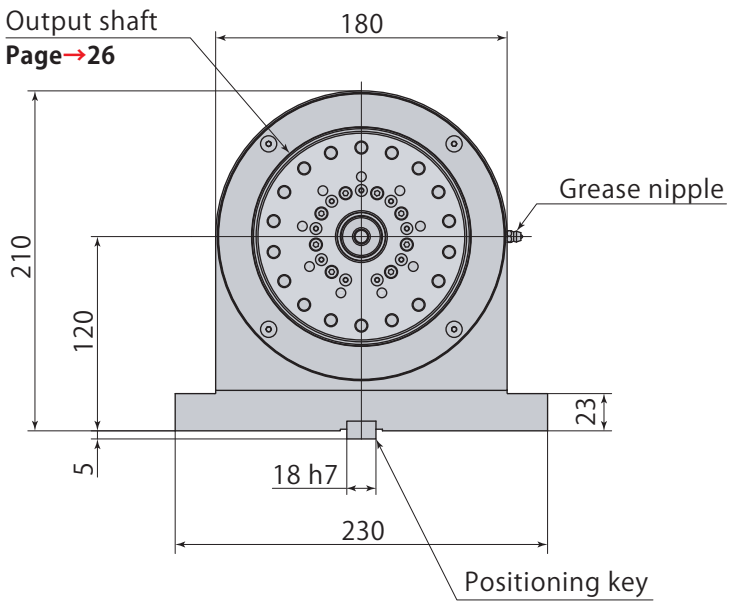
### Specifications of rotary joint

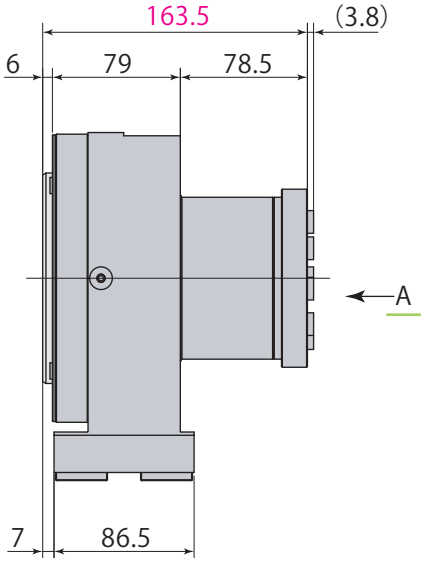
| Ports | | Hydraulic and air 9 port Cutting fluid 1 port | Hydraulic and air 3 port Cutting fluid 1 port |
|---|---|---|---|
| Hydraulic and air | Number of circuits | 9 ports | 3 ports |
| | Working fluid | General mineral based hydraulic oil (ISO-VG32 equivalent) / Air | |
| | Max. working pressure MPa | 7 | |
| | Piping port | G1/8（Rc1/8 for Rc threaded type） | |
| Cutting fluid | Number of circuits | 1 circuit (in the center) | |
| | Max. working pressure MPa | 0.3 | |
| | Piping port | G1/8（Rc1/8 for Rc threaded type） | |

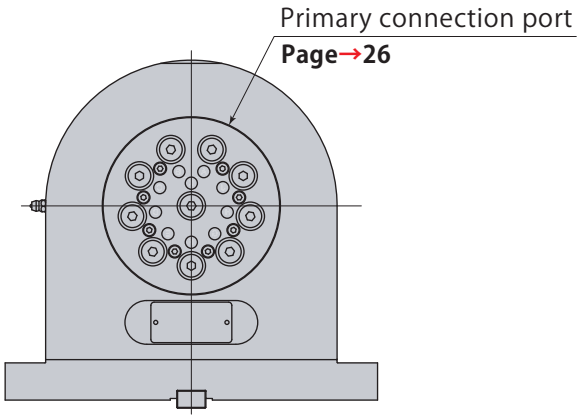
- In case that air is used for rotary joint, use of lubricator is recommendable.
- In case that working fluid is used, leakage of oil film to the adjacent circuit occurs inside the rotary joint. When both the working fluid and air are used, provide a drain circuit between the hydraulic circuit and air circuit. (In case of the air circuit which allows leakage of oil film, there is no need to provide a drain circuit.)
- Supply the cutting fluid which is filtered to connecting port of cutting fluid.

model MDS130-R(C)9



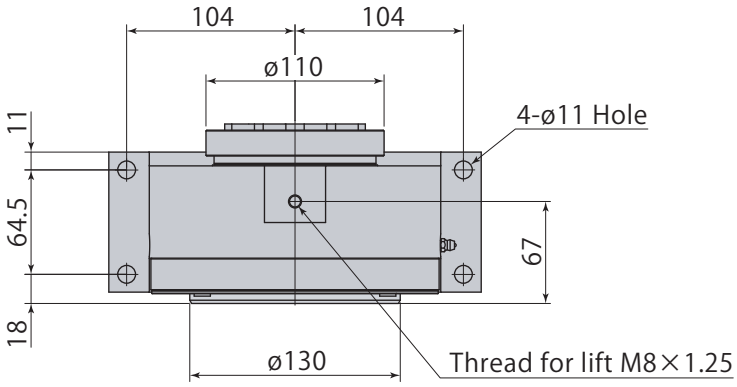



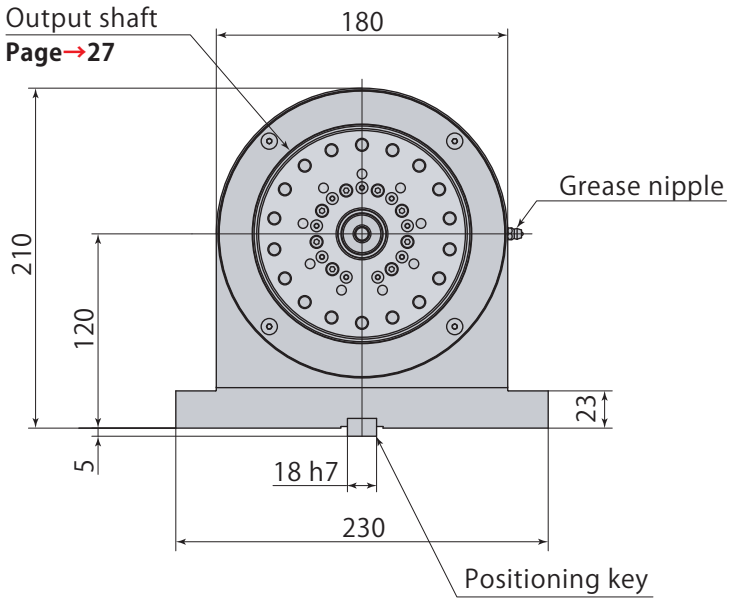



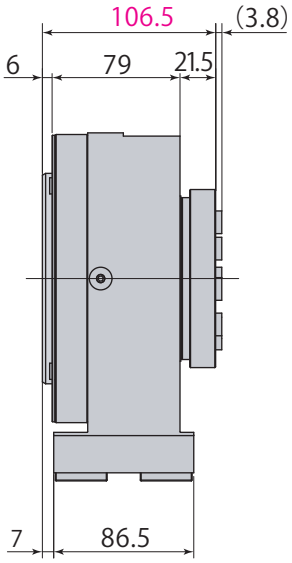




View A

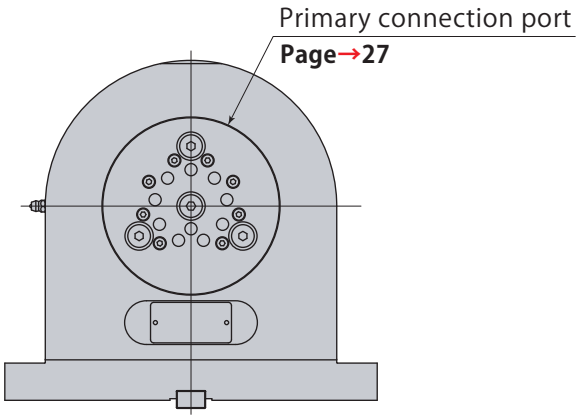
model **MDS130-R(C)3**



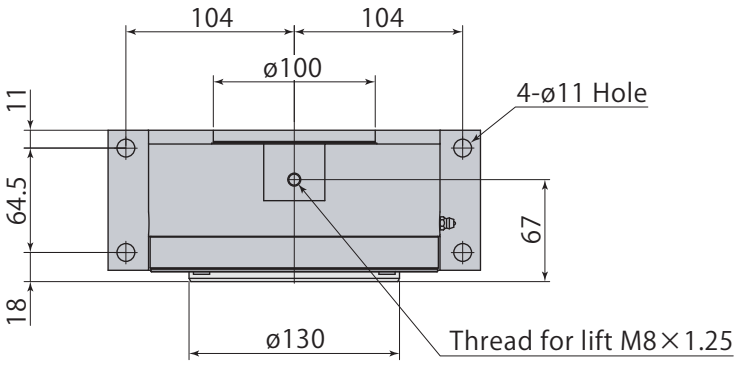



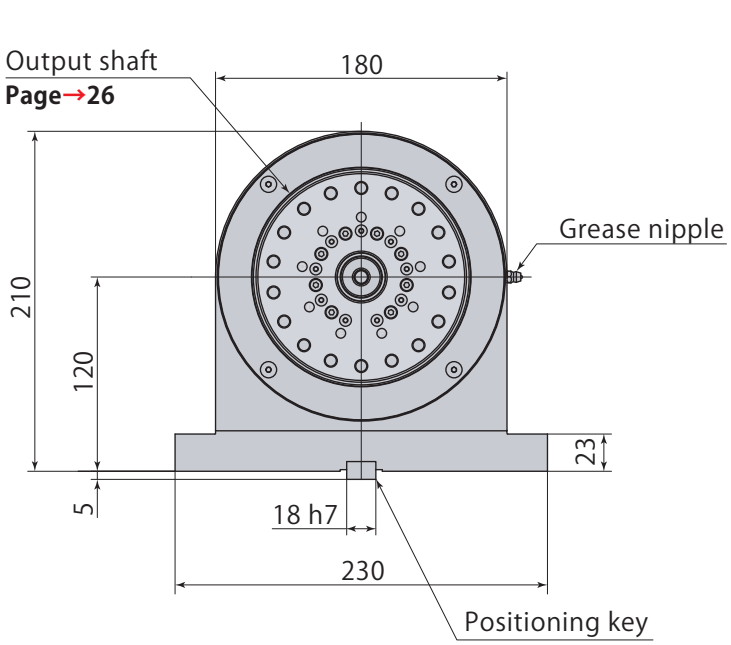

←A

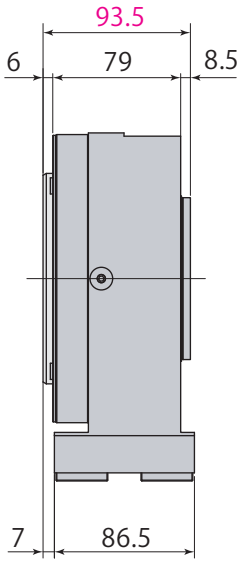



View A

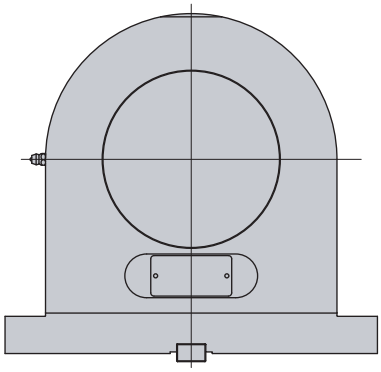
model **MDS130**



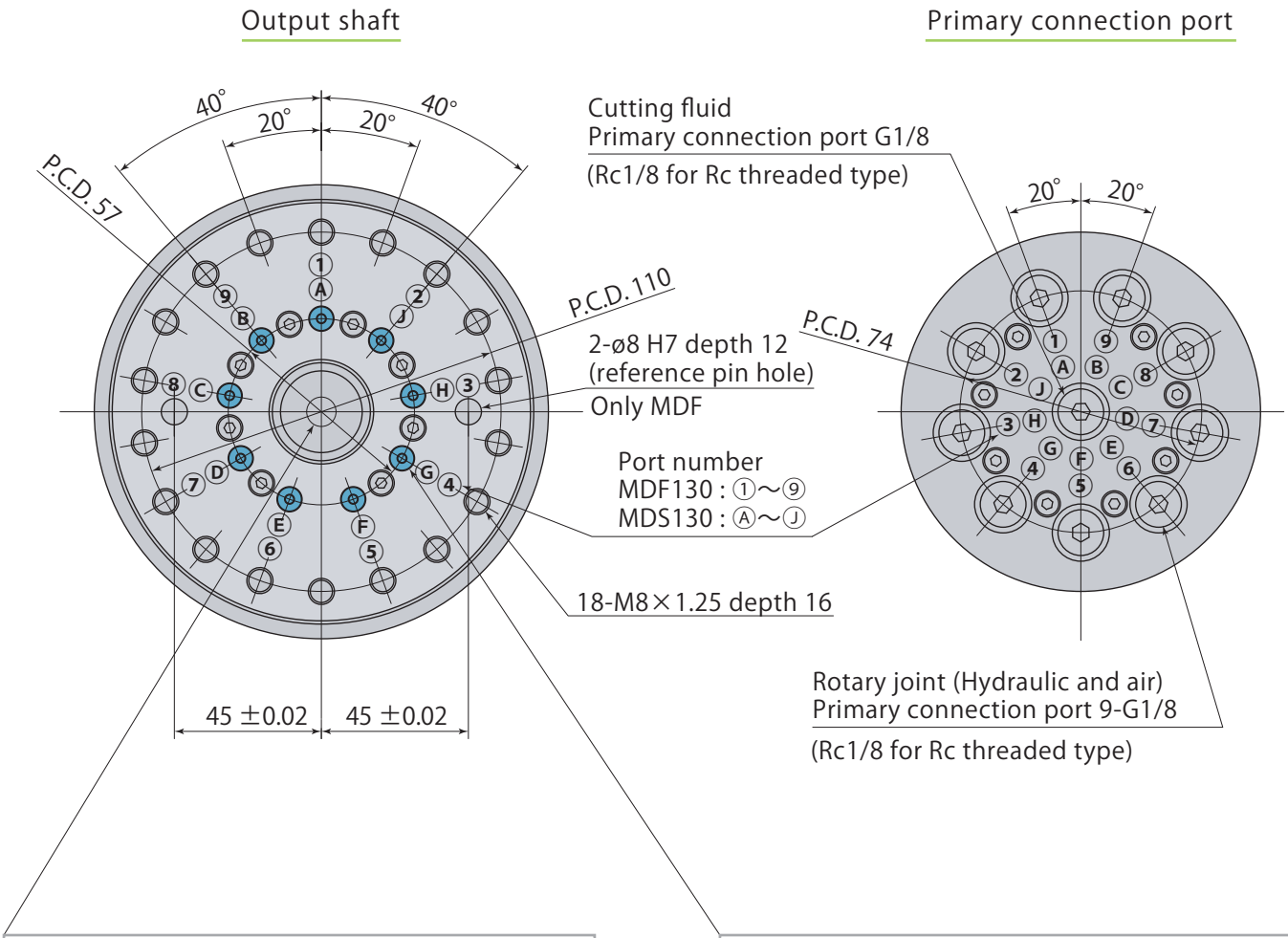

←A

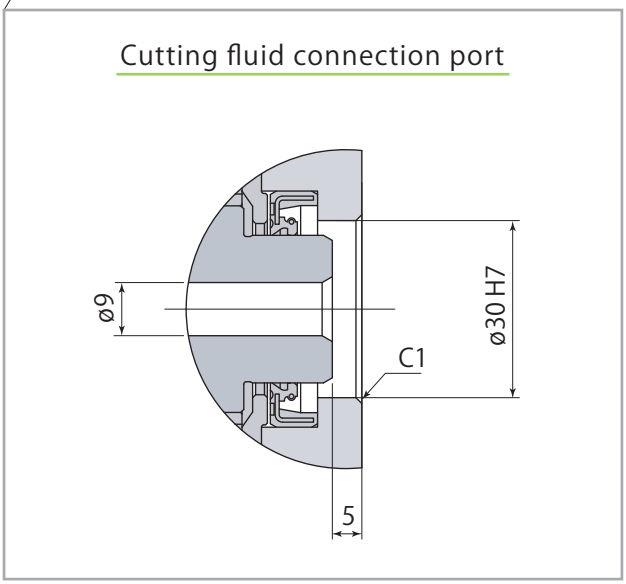


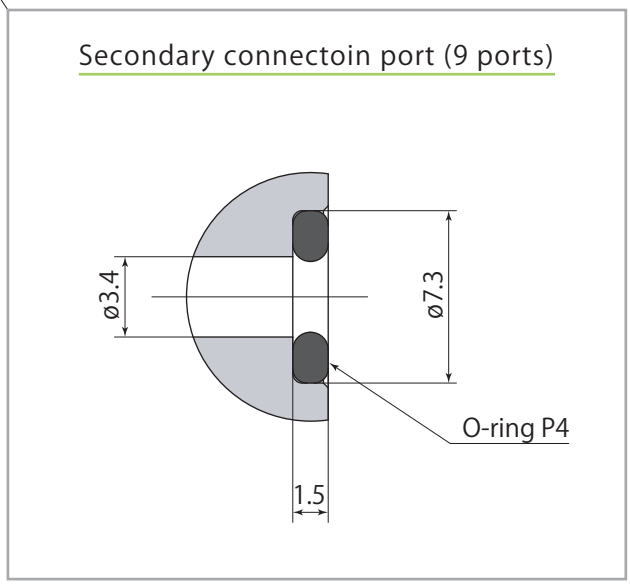
View A

# Rotary joint 9 port Table face Dimensions

model MDF130AR-R(C)F□／ model MDS130-R(C)9

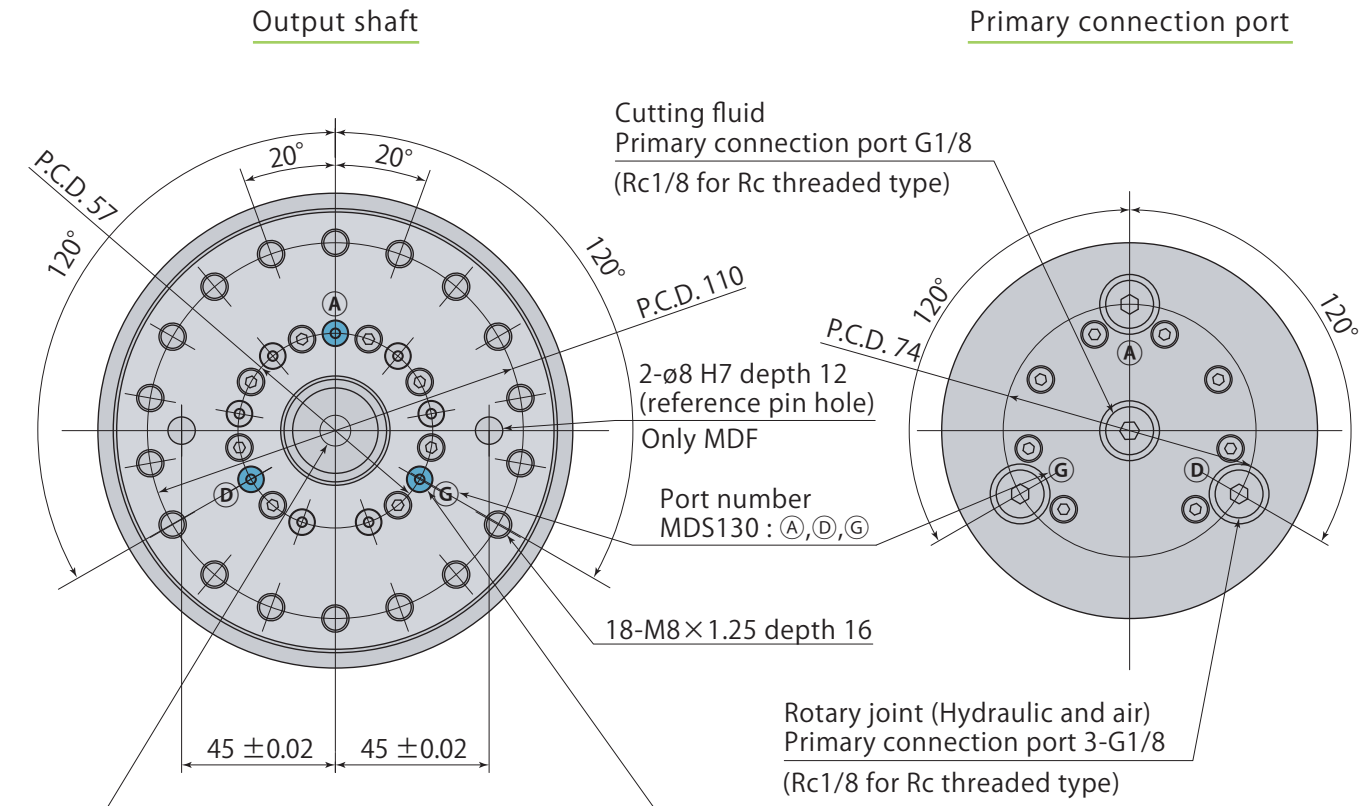


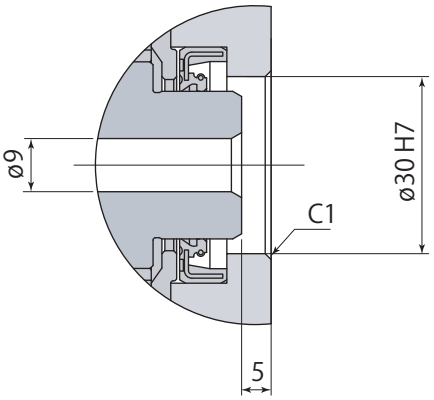



# Rotary joint 3 port Table face Dimensions

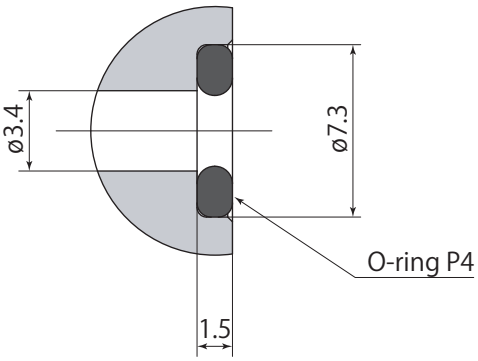
model MDS130-R(C)3




## Cutting fluid connection port

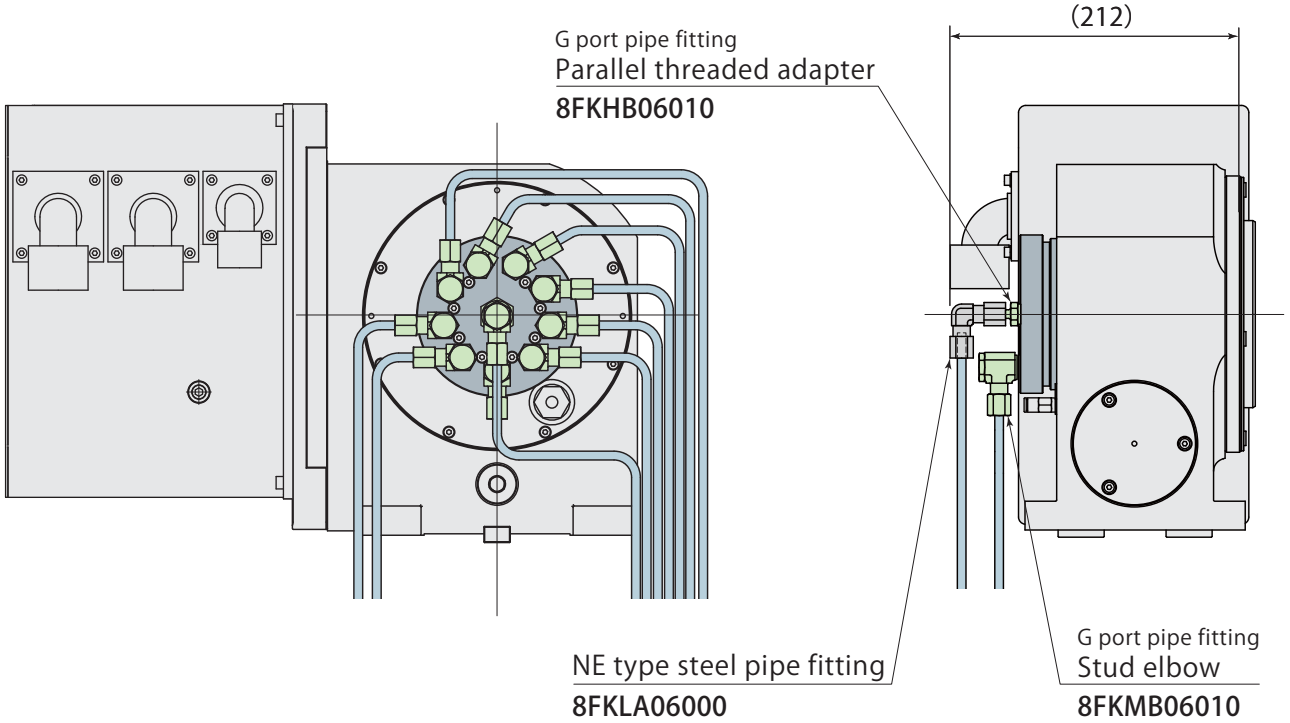



## Secondary connectoin port (3 ports)

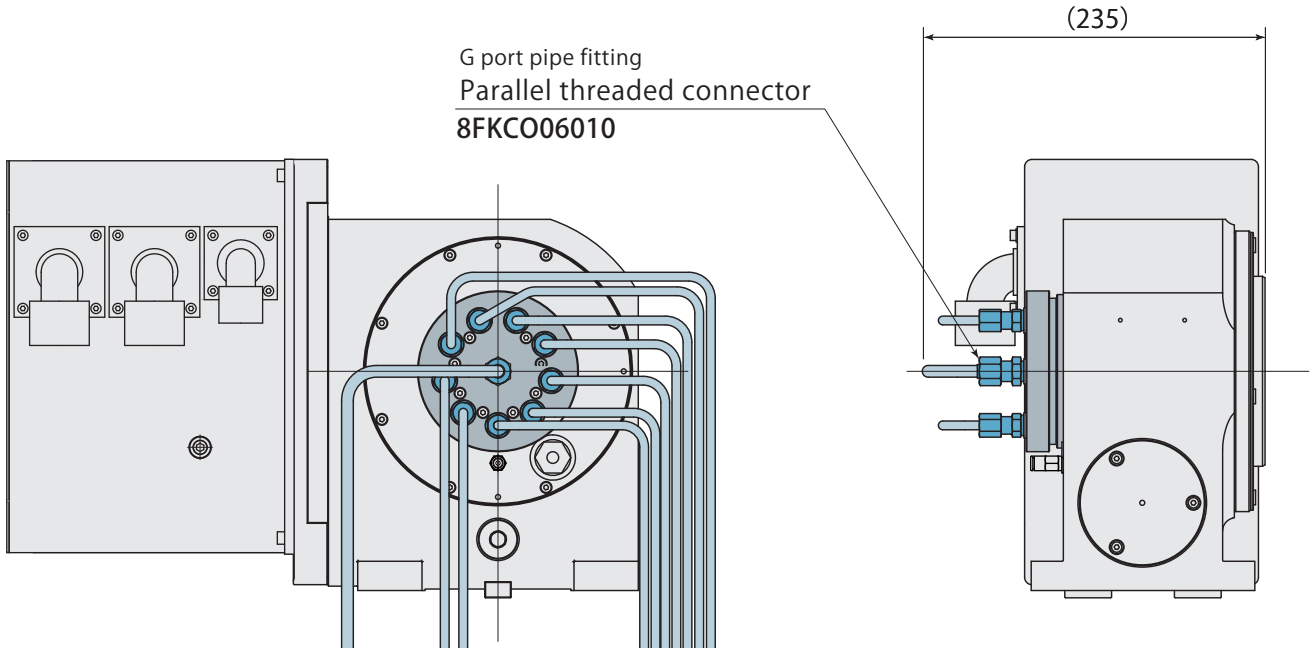


# MDF130 Rotary joint G port piping example

## Stud elbow & Parallel threaded adapter



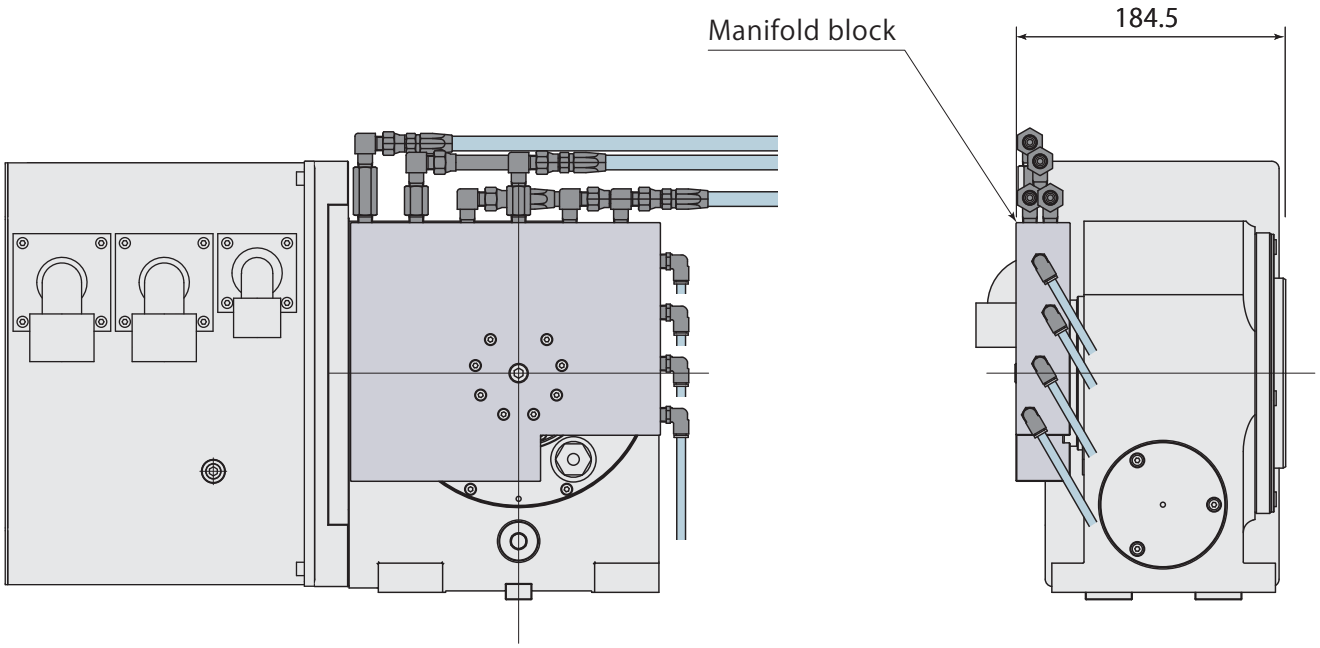

## Parallel threaded connector



## Manifold block

Manifold blocks can reduce projections on piping materials.

Contact us for the details.

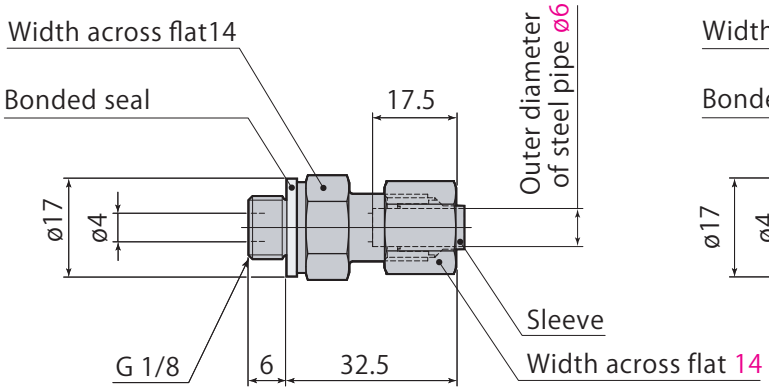


# G port pipe fitting model 8FK□

## Parallel threaded connector

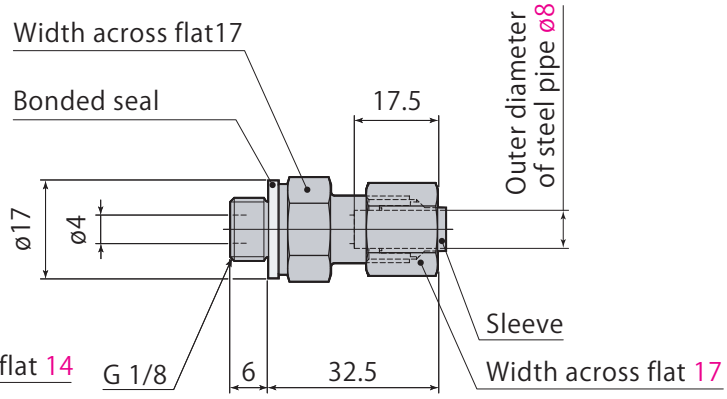
model 8FKCO06010

**Outer diameter of steel pipe** ø6




model 8FKCO08010

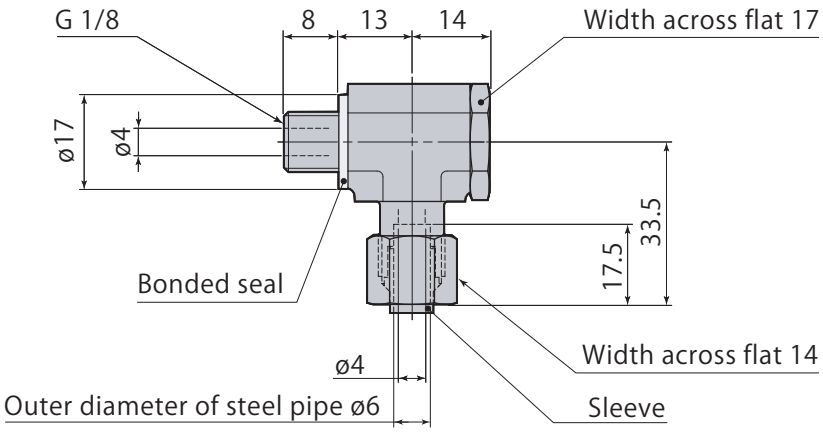
**Outer diameter of steel pipe** ø8




## Stud elbow

model 8FKMB06010

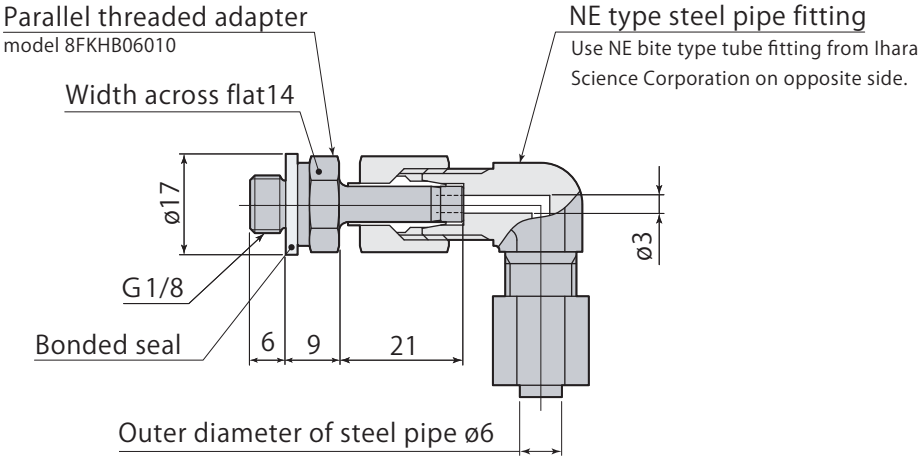
**Outer diameter of steel pipe** ø6




- Use a bonded seal to seal flange surface where a fitting will be fitted (do not use O-ring type G thread fitting).
- Use the sleeve KKO from Ihara Science Corporation for the sleeve of fitting.

## Parallel threaded adapter

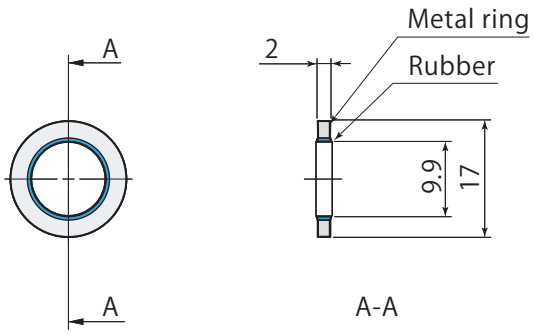
model 8FKHB06010




## Bonded seal (Spare parts)

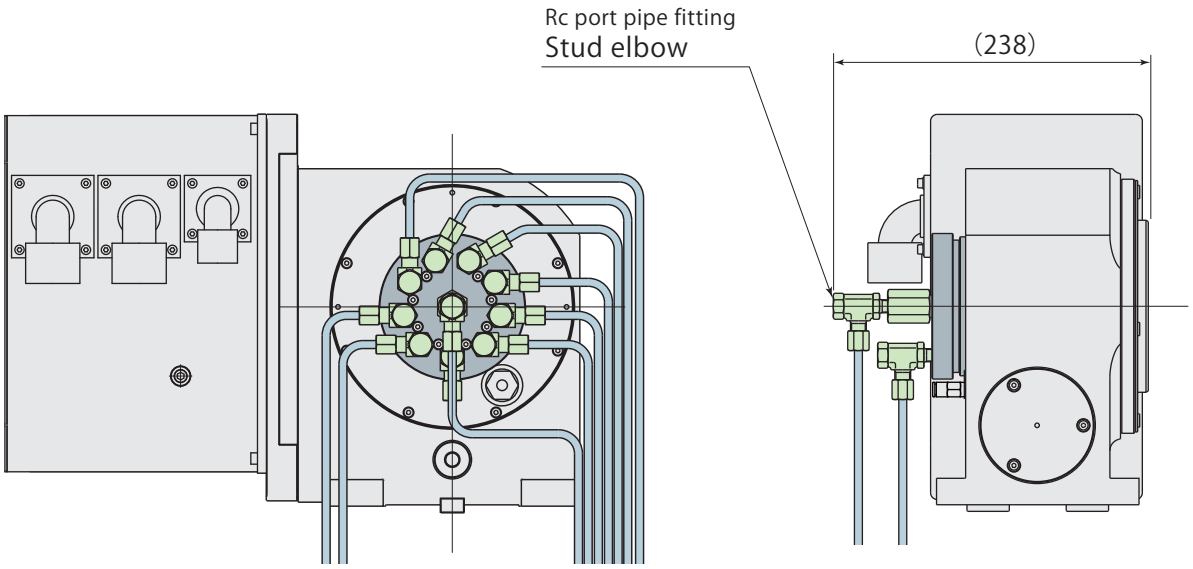
model 8FKP-C-010

The standard specification is NBR for the rubber material and SPCC (cold rolled steel plate) for the metal ring.
Bonded seals are supplied with the fittings and are available for sale soley as spare parts.

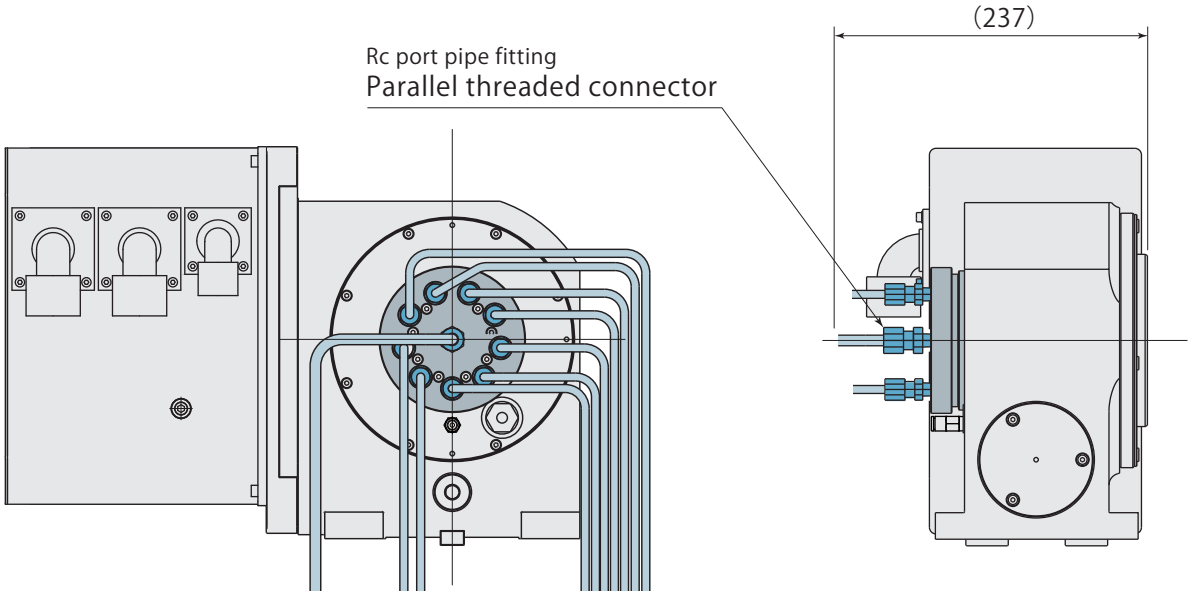


# MDF130 Rotary joint Rc port pipe fitting example

## Stud elbow




## Parallel threaded connector



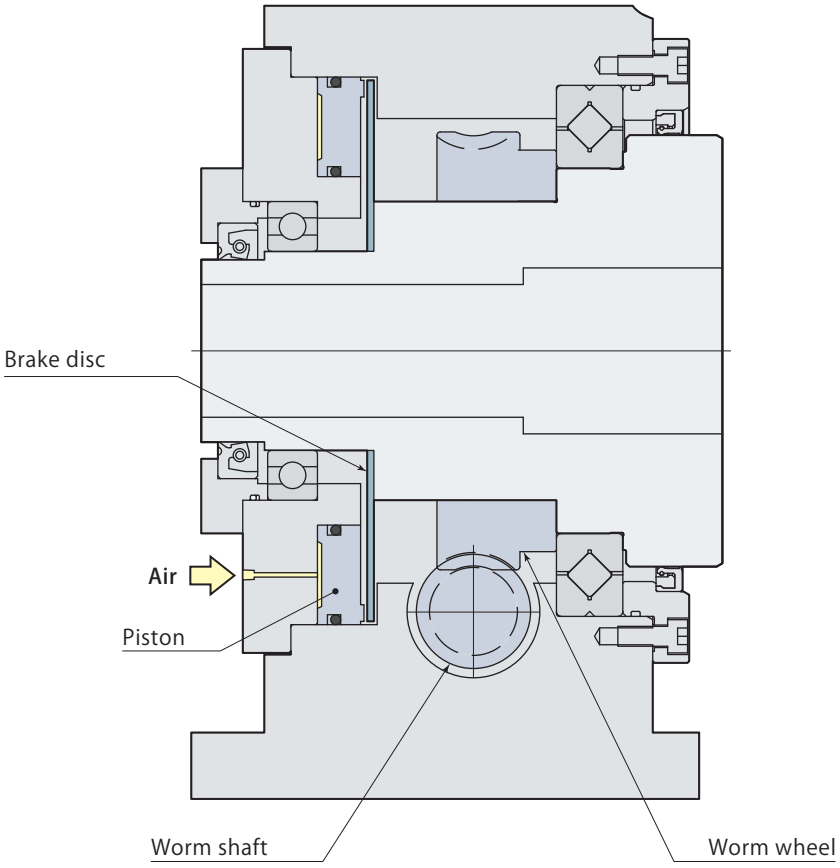

## Difference between Rc port and G port

For the hydraulic connection, Rc port is applied, a sealing tape is normally used for the piping but bits of the table may cause internal leakage of a rotary joint or malfunction of the actuator. Model MDF introduces G port which accepts the fittings with bonded seal being composed with a metal ring and rubber thereby no bits or debris that causes internal leakgae is produced when piping.

# Brake structure of worm gear

- **Because the worm gear index table has backlash, a brake is required to maintain the table position. In addition, the same can be said for DD motor driven tables since the DD motor has low holding torque. The brake is generally a friction brake which is built by an air piston and a brake disc. Not only brake mechanism but also solenoid valve that controls the air flow and a sensor to detect the completion of the braking are required. Friction brakes have the following problems.**

  - There is time loss of switching the solenoid valve when the brake ON / OFF operation.
  - When the friction surface wears, the brake torque decreases (the coefficient of friction decreases)
  - There is a risk of malfunction of the solenoid valve and operation detection sensor.
  - The brake may go down in high humidity areas where the factory air environment is poor.




Worm gear index table

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CERTIFICATE OF APPROVAL ISO9001

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