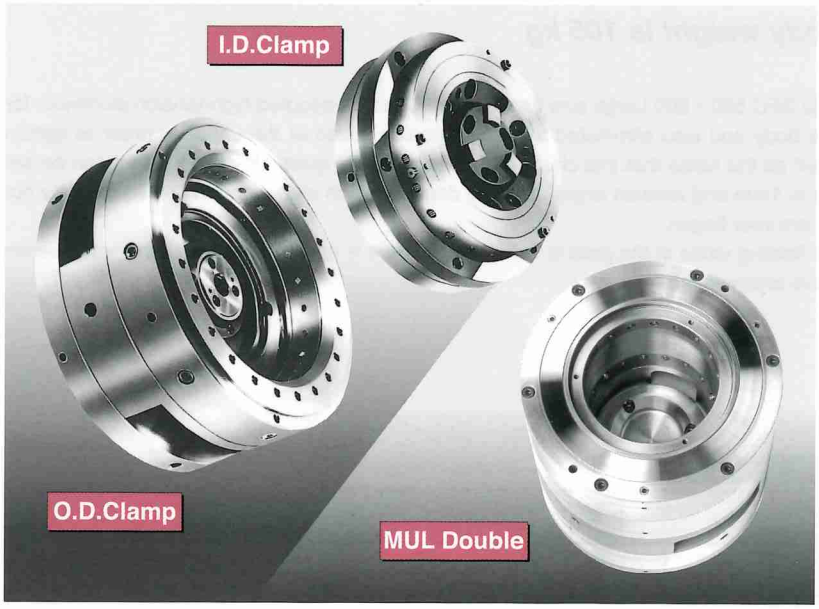
PIN EXPANDING TYPE

MUL Multi-Jaw Chuck

PAT.P

For chucking thin-walled cylindrical work-pieces with uneven surfaces.

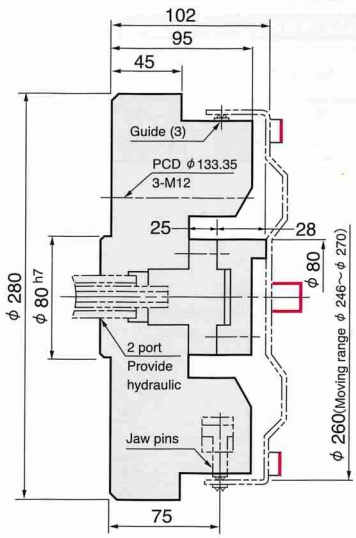


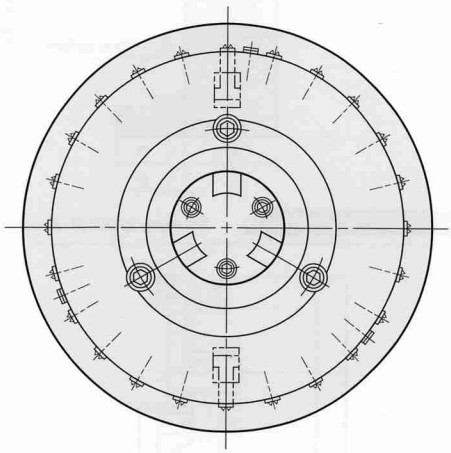
The thin-walled cylindrical work-pieces are subject to elastic deformation even under small force such as clamping force, cutting resistance or centrifugal force. Therefore, this kind of work-pieces require several counter measure such as to secure the roundness accuracy or prepare the special chucks and cutting tools for anti-vibration, and add some extra operation. The MUL Chuck has the floating mechanism which enables to clamp the surface of the thin-walled cylindrical work-pieces with equal force and it is effective to the uneven material work-pieces. Furthermore, the Multi-Jaws function allows to have soft and strong clamping torque without deform the work-pieces and also add more rigidity on processed portion. Then, it is possible to obtain the roundness accuracy in the first operation even when processing deformable cast & wrought, or press formed thin-walled cylindrical work-pieces.

※ Now, we are corresponding to make that chuck with centering device, cartridge system, and big size for variety of thin-walled work-pieces.

I.D.Clamping type

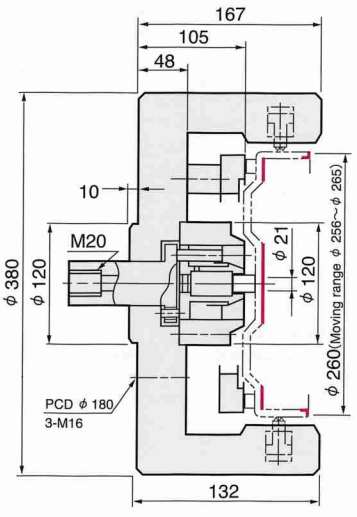
- **Process [OP-1] :** Using three guides as center reference, it can machine four attaching end faces, and the end surface and the O.D. of the boss.
- **Clamping force :** 6.5-33 kN with hydraulic adjustment [0.5-2.5 MPa]. The pushing force on each point is 270N to 1375N.
- **Wide clamping diameter range :** It can clamp work-pieces in a diameter range of ϕ248-ϕ266 [Working diameter : ϕ246-ϕ270]
- **Accuracy :** For machining of 4 end surface [1.5mm depth of cut, 0.2mm feed / rev., continuos cutting], parallelism is 15μm max. [precision requirement : 60μ].

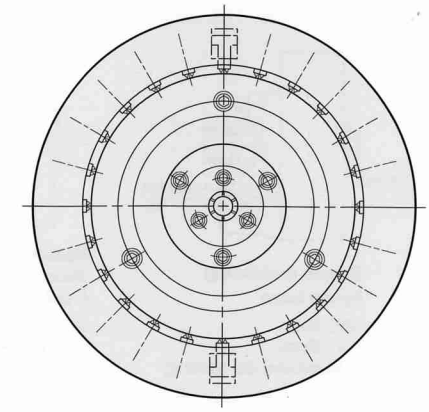




O.D.Clamping type

- **Process [OP-2] :** Using the ϕ21 boss as the center reference and the 4 attaching faces as reference end faces, it can machine the I.D. surface and end surface within ϕ250, and the bottom faces.
- **Clamping method :** Precision is ensured by a static collet and a stopper. Holding force and prevention of the work piece run-out or vibration are achieved by evenly powered clamping with 24 jaw pins on O.D. up to ϕ260 [Thickness : 5mm]
- **Clamping force :** 3-8 kN with hydraulic adjustment [0.5-1MPa]. The pushing force on each point is 125N to 333N.
- **Accuracy :** Under the same machining conditions as OP-1, parallelism is 30μ (including influence by roundness deviation), flatness is 20μ and roundness is 20μ [precision requirrement : 100μ]. These data are with adequate tolerance.





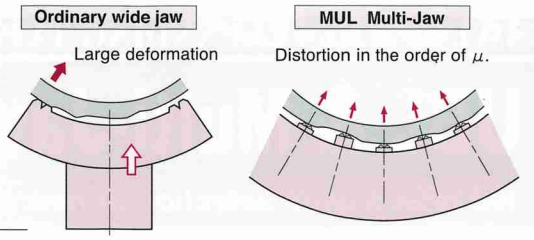
※ 1kN = 1000N ≒ 102kgf 1MPa = 10.2kgf/cm^2

Advantages

1 Even distribution of clamping force by a floating mechanism

Once all of the jaw pins, which are designed to accommodate uneven surfaces, are in contact with the work-piece, evenly distributed forces are applied.

* The MUL Chuck has high-performance compensating function, therefore there would be no problem if work-piece has center difference between datum of concentricity and clamping portion.



2 Powerful clamping torque with a soft touch

The holding force [clamping torque] of the work-pieces, or the clamping torque, is a total of the force on each jaw multiplied by friction factor. Since the MULTI-JAW type is adopted many clamping points and spiked jaw tips, a small force on each point can provide a strong clamping torque. [In case of 24 clamping points, only a quarter of the force of which is obtained from a 6-point clamping-type of the UBL [Universal Ball-Lok Chuck] provides the same clamping power.]

* The UBL [Universal Ball-Lok Chuck] has equalizing mechanism, therefore it is the top level product in conventional 3JAW chucks with regard to after machining roundness accuracy.

Clamping torque

$$Tr = \frac{\text{Force on each point} \times \text{Number of point} \times \text{Friction factor} \times \text{Gripping dia.}}{1000}$$

$$= \frac{(24 \cdot P_1) \cdot \mu \cdot D}{1000} \quad [\text{Multi-Jaw}]$$

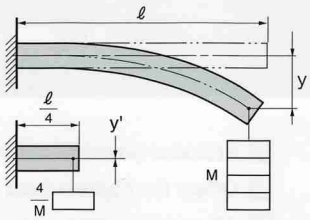
$$= \frac{(6 \cdot P_2) \cdot \mu \cdot D}{1000} \quad [\text{UBL}]$$

3 The Multi-Jaw design minimizes distortion

Both the pushing force and the distance between of the jaws at each clamping portion of the MUL [24 points clamping] are a quarter of the UBL's [6 points clamping]. By applying this relationship in the equation of the right figure, as load (M), distance (l), deflection in cantilever beams (y), It is able to see that the distortion is dramatically reduced with the multiple effect.

* Based on the detail calculation of the load and displacement of "thin-walled curved beam", the deflection value became approximately 1/100.

Relationship between load, distance, and deflection in cantilever beams

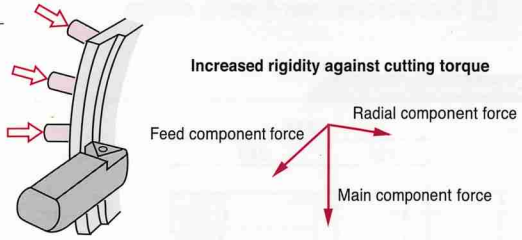


$$y = \frac{M\ell^3}{3EI} \qquad y' = \frac{1}{256} \cdot \frac{M\ell^3}{3EI}$$

E : Young's modulus
I : Geometrical moment of inertia

4 Increased work-piece rigidity

Multi-Jaws are spaced evenly on the circumference of a thin-walled work-piece of the back side, providing higher rigidity of the work-piece. This will prevent the work-piece from run-out or irregular vibration even under a large cutting resistance (for example, a hardened steel piece having a large radius force) resulting in the roundness improvement, longer tool life and better finishing.



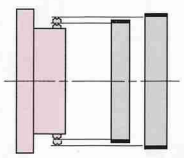
5 Jaw pins flexible working range

① The standard design model of which jaw stroke is 12mm (24mm in diameter) is available for the work-pieces having diameter difference about 20 mm.

② In order to clamp 4 kinds of work-pieces having diameter difference 60mm (ϕ220~ϕ280), just a single change-over with cartridge method is necessary.

③ Moreover, we had already developed new type design chucks that could easily exchange from I.D. to O.D. clamping or vice-versa and clamp large difference diameter work-pieces.

Long stroke design



No setup for a difference up to 20mm in dia.

Cartrige type

6 Hi-Lo swich-over according to machining requirements

The MUL [Multi-Jaw Chuck] is hydraulically powered with a rotary joint attached at the rear part of the spindle. The clamping force set can be switched over between Hi and Lo for finishing, as well as the roughing process, to meet high precision requirements.

1MPa=10.2kgf/cm²

Switch-over	Hydraulic pressure (MPa)	Finishing requirement
Hi	2 ~ 3	Roughing
Lo	0.5	Finishing

7 All custom-designed to meet various needs

① The centering method is guide type. It is available to design various types of chucks such as high precision PA / DC and design collet chuck according to each use condition.

② Jaw pins centering type is also available. (PAT)

③ Corresponding to wide range of thin-walled work-pieces ϕ63 (press forming product) ~ ϕ470 (large size brake drum).

We can offer flexibility to design a whole unit of chuck.

Centering chuck

Diaphragm

Pin-Arbor

Big size