

SINCE 1944

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# DL R/B series (En)

## CNC Turning Center

### DL R series (Roller guide way)

DL 21A / DL 21LA / DL 21MA / DL 21LMA  
DL 21B / DL 21LB / DL 21MB / DL 21LMB

### DL B series (Box guide way)

DL 22A / DL 22LA / DL 22LMA  
DL 22B / DL 22LB / DL 22LMB

[www.ffg-dmc.com](http://www.ffg-dmc.com)



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# DL R/B series

## DL R series (Roller guide way)

DL 21A / DL 21LA / DL 21MA / DL 21LMA

DL 21B / DL 21LB / DL 21MB / DL 21LMB

## DL B series (Box guide way)

DL 22A / DL 22LA / DL 22LMA

DL 22B / DL 22LB / DL 22LMB

**High speed, High precision, High productivity**  
 High accuracy and powerful turning center equipped  
 with Roller guide and Box way



### DL 21MA

|                         |                  |              |
|-------------------------|------------------|--------------|
| Travel (X/Z) (mm)(inch) | 200 × 410        | 7.87 × 16.14 |
| Guideway Type           | Roller Guide Way |              |
| Spindle speed (rpm)     | 4,000            |              |
| Number of tools (pcs)   | 12               |              |



### DL 21LMA

|                         |                  |              |
|-------------------------|------------------|--------------|
| Travel (X/Z) (mm)(inch) | 200 × 550        | 7.87 × 21.65 |
| Guideway Type           | Roller Guide Way |              |
| Spindle speed (rpm)     | 4,000            |              |
| Number of tools (pcs)   | 12               |              |



### DL 22LMA

|                         |           |              |
|-------------------------|-----------|--------------|
| Travel (X/Z) (mm)(inch) | 200 × 550 | 7.87 × 21.65 |
| Guideway Type           | BOX Way   |              |
| Spindle speed (rpm)     | 4,000     |              |
| Number of tools (pcs)   | 12        |              |

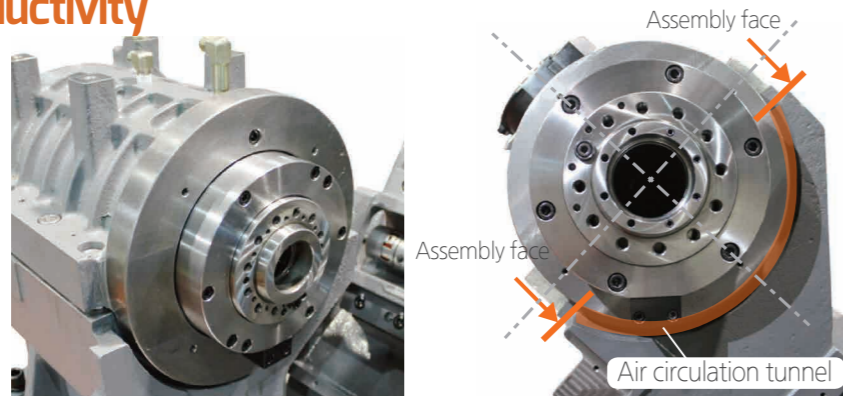


### DL 22LMB

|                         |           |              |
|-------------------------|-----------|--------------|
| Travel (X/Z) (mm)(inch) | 200 × 550 | 7.87 × 21.65 |
| Guideway Type           | BOX Way   |              |
| Spindle speed (rpm)     | 3,500     |              |
| Number of tools (pcs)   | 12        |              |

## High productivity

### Spindle



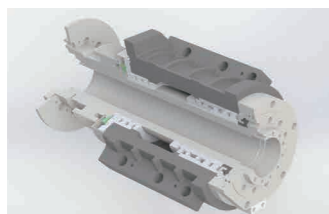
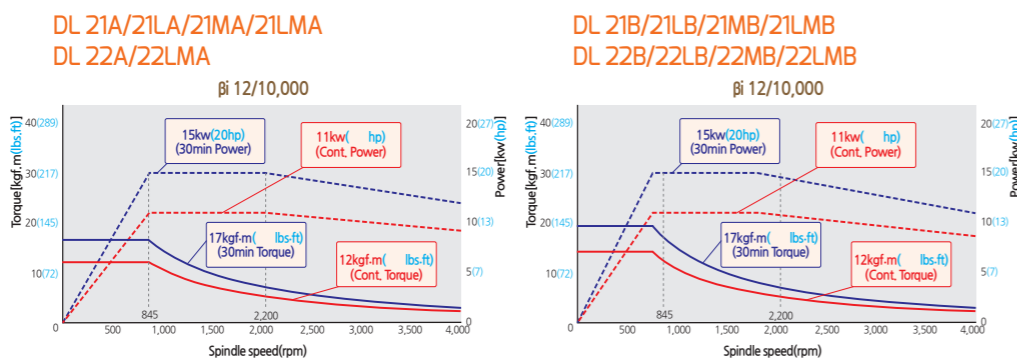
The central fixation spindle cartridge structure prevents heat distortion, enabling highly stable and precise spindle capability.

- Because of separate assemble between Spindle Cartridge and Head Body, it can block the transfer of heat.
- When repairing, only Cartridge needs to be changed.
- Cooling effect as designed Air Circulation Tunnel[Aerial Exposure in the bottom of structure]
- Keep high precision with blocking vibration and heat strain.

[ ]:Option

|                                 | DL 21A/21LA<br>DL 21MA/21LMA | DL 21B/21LB<br>DL 21MB/21LMB | DL 22A/22LA<br>DL 22LMA | DL 22B/22LB<br>DL 22LMB |
|---------------------------------|------------------------------|------------------------------|-------------------------|-------------------------|
| Chuck size                      | 8"BIG                        | 10"                          | 8"BIG                   | 10"                     |
| Max. Spindle Speed[rpm]         | 4,000                        | 3,500                        | 4,000                   | 3,500                   |
| Max Spindle Motor[kw(hp)]       | 15(20)                       | 15(20)[20/25]                | 15(20)                  | 15(20)[20/25]           |
| Max Spindle torque[Nm(lbs-ft)]  | 167(1205)                    | 196(1418)                    | 167(1205)               | 196(1418)               |
| Spindle Bore diameter[mm(inch)] | 76(2.99)                     | 86(3.39)                     | 76(2.99)                | 86(3.39)                |
| Bar Capacity[mm(inch)]          | 65(2.56)                     | 76(2.99)                     | 65(2.56)                | 76(2.99)                |

## Power - Torque diagram

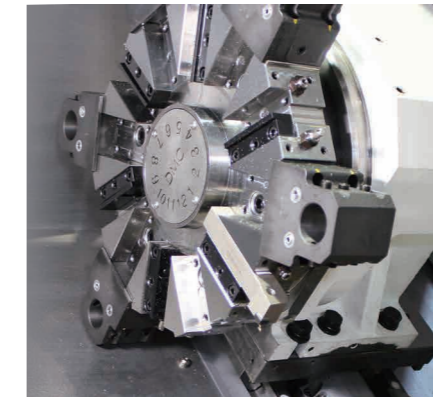


- High precision spindle structure  
Front-end double anchorage cylindrical roller bearing(4 at the front and 2 at the back)



## Turret

### High Torque Servo Turret



| Indexing time | Number of tool positions |
|---------------|--------------------------|
| 0.2 sec       | 12 station               |

- The 12-position turret enables various combinations of O.D./I.D. tool holders in all positions, FANUC servo motor index and 3-pieces curvic coupling of 4,913kgf hydraulic clamping power guarantees rapid tool change, quiet and stable machining experience, and versatile cutting abilities such as heavy duty and intermittent cutting.
- Turret indexing is non-stop bi-direction with a 0.2 sec next station time each turret stations capable of accepting both milling and turning tools.

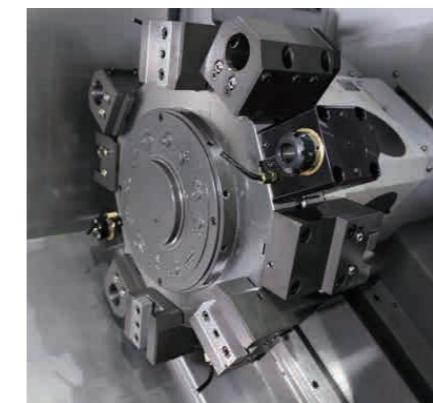
### Standard Turret

unit:mm(inch)

- 3Piece curvic coupling non protruding when turret rotating
- Tool size : □25(0.98)xØ40(1.57)
- Turret claming : 4,913kgf(10,831lbs)
- Turret indexing : repeatability ±0.005(0.0002)

24 tools can be attached  
(consult with our engineer)

### High Torque BMT Servo Turret

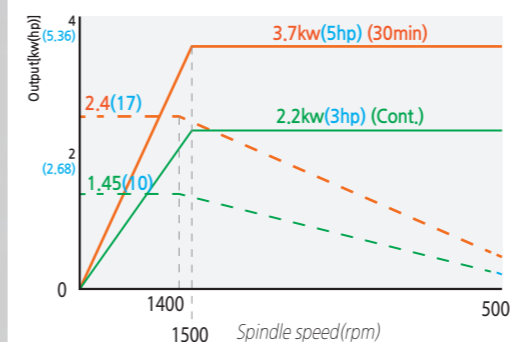


| Milling spindle speed | Tool holer |
|-----------------------|------------|
| 5,000 rpm             | BMT55      |

## The 12 station BMT turret with the curvic coupling and hydraulic clamping power

The 12-station turret of curvic coupling and hydraulic clamping capability effectively prevents vibration in heavy cutting. Longer tool life and high accuracy indexing add to great precision machining. All turret acceleration/deceleration clamp activities are controlled by the high torque servo motor. The milling tool holder(BMT55), which is to be attached on the turret face, is operated by the separate servo motor, and superb accuracy and precision are greatly improved.

### Milling motor torque diagram

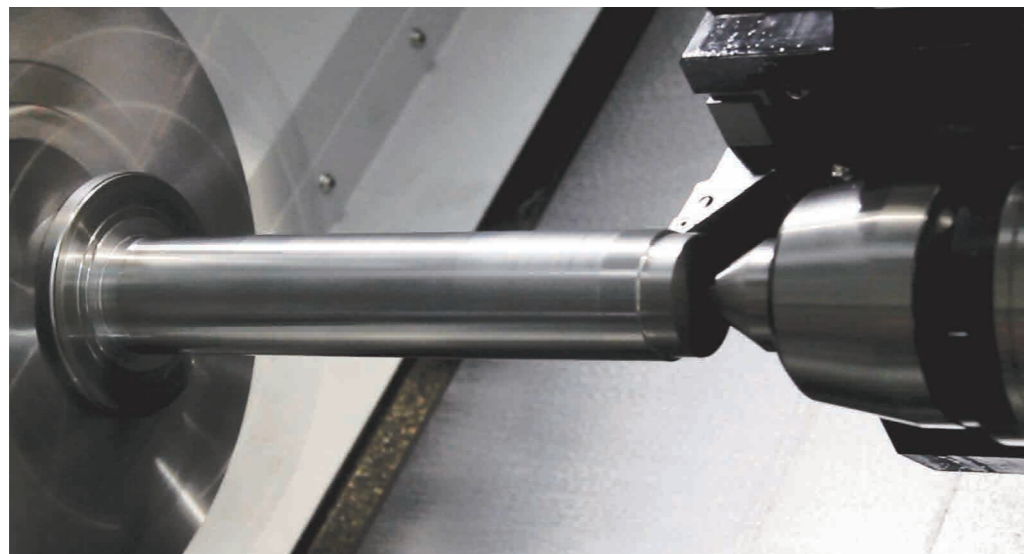


### Mill Turret [BMT55]

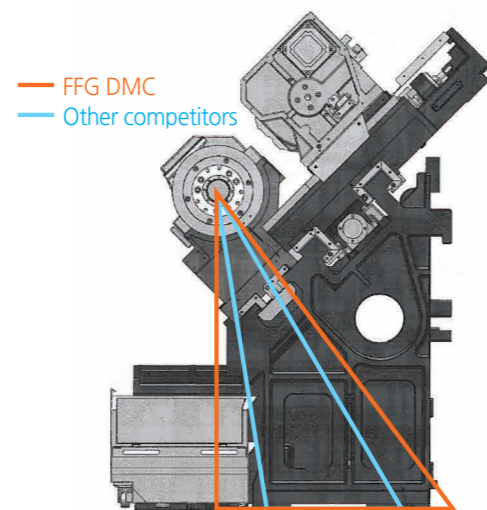
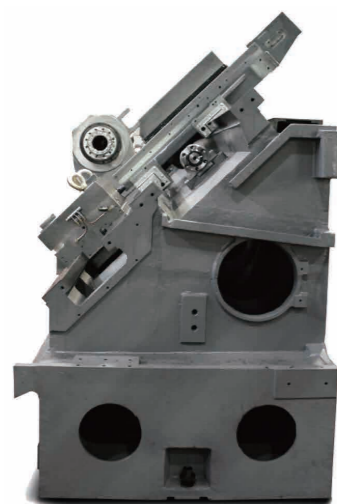
unit:mm(inch)

- Tool size : □25(0.98), Ø40(1.57)
- Turret clamping : 4453kgf(9,817lbs)
- Turret indexing : repeatability ±0.005(0.0002)
- Large size diameter coupling : Ø200(7.87)
- Spindle Motor : 3.7kw(5hp)
- Milling Spindle Speed : 5,000rpm

## High productivity



## Bed

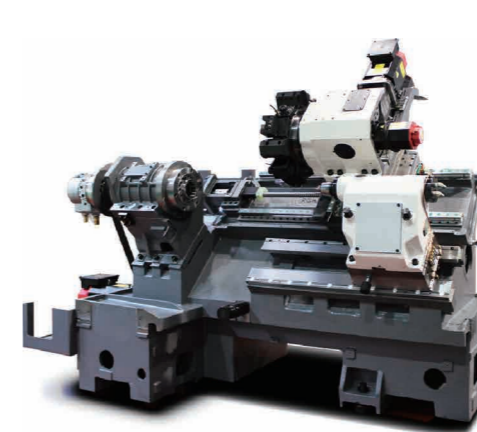
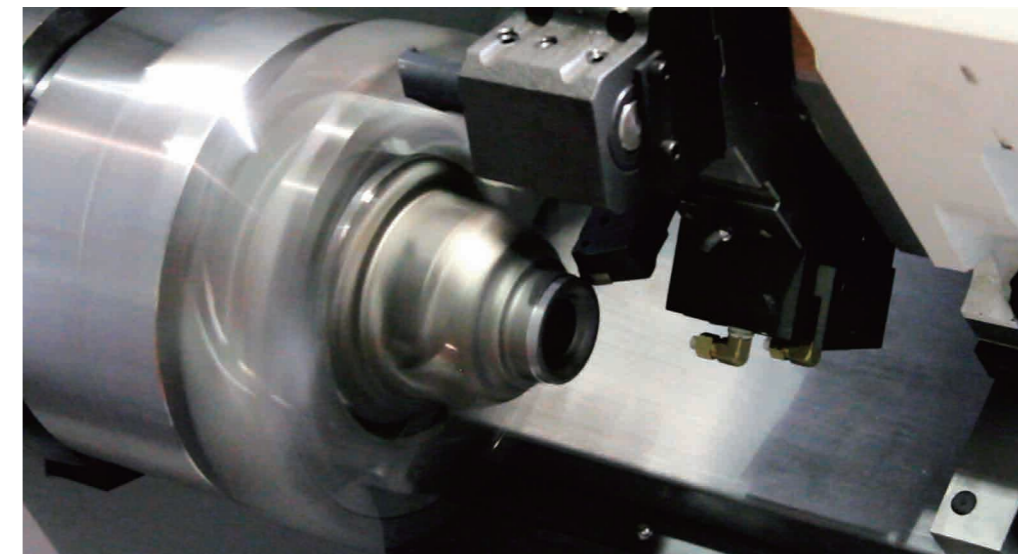


Highest precision even in intermittent cutting with great absorption ability

- 45degree slant bed is great for vibration-dampening capability. High precision quality is guaranteed in a heavy duty cutting and enhanced machine life with elimination of distortion or deformation.

### Offers Wide Bed Leveling

- Spindle overhang prevention (provides greater stability)
- **FFG DMC** : Right triangle
- **Other company** : Obtuse triangle
- Guaranteed stability against cutting resistance.
- Reduced vibration during high-speed rotation.
- Strong structure against any deformation in long-term.
- Protruding bed leveling boss ensures greater stability in performance.



**Roller Guide type**  
DL 21A / 21LA / 21MA / 21LMA  
DL 21B / 21LB / 21MB / 21LMB



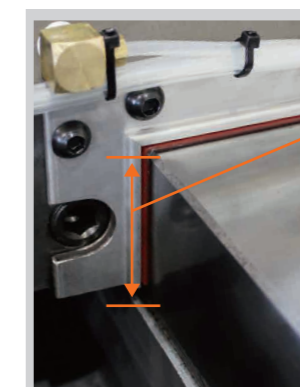
**Box way type**  
DL 22A / 22LA / 22LMA  
DL 22B / 22LB / 22LMB

Roller guide best for high speed heavy industry cutting



Roller guide offers faster speed and realizes repeat accuracy in determining position with 0.001 mm accuracy.

Box way: 1.8x thicker than other company's



Wider and thicker guide way and 6-faces fixed slide way are meticulously machined after high frequency heat treatment for the long-lasting precision quality and strong heavy cutting. Hand scrapping on the cast iron (other companies use turcite)

## High productivity

### Rapid traverse rate

**Roller type** Rapid traverse rate **X/Z axis 36m/min(1,417ipm)**  
Competitor's model rapid traverse rate X/Z axis 20m/min(787ipm)

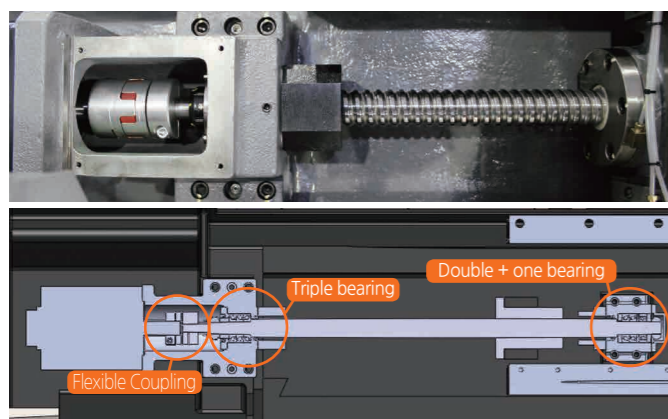
**Box type** Rapid traverse rate **X/Z axis 24m/min(945ipm)**  
Competitor's model rapid traverse rate X/Z axis 20m/min(787ipm)

| Type   | MODEL  | X axis    | Z axis    |
|--------|--|-----------|-----------|
| Roller | DL 21A/21LA/21MA/21LMA<br>DL 21B/21LB/21MB/21LMB | 36(1,417) | 36(1,417) |
| Box    | DL 22A/22LA/22LMA<br>DL 22B/22LB/22LMB           | 24(945)   | 24(945)   |

### Travel

| MODEL                      | X axis    | Z axis     |
|----------------------------|-----------|------------|
| DL 21A/22A/21B/22B         | 210(8.27) | 430(16.93) |
| DL 21LA/22LA/21LB/22LB     | 210(8.27) | 580(22.83) |
| DL 21MA/DL21MB             | 200(7.87) | 410(16.14) |
| DL 21LMA/22LMA/21LMB/22LMB | 200(7.87) | 550(21.65) |

### Axis



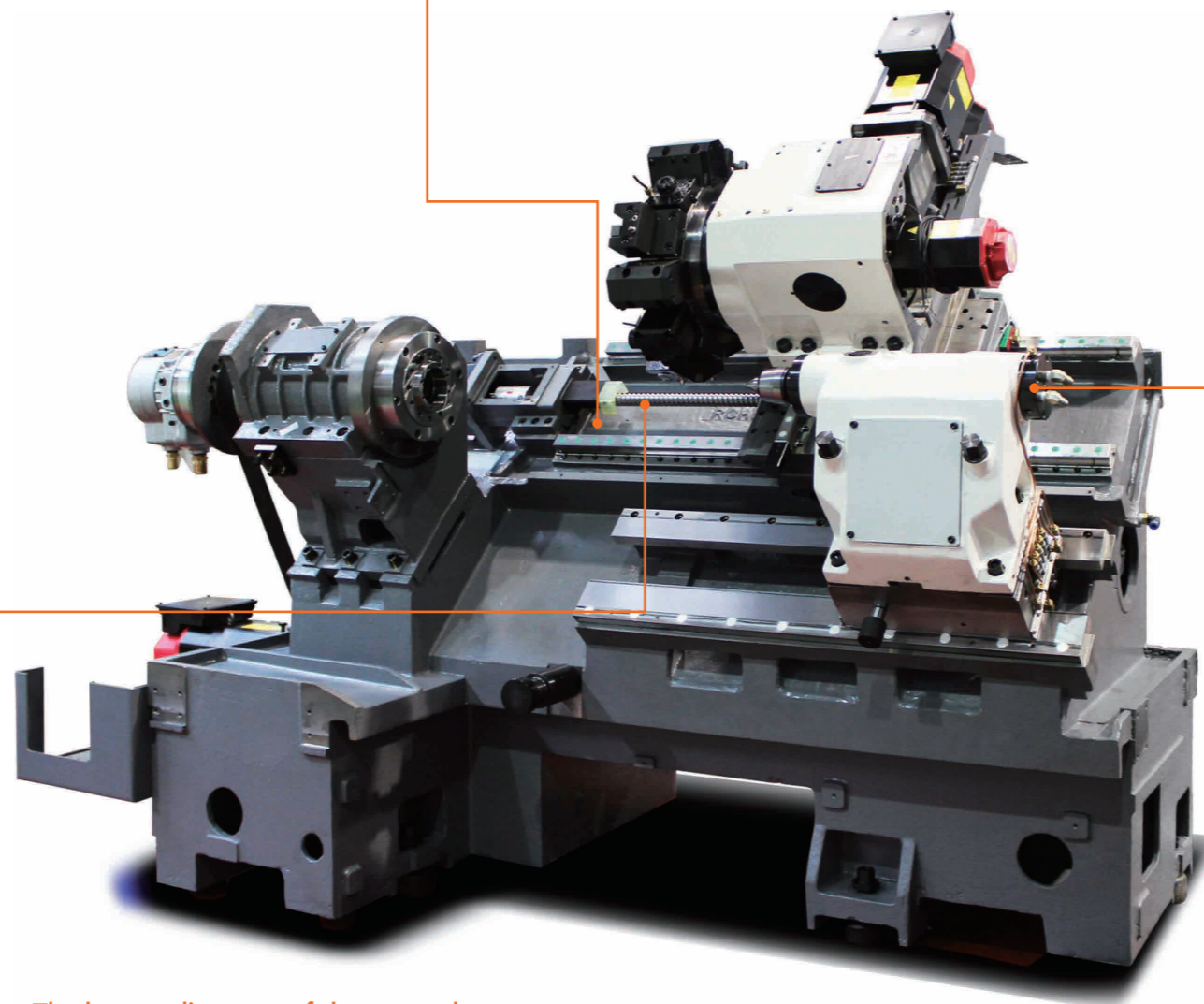
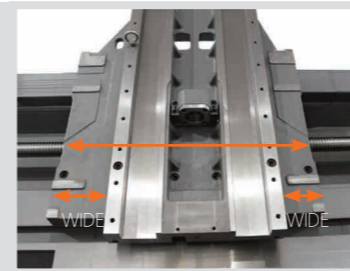
Flexible coupling connection for the efficient delivering power input and shock absorbtion

- Double anchorage ball screw support type.
- Optimized combination of the triple angular ball bearing, double angular ball bearing, and radial bearing to maximize thrust & radial direction rigidity.
- Minimized heat distortion due to the pretension treatment.
- Flexible coupling connects large size diameter, high precision ball screw to convey motion power without loss and to dampen shock.

### Wide saddle

**Wide saddle structure prevent machining vibrations**

- The highest rigidity of the same class
- Expand Saddle Guideway's contact surface width, prevent the overhang of turret and machining vibration.



### The largest diameter of the same class

DL 22A/22LA/22LMA/22B/22LB/22LMB

FFG DMC **X axis  $\varnothing 32(1.26)$ , Z axis  $40(1.57)$**

Competitor's **X axis  $\varnothing 32(1.26)$ , Z axis  $\varnothing 32(1.26)$**

Unit : min(inch)



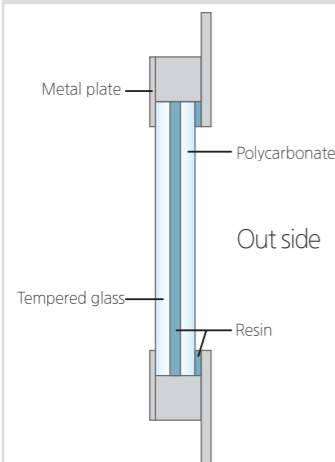
### Manual Tail stock

- The superb tail stock comes with the widest guideway of the same class and tail spindle diameter.
- High rigidity and high precision guideway with the largest size of tail spindle diameter.

| Tail stock specification |             | DL 21A<br>DL 21MA<br>DL 21B<br>DL 21MB | DL 21LA/21LMA<br>DL 21LB/21LMB<br>DL 22LA/22LMA<br>DL 22LB/22LMB |
|--------------------------|-------------|--|--|
| Manual (STD.)            | Live Center | Tail spindle diameter [mm(inch)]       | $\varnothing 65(2.56)$ / $\varnothing 80(3.15)$                  |
|                          |             | Tail spindle travel [mm(inch)]         | 80(3.15) / 80(3.15)  |
|                          |             | Tail spindle power [kgf(lbs)]          | 511(1,127) / 690(1,521)  |
|                          |             | Tail spindle taper                     | MT#4 / MT#4  |

## Enhanced Operator Feature

### Double-paneled safety window



### LED Worklight



+ Long life LED allows bright and safe work ambience.

### Chuck open/close identification

+ Chuck status is regularly checked for smooth operation

### Oil retrieval box



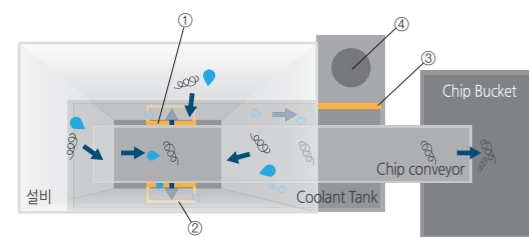
### Oil leak prevention

+ Cover to ensure the pleasant work place.  
+ Long-lasting life with wiper protection.



### 3-steps filter coolant tank to prevent over flow and for easy maintenance

+ Chip conveyor installation - front/side type



- ① 1st step : Mesh filter
- ② 2nd step : Bucket mesh
- ③ 3rd step : Mesh filter
- ④ 4th step : Motor suction filter

Option

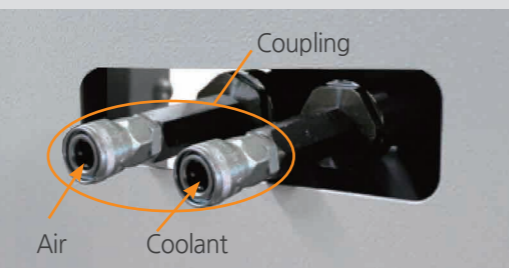
### Coolant gun



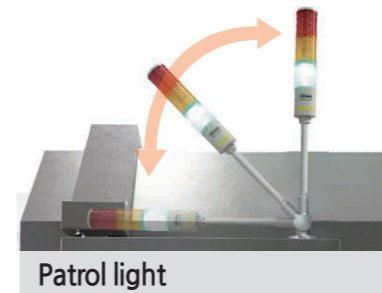
### Air gun



### Nipple (air, coolant)



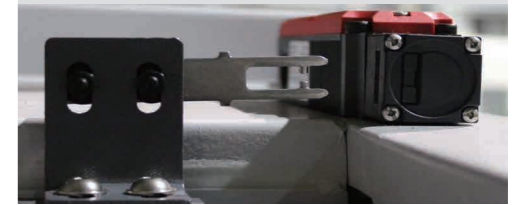
### Spindle load meter for the visual spindle load time check



### Patrol light

+ LED 3 color wrapped folded when shipping

### Front door interlock equipment



+ Safety switch identifies open/close status of the door. To ensure safety, machining is only operated when the door is properly locked.

### RS232C (Input/output interface)



+ USB port

### Movable CNC panel



+ Convenient swiveling CNC panel

### Detachable cutting oil tank for easy maintenance and cleaning



+ Large tank volume  
+ Drawer-type oil tank with wheels is detachable from the coolant tank for easy daily maintenance.

|                         |  |
|-------------------------|--|
| Cutting oil tank volume | 140ℓ (36.98gal) : DL 21A/21LA/21MA/21B/21MB/22A/22B<br>190ℓ (50.19gal) : DL 21LMA/21LB/21LMB/22LA/22LMA/22LB/22LMB |
| Hydraulic tank volume   | 14ℓ (3.7gal)   |

### Tool setter(OPT.)



**Portable**  
+ Portable Tool setter  
+ Aluminum metallic tube, compact design

**Automatic(auto)**  
+ Motor Driven Arm Tool setter  
+ Fully authenticated components

### Foot switch



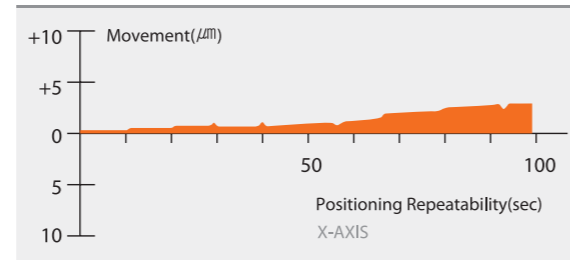
## Precision

### High precision 3 $\mu$ m repeatability, provides high accuracy and acceleration

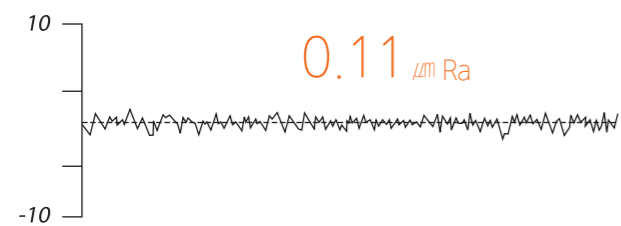
- Effectively prevented heat distortion
- Backlash prevented and vibration dampened



- Ball screw length movement

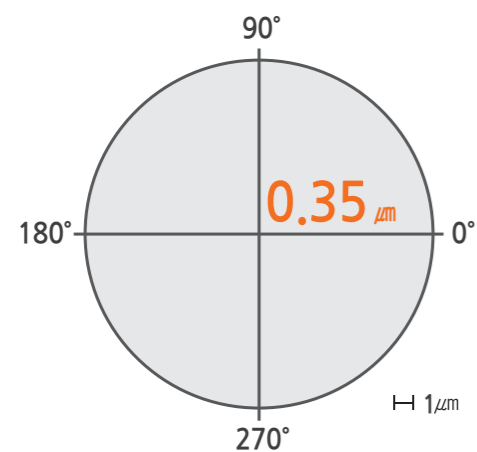


## Surface profile

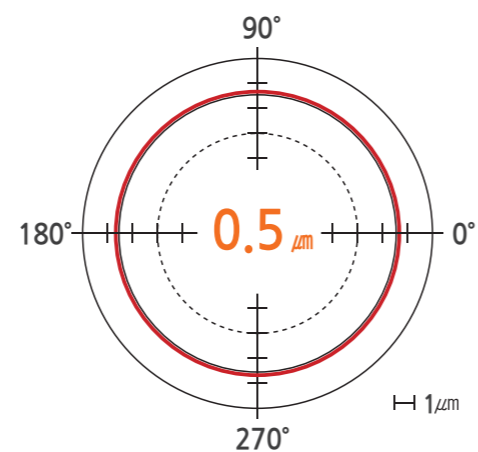


|                |  |
|----------------|--|
| Model          | DL 22B                                     |
| Workpiece size | $\varnothing$ 50(1.97")xL50(1.97") (SM45C) |
| Spindle speed  | 3,500rpm                                   |
| Cutting depth  | 0.02mm(0.000787inch)                       |
| Traverse       | 0.025 mm/rev                               |

## Roundness



## Cylindricity



Above data are based on our in-house testing standards and can be circumstantial depending on working environment.

## Option

### Various standard options and Specialized features for customers

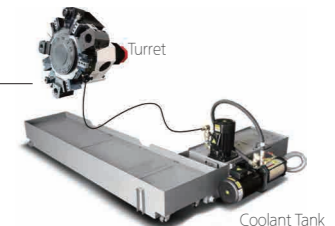
#### Features

Standard: Hydraulic chuck, Soft jaw, Tool box, Hydraulic unit, Door interlock, Cutting oil supplying device, Work light, Leveling bolt&plate, Foot switch, Air unit, Lubrication unit, Chuck open/close identification devices, RS232C + USB Port

#### Option Equipment



Auto Front Door



Coolant Tank

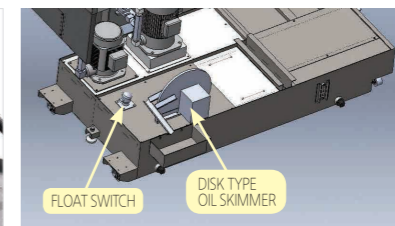
Moderate/High pressure Coolant(6/20 bar)



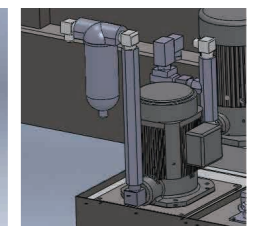
Oil Mist Collector



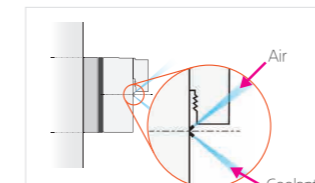
Oil Skimmer(Belt type)



Oil Skimmer(Disk type)



Line Filter(100 Mesh)



Spindle thru Air/Coolant (when special chuck is included)



Parts Catcher



Special Chuck



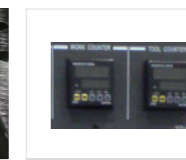
Upper side chuck Air/Coolant



- 230 $\ell$  (60.76gal) (Swing)
- 300 $\ell$  (79.25gal) (Swing)
- 300 $\ell$  (79.25gal) (Fork lift)
- 380 $\ell$  (100.38gal) (Fork lift)
- 440 $\ell$  (116.23gal) (Fork lift)



Point Sensor(2 Point high precision position control)



Multi Counter



Counter



Linear scale(High precision position control)



Sub control panel



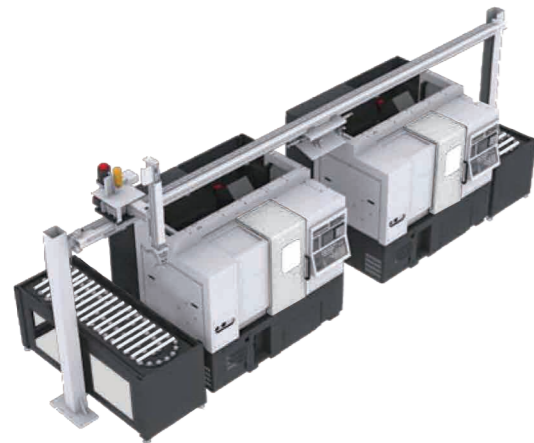
Air Limit(Workpiece contact surface check equipment)

#### Other soft options selection

- I/O extension(16 contacts, 32 contacts)
- Automatic power-off
- M - code

## Automation

### Gantry Loader Automation



#### Work piece : Diff case(separate type)

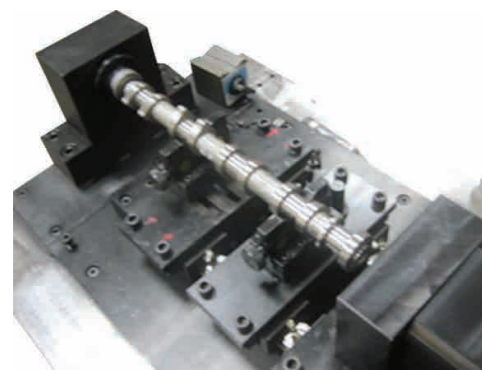
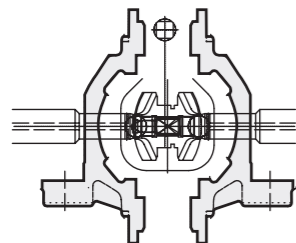
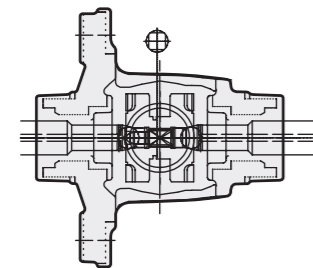
| No.  | Process             | Machine           | Unit | Notes                             |
|------|---------------------|-------------------|------|-----------------------------------|
| OP10 | 1st turning         | DL 22B            | 1    |                                   |
| OP20 | 2nd turning         | DL 22B            | 1    |                                   |
| OP30 | 3rd turning         | DL 22B            | 1    |                                   |
| OP40 | Plug hole           | DM 43VCD          | 1    |                                   |
| OP50 | Bolt hole           | DM 43VCD          | 1    |                                   |
| OP60 | Machining of facing | Special M/C       | 1    |                                   |
| OP70 | Boring              | Finish boring M/C | 1    | Selectable depending on allowance |



- Line cycle time : 119sec
- Production : 159,600ea/year
- Space : 34,390x12,210mm<sup>3</sup>  
(1,353.94x480.71inch<sup>3</sup>)

#### Work piece : Diff case(Integrative type)

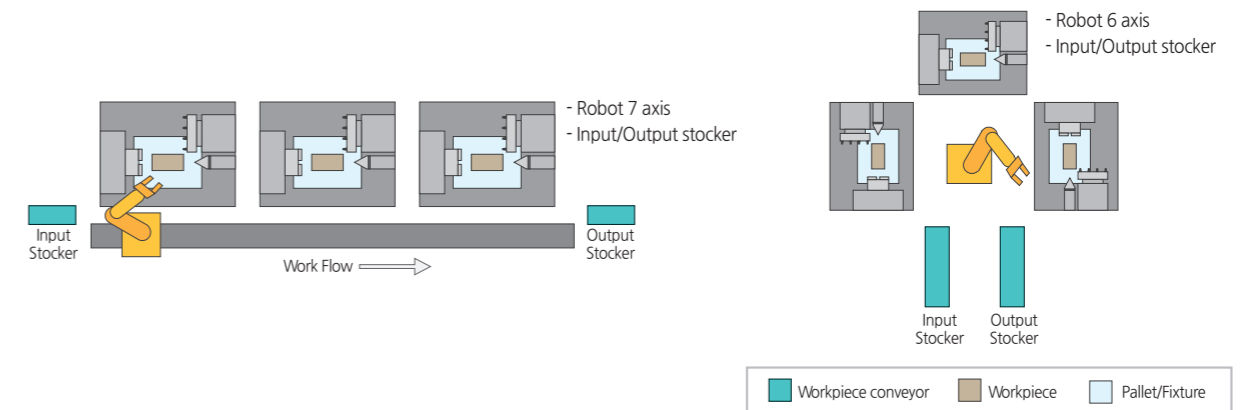
| No.  | Process             | Machine           | Unit | Notes                             |
|------|---------------------|-------------------|------|-----------------------------------|
| OP10 | 1st turning         | DL 22B            | 1    |                                   |
| OP20 | 2nd turning         | DL 22B            | 1    |                                   |
| OP30 | 3rd turning         | DL 22B            | 1    |                                   |
| OP40 | Plug hole           | DM 43VCD          | 1    |                                   |
| OP50 | Bolt hole           | DM 43VCD          | 1    |                                   |
| OP60 | Machining of facing | DL 22LB           | 1    |                                   |
| OP70 | Machining of sphere | DL 22LB           | 1    |                                   |
| OP80 | Finish boring       | Finish boring M/C | 1    | Selectable depending on allowance |



#### Cam shaft

| No.  | Process               | Machine         | Unit | Notes |
|------|-----------------------|-----------------|------|-------|
| OP10 | FACING & CENTERING    | SPECIAL MACHINE | 1    |       |
| OP20 | Turning of Journal    | DL 22LB         | 1    |       |
| OP30 | Turning of Journal    | DL 22LB         | 1    |       |
| OP40 | Machining of oil hole | DM 43VCD        | 1    |       |

## Robot Automation



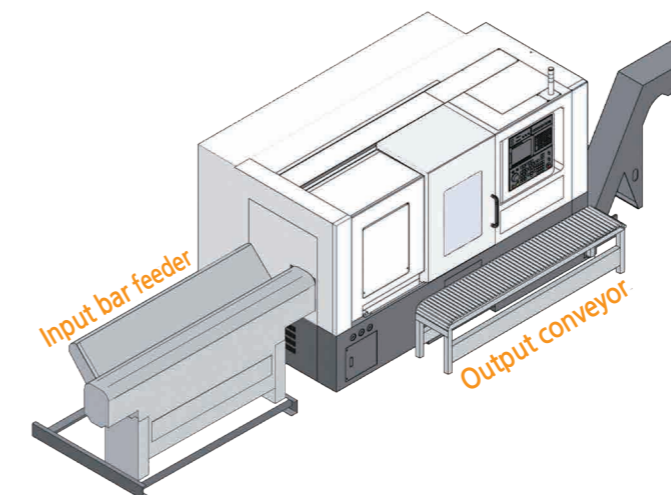
#### Work piece : Cylinder liner



| No.  | Process       | Machine | Unit | Notes   |
|------|---------------|---------|------|---------|
| OP10 | 1st turning   | DL 22B  | 5    |         |
| OP20 | 2nd turning   | DL 22B  | 5    |         |
| OP30 | Finish boring | CVH-12D | 2    | Special |

- Line cycle time : 171sec
- Production : 480,000ea/year
- Space : 40,700x6,920mm<sup>3</sup>(1,602.36x272.44inch<sup>3</sup>)

## Bar Feeder Automation



- Use of bar feeder, parts catcher, and output conveyor at once to maximize production through automation

## Work

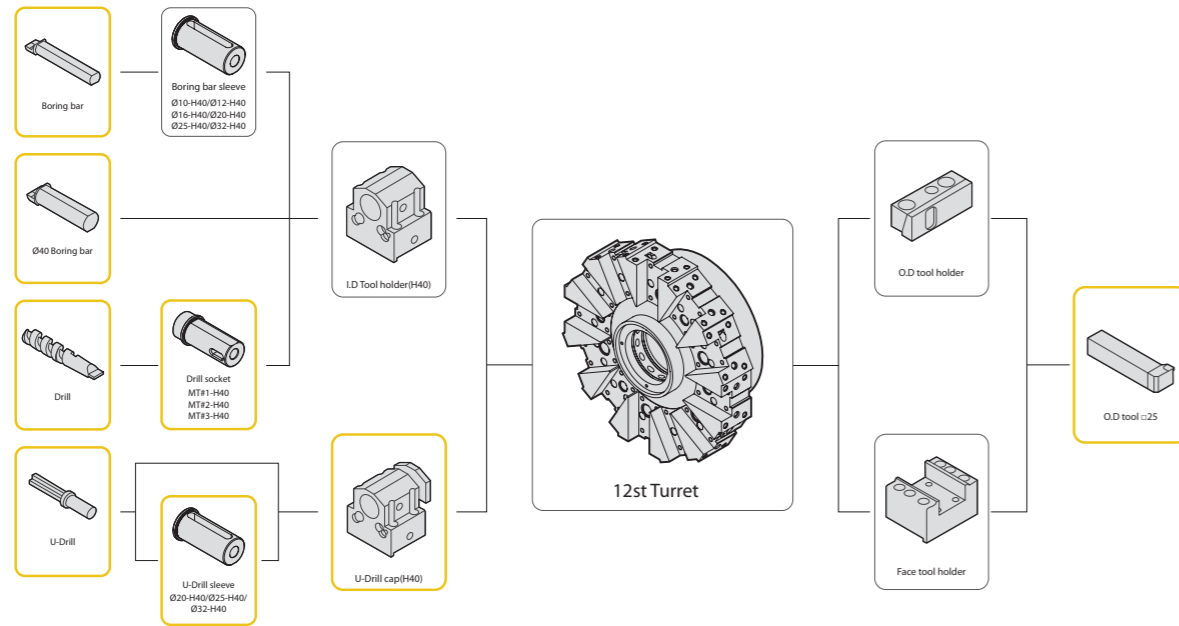




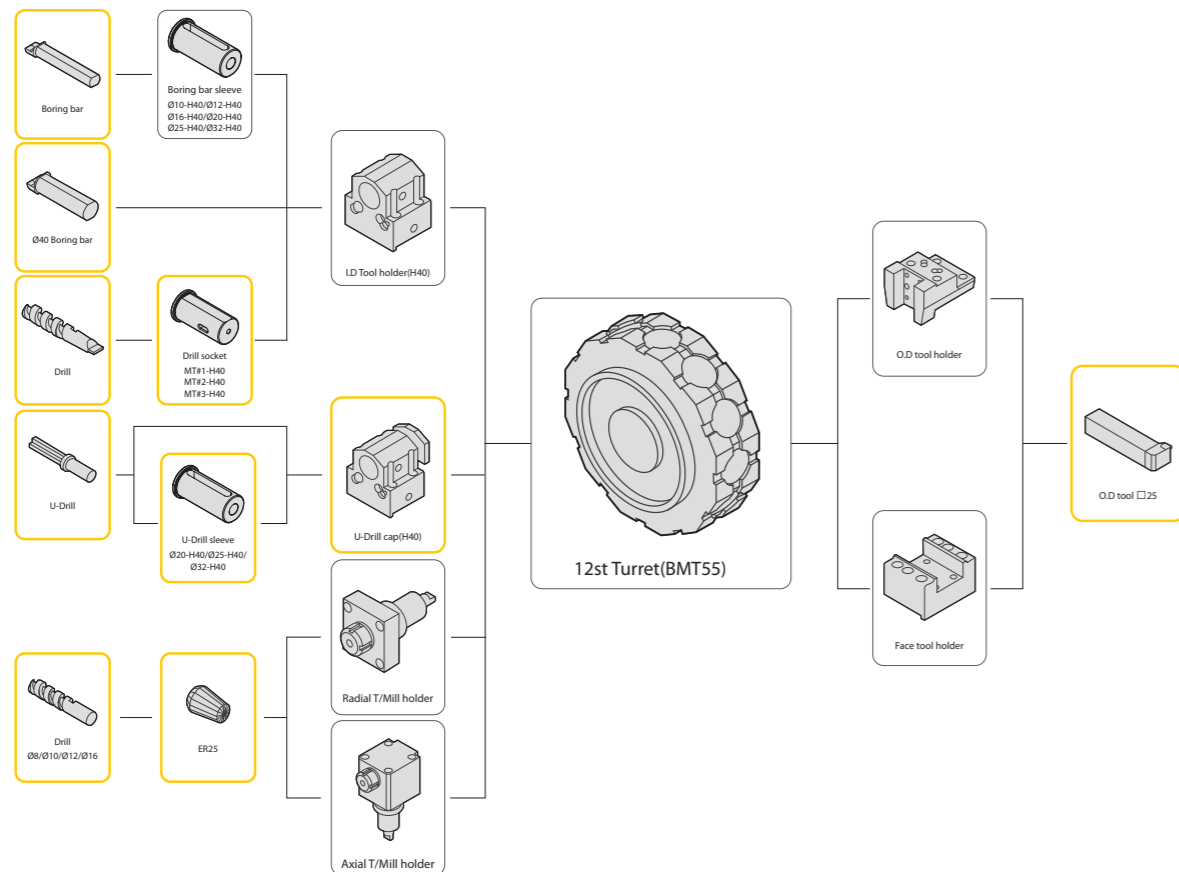
## Tooling system

□ : Option (Not-Supplied)

### DL 21A/21LA/22A/22LA/21B/21LB/22B/22LB



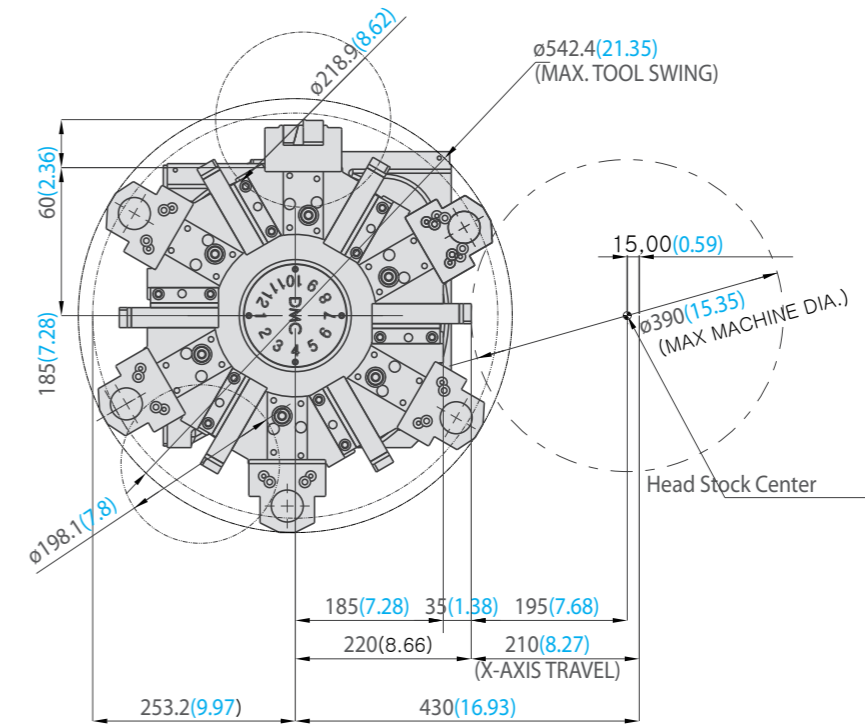
### DL 21MA/21LMA/22LMA/21MB/21LMB/22LMB



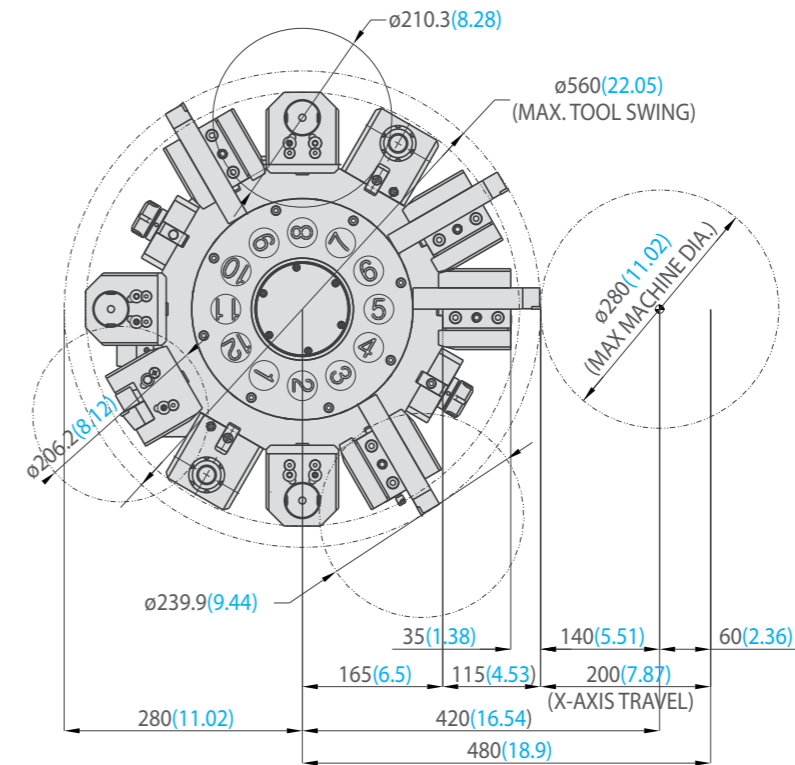
## Tooling interference diagram

Unit : mm (inch)

### DL 21A/21LA/22A/22LA/21B/21LB/22B/22LB



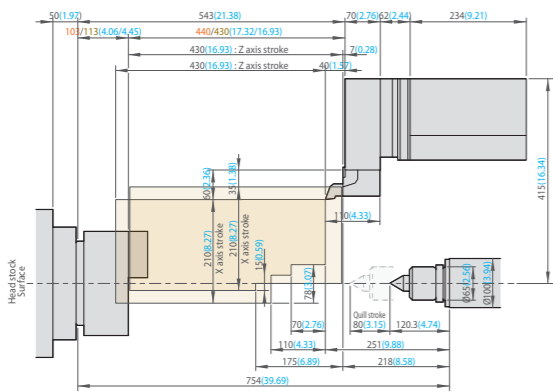
### DL 21MA/21LMA/22LMA/21MB/21LMB/22LMB



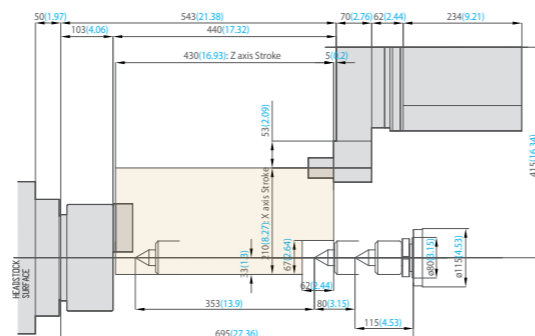
## Working range

Unit : mm(inch)

### DL 21A/22A/21B/22B

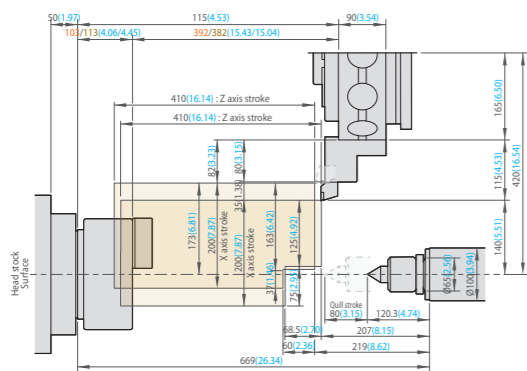


O.D tool/Face tool

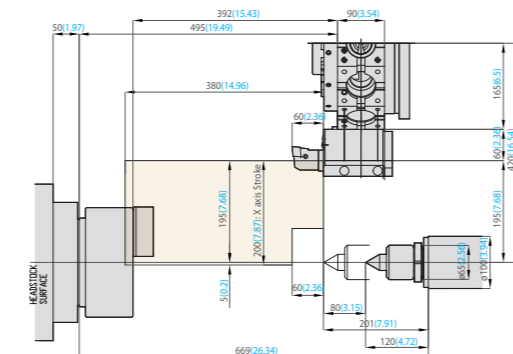


I.D tool

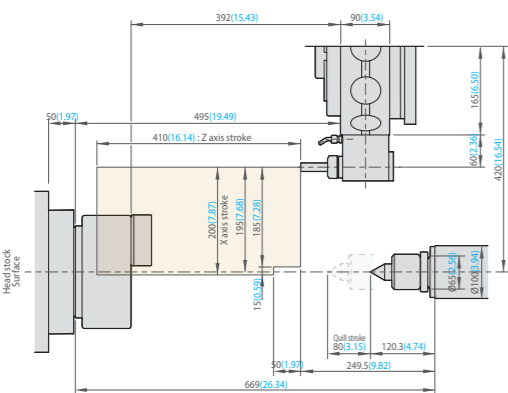
### DL 21MA/21MB



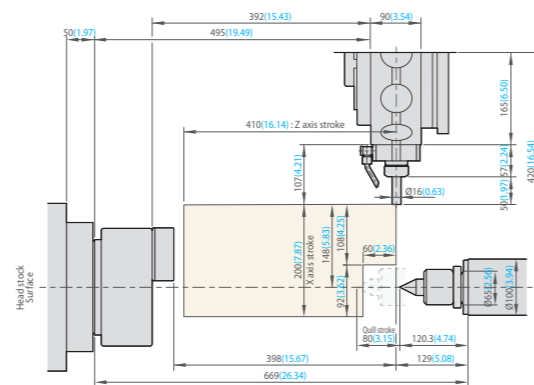
O.D tool/Face tool



I.D tool



Axial(z axis) driven tool

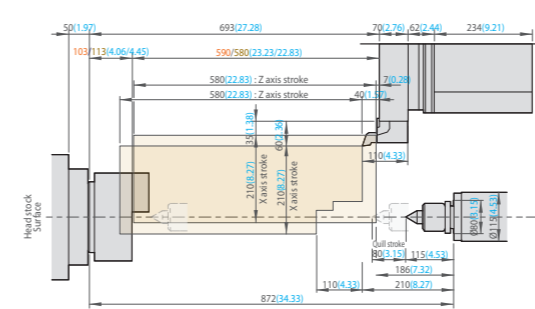


Radial(x axis) driven tool

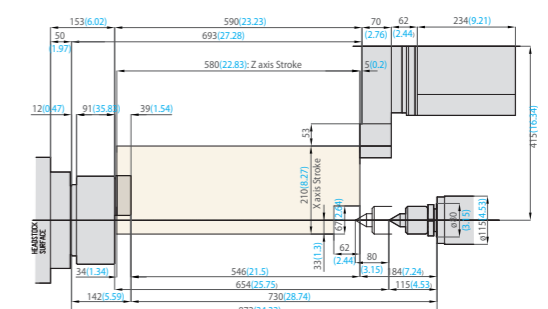
## Working range

Unit : mm(inch)

### DL 21LA/22LA/21LB/22LB

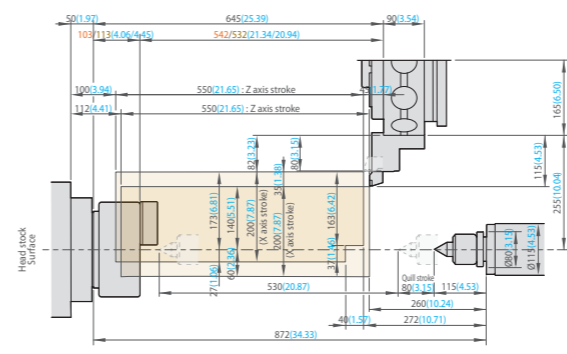


O.D tool/Face tool

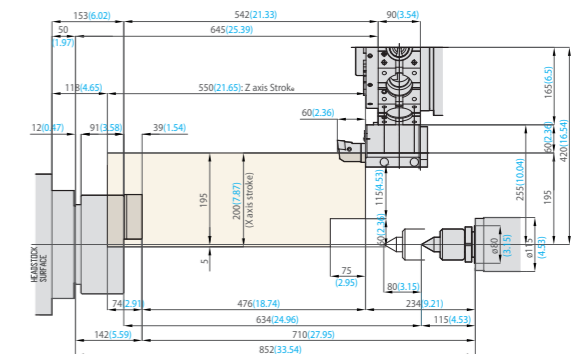


I.D tool

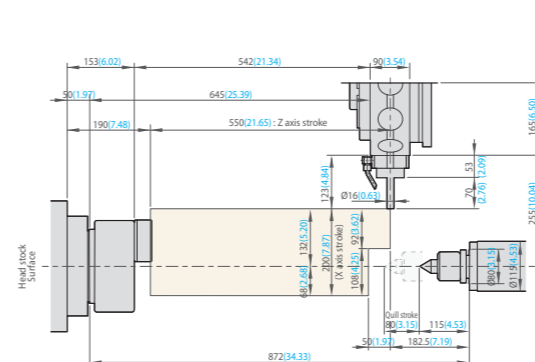
### DL 21LMA/22LMA/21LMB/22LMB



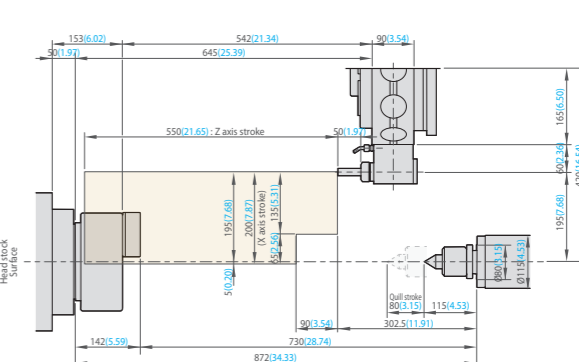
O.D tool/Face tool



I.D tool



Axial(z axis) driven tool

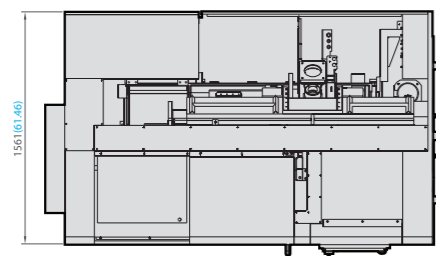


Radial(x axis) driven tool

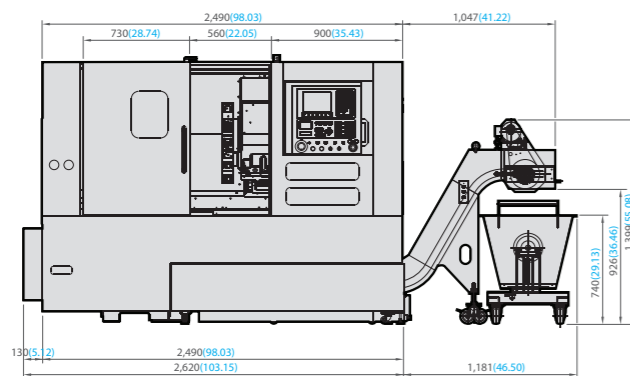
## Machine lay-out

Unit : mm(inch)

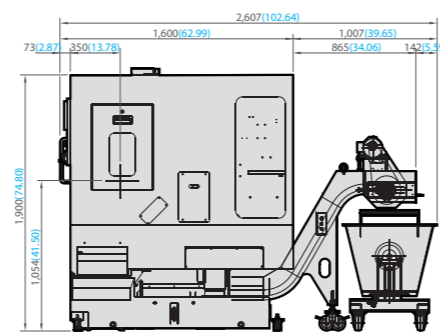
### DL 21A/22A/21MA/21B/22B/21MB



Top

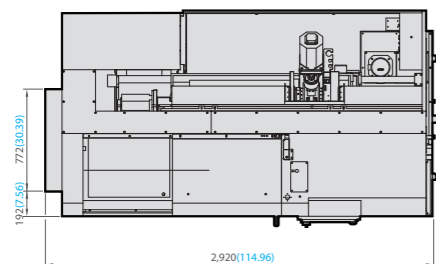


Front

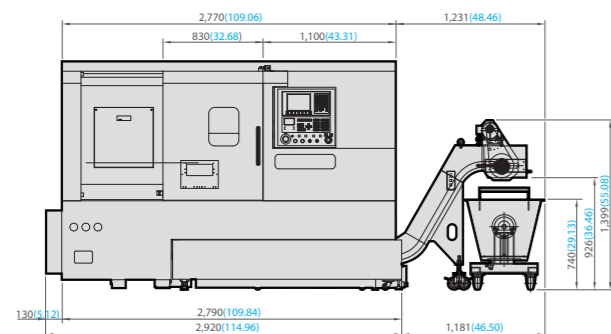


Side

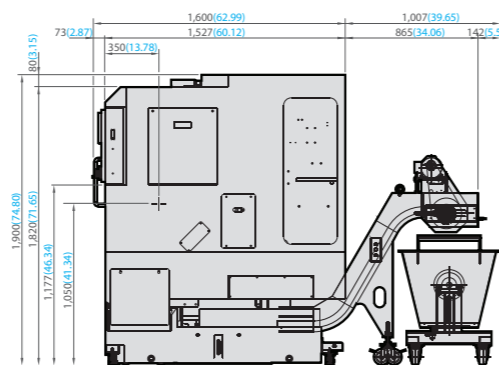
### DL 21LA/22LA/21LMA/22LMA/21LB/22LB/21LMB/22LMB



Top



Front



Side

## Machine Specifications

| Specifications                   | DL 21A     | DL 21LA      | DL 21MA       | DL 21LMA           | DL 21B        | DL 21LB                       | DL 21MB       | DL 21LMB           |  |
|----------------------------------|------------|--------------|---------------|--------------------|---------------|-------------------------------|---------------|--------------------|--|
| Capacity                         |            |              |               |                    |               |                               |               |                    |  |
| Swing over Bed (Max.swing dia.)  | mm(inch)   | 550(21.65)   | 550(21.65)    | 550(21.65)         | 550(21.65)    | 550(21.65)                    | 550(21.65)    | 550(21.65)         |  |
| Swing over Cross slide           | mm(inch)   | 360(14.17)   | 360(14.17)    | 360(14.17)         | 360(14.17)    | 360(14.17)                    | 360(14.17)    | 360(14.17)         |  |
| Max. Turning Dia.                | mm(inch)   | 390(15.35)   | 390(15.35)    | 280(11.02)         | 280(11.02)    | 390(15.35)                    | 390(15.35)    | 280(11.02)         |  |
| Max.Turning Length               | mm(inch)   | 410(16.14)   | 540(21.26)    | 340(13.39)         | 500(19.69)    | 380(14.96)                    | 530(20.87)    | 490(19.29)         |  |
| Bar Capacity                     | mm(inch)   | 65(2.56)     | 65(2.56)      | 65(2.56)           | 65(2.56)      | 76(2.99)                      | 76(2.99)      | 76(2.99)           |  |
| Main spindle                     |            |              |               |                    |               |                               |               |                    |  |
| Max.Spindle Speed                | rpm        | 4,000        | 4,000         | 4,000              | 4,000         | 3,500                         | 3,500         | 3,500              |  |
| Spindle Nose                     | -          | A2-6         | A2-6          | A2-6               | A2-6          | A2-8                          | A2-8          | A2-8               |  |
| Spindle Bore diameter            | mm(inch)   | 76(2.99)     | 76(2.99)      | 76(2.99)           | 76(2.99)      | 86(3.39)                      | 86(3.39)      | 86(3.39)           |  |
| Cs-Axis Spindle Index angle      | deg        | -            | -             | 360(0.001)         | 360(0.001)    | -                             | -             | 360(0.001)         |  |
| Max. Spindle Torque              | Nm(lbs.ft) | 167(1205)    | 167(1205)     | 167(1205)          | 167(1205)     | 196(1418)                     | 196(1418)     | 196(1418)          |  |
| Spindle Driven Method            | -          | Belt         | Belt          | Belt               | Belt          | Belt                          | Belt          | Belt               |  |
| Chuck Size                       | inch       | 8"BIG        | 8"BIG         | 8"BIG              | 8"BIG         | 10"                           | 10"           | 10"                |  |
| Motor                            |            |              |               |                    |               |                               |               |                    |  |
| Main Spindle Motor(Cont./30min)  | kw(hp)     | 11/15(15/20) |               |                    |               | 11/15[15/18.5] (15/20[20/25]) |               |                    |  |
| X axis Servo Motor               | kw(hp)     | 3(4)         | 3(4)          | 3(4)               | 3(4)          | 3(4)                          | 3(4)          | 3(4)               |  |
| Z axis Servo Motor               | kw(hp)     | 3(4)         | 3(4)          | 3(4)               | 3(4)          | 3(4)                          | 3(4)          | 3(4)               |  |
| Mill Spindle Motor(Cont./30min)  | kw(hp)     | -            | -             | 2.2/3.7(2.95/4.96) |               | -                             | -             | 2.2/3.7(2.95/4.96) |  |
| Travel                           |            |              |               |                    |               |                               |               |                    |  |
| X axis travel                    | mm(inch)   | 210(8.27)    | 210(8.27)     | 200(7.87)          | 200(7.87)     | 210(8.27)                     | 210(8.27)     | 200(7.87)          |  |
| Z axis travel                    | mm(inch)   | 430(16.93)   | 580(22.83)    | 410(16.14)         | 550(21.65)    | 430(16.93)                    | 580(22.83)    | 550(21.65)         |  |
| Guideway Type(X/Z)               | -          | Roller Guide | Roller Guide  | Roller Guide       | Roller Guide  | Roller Guide                  | Roller Guide  | Roller Guide       |  |
| X axis rapid traverse rate       | m/min(ipm) | 36(1,417)    | 36(1,417)     | 36(1,417)          | 36(1,417)     | 36(1,417)                     | 36(1,417)     | 36(1,417)          |  |
| Z axis rapid traverse rate       | m/min(ipm) | 36(1,417)    | 36(1,417)     | 36(1,417)          | 36(1,417)     | 36(1,417)                     | 36(1,417)     | 36(1,417)          |  |
| Turret                           |            |              |               |                    |               |                               |               |                    |  |
| Turret Index Type                | -          | Servo        | Servo         | Servo              | Servo         | Servo                         | Servo         | Servo              |  |
| Max. No. of Tools                | ea         | 12           | 12            | 12/BMT55           | 12/BMT55      | 12                            | 12            | 12/BMT55           |  |
| Turning tool shank size          | mm(inch)   | □25(0.98)    | □25(0.98)     | □25(0.98)          | □25(0.98)     | □25(0.98)                     | □25(0.98)     | □25(0.98)          |  |
| Borning bar diameter             | mm(inch)   | ∅40(1.57)    | ∅40(1.57)     | ∅40(1.57)          | ∅40(1.57)     | ∅40(1.57)                     | ∅40(1.57)     | ∅40(1.57)          |  |
| Turret Indexing Time(1st swivel) | sec        | 0.2          | 0.2           | 0.2                | 0.2           | 0.2                           | 0.2           | 0.2                |  |
| Rotating Tool Speed              | rpm        | -            | -             | 5,000              | 5,000         | -                             | -             | 5,000              |  |
| Tailstock                        |            |              |               |                    |               |                               |               |                    |  |
| Tailstock Quill diameter         | mm(inch)   | 65(2.56)     | 80(3.15)      | 65(2.56)           | 80(3.15)      | 65(2.56)                      | 80(3.15)      | 65(2.56)           |  |
| Tailstock Quill stroke           | mm(inch)   | 80(3.15)     | 80(3.15)      | 80(3.15)           | 80(3.15)      | 80(3.15)                      | 80(3.15)      | 80(3.15)           |  |
| Tailstock Quill Taper            | MT         | MT#4         | MT#4          | MT#4               | MT#4          | MT#4                          | MT#4          | MT#4               |  |
| Tank Capacity                    |            |              |               |                    |               |                               |               |                    |  |
| Coolant Tank Capacity            | ℓ(gal)     | 140(36.98)   | 190(50.19)    | 140(36.98)         | 190(50.19)    | 140(36.98)                    | 190(50.19)    | 140(36.98)         |  |
| Hydraulic Tank Capacity          | ℓ(gal)     | 14(3.70)     | 14(3.70)      | 14(3.70)           | 14(3.70)      | 14(3.70)                      | 14(3.70)      | 14(3.70)           |  |
| General                          |            |              |               |                    |               |                               |               |                    |  |
| Machine Weight                   | kgf(lbs)   | 3,950(8,708) | 4,350(9,590)  | 4,050(8,929)       | 4,450(9,810)  | 4,050(8,929)                  | 4,450(9,810)  | 4,150(9,149)       |  |
| Machine height                   | mm(inch)   | 1,900(74.80) | 1,900(74.80)  | 1,900(74.80)       | 1,900(74.80)  | 1,900(74.80)                  | 1,900(74.80)  | 1,900(74.80)       |  |
| Floor space                      | Length     | mm(inch)     | 2,660(104.72) | 2,960(116.54)      | 2,660(104.72) | 2,960(116.54)                 | 2,660(104.72) | 2,960(116.54)      |  |
|                                  | Width      | mm(inch)     | 1,650(64.96)  | 1,650(64.96)       | 1,650(64.96)  | 1,650(64.96)                  | 1,650(64.96)  | 1,650(64.96)       |  |
| Power capacity[15/18.5kw]        | kVA        | 27           | 27            | 30                 | 30            | 27[32]                        | 27[32]        | 30[32]             |  |
| Controller                       | -          | FOI-TF       | FOI-TF        | FOI-TF             | FOI-TF        | FOI-TF                        | FOI-TF        | FOI-TF             |  |

### Machine Specifications

| Specifications                        | DL 22A                                   | DL 22LA         | DL 22LMA      | DL 22B                        | DL 22LB       | DL 22LMB      |                    |               |
|---------------------------------------|--|-----------------|---------------|-------------------------------|---------------|---------------|--------------------|---------------|
| Capacity                              | Swing over Bed (Max.swing dia.) mm(inch) | 550(21.65)      | 550(21.65)    | 550(21.65)                    | 550(21.65)    | 550(21.65)    |                    |               |
|                                       | Swing over Cross slide mm(inch)          | 360(14.17)      | 360(14.17)    | 360(14.17)                    | 360(14.17)    | 360(14.17)    |                    |               |
|                                       | Max. Turning Dia. mm(inch)               | 390(15.35)      | 390(15.35)    | 280(11.02)                    | 390(15.35)    | 390(15.35)    | 280(11.02)         |               |
|                                       | Max. Turning Length mm(inch)             | 410(16.14)      | 540(21.26)    | 500(19.69)                    | 380(14.96)    | 530(20.87)    | 490(19.29)         |               |
|                                       | Bar Capacity mm(inch)                    | 65(2.56)        | 65(2.56)      | 65(2.56)                      | 76(2.99)      | 76(2.99)      | 76(2.99)           |               |
| Main spindle                          | Max.Spindle Speed rpm                    | 4,000           | 4,000         | 4,000                         | 3,500         | 3,500         | 3,500              |               |
|                                       | Spindle Nose                             | A2-6            | A2-6          | A2-6                          | A2-8          | A2-8          | A2-8               |               |
|                                       | Spindle Bore diameter mm(inch)           | 76(2.99)        | 76(2.99)      | 76(2.99)                      | 86(3.39)      | 86(3.39)      | 86(3.39)           |               |
|                                       | Cs-Axis Spindle Index angle deg          | -               | -             | 360(0.001)                    | -             | -             | 360(0.001)         |               |
|                                       | Max. Spindle Torque Nm(lbs.ft)           | 167(1205)       | 167(1205)     | 167(1205)                     | 196(1418)     | 196(1418)     | 196(1418)          |               |
|                                       | Spindle Driven Method                    | Belt            | Belt          | Belt                          | Belt          | Belt          | Belt               |               |
| Motor                                 | Chuck Size inch                          | 8"BIG           | 8"BIG         | 8"BIG                         | 10            | 10            | 10                 |               |
|                                       | Main Spindle Motor(Cont./30min) kw(hp)   | 11/15(15/20)    |               | 11/15[15/18.5] (15/20[20/25]) |               |               |                    |               |
|                                       | X axis Servo Motor kw(hp)                | 3(4)            | 3(4)          | 3(4)                          | 3(4)          | 3(4)          | 3(4)               |               |
|                                       | Z axis Servo Motor kw(hp)                | 3(4)            | 3(4)          | 3(4)                          | 3(4)          | 3(4)          | 3(4)               |               |
| Travel                                | Mill Spindle Motor(Cont./30min) kw(hp)   | -               | -             | 2.2/3.7(2.95/4.96)            | -             | -             | 2.2/3.7(2.95/4.96) |               |
|                                       | X axis travel mm(inch)                   | 210(8.27)       | 210(8.27)     | 200(7.87)                     | 210(8.27)     | 210(8.27)     | 200(7.87)          |               |
|                                       | Z axis travel mm(inch)                   | 430(16.93)      | 580(22.83)    | 550(21.65)                    | 430(16.93)    | 580(22.83)    | 550(21.65)         |               |
|                                       | Guideway Type(X/Z)                       | BOX Guide       | BOX Guide     | BOX Guide                     | BOX Guide     | BOX Guide     | BOX Guide          |               |
|                                       | X axis rapid traverse rate m/min(ipm)    | 24(945)         | 24(945)       | 24(945)                       | 24(945)       | 24(945)       | 24(945)            |               |
| Z axis rapid traverse rate m/min(ipm) | 24(945)                                  | 24(945)         | 24(945)       | 24(945)                       | 24(945)       | 24(945)       |                    |               |
| Turret                                | Turret Index Type                        | Servo           | Servo         | Servo                         | Servo         | Servo         | Servo              |               |
|                                       | Max. No. of Tools ea                     | 12              | 12            | 12/BMT55                      | 12            | 12            | 12/BMT55           |               |
|                                       | Turning tool shank size mm(inch)         | □25(0.98)       | □25(0.98)     | □25(0.98)                     | □25(0.98)     | □25(0.98)     | □25(0.98)          |               |
|                                       | Boring bar diameter mm(inch)             | ∅40(1.57)       | ∅40(1.57)     | ∅40(1.57)                     | ∅40(1.57)     | ∅40(1.57)     | ∅40(1.57)          |               |
|                                       | Turret Indexing Time(1st swivel) sec     | 0.2             | 0.2           | 0.2                           | 0.2           | 0.2           | 0.2                |               |
|                                       | Rotating Tool Speed rpm                  | -               | -             | 5,000                         | -             | -             | 5,000              |               |
| Tailstock                             | Tailstock Quill diameter mm(inch)        | 80(3.15)        | 80(3.15)      | 80(3.15)                      | 80(3.15)      | 80(3.15)      | 80(3.15)           |               |
|                                       | Tailstock Quill stroke mm(inch)          | 80(3.15)        | 80(3.15)      | 80(3.15)                      | 80(3.15)      | 80(3.15)      | 80(3.15)           |               |
|                                       | Tailstock Quill Taper MT                 | MT#4            | MT#4          | MT#4                          | MT#4          | MT#4          | MT#4               |               |
| Tank Capacity                         | Coolant Tank Capacity ℓ (gal)            | 140(36.98)      | 190(50.19)    | 190(50.19)                    | 140(36.98)    | 190(50.19)    | 190(50.19)         |               |
|                                       | Hydraulic Tank Capacity ℓ (gal)          | 14(3.70)        | 14(3.70)      | 14(3.70)                      | 14(3.70)      | 14(3.70)      | 14(3.70)           |               |
| General                               | Machine Weight kgf(lbs)                  | 3,950(8,708)    | 4,400(9,700)  | 4,450(9,810)                  | 4,000(8,818)  | 4,450(9,810)  | 4,500(9,921)       |               |
|                                       | Machine height mm(inch)                  | 1,900(74.80)    | 1,900(74.80)  | 1,900(74.80)                  | 1,900(74.80)  | 1,900(74.80)  | 1,900(74.80)       |               |
|                                       | Floor space                              | Length mm(inch) | 2,660(104.72) | 2,960(116.54)                 | 2,960(116.54) | 2,660(104.72) | 2,960(116.54)      | 2,960(116.54) |
|                                       |  | Width mm(inch)  | 1,650(64.96)  | 1,650(64.96)                  | 1,650(64.96)  | 1,650(64.96)  | 1,650(64.96)       | 1,650(64.96)  |
|                                       | Power capacity[15/18.5kw] kVA            | 27              | 27            | 30                            | 27[32]        | 27[32]        | 30[32]             |               |
| Controller                            | -  | FOI-TF          | FOI-TF        | FOI-TF                        | FOI-TF        | FOI-TF        | FOI-TF             |               |

### NC Specifications (FANUC FOI-TF)

○ : Standard, OPT. : Option, (!) : M type, (!!) : 250 type

| Item                               | Specification                                | OITF                                   |                             |
|------------------------------------|--|--|-----------------------------|
| Controls                           | Controlled axes                              | Std. 2axes X, Z, C (!)                 |                             |
|                                    | Simultaneously control axes expansion(Total) | 0.001mm/0.0001" 3 axes (!)             |                             |
| Axis Functions                     | Least input increment                        | ○                                      |                             |
|                                    | Cs contouring control                        | ○ (!)                                  |                             |
|                                    | HRV2 control                                 | ○                                      |                             |
|                                    | Inch/metric conversion                       | G20/G21 ○                              |                             |
|                                    | Increment system 1/10                        | 0.0001mm/0.00001" ○                    |                             |
|                                    | Stored stroke 1                              | Overtravel control ○                   |                             |
|                                    | Stored stroke 2 and 3                        | ○                                      |                             |
|                                    | Mirror image                                 | ○                                      |                             |
|                                    | Chamfering on/off                            | ○                                      |                             |
|                                    | Backlash compensation                        | Max. 255 pulses ○                      |                             |
| Operation                          | Stored pitch error compensation              | ○                                      |                             |
|                                    | Automatic operation(memory)                  | ○                                      |                             |
|                                    | MDI operation                                | ○                                      |                             |
|                                    | Buffer register                              | ○                                      |                             |
|                                    | Program restart                              | ○                                      |                             |
|                                    | Search function                              | Sequence NO. / Program NO. / Address ○ |                             |
|                                    | DNC operation                                | ○                                      |                             |
|                                    | Reference position shift                     | -                                      |                             |
|                                    | Manual handle feed rate                      | X1, X10, X100 ○                        |                             |
|                                    | Manual pulse generator                       | 1unit ○                                |                             |
|                                    | Manual handle interruption                   | ○                                      |                             |
|                                    | Interpolation                                | Linear interpolation                   | G01 ○                       |
|                                    |  | Circular interpolation                 | G02, G03 ○                  |
|                                    |  | Dwell                                  | G04 ○                       |
|                                    |  | Polar coordination interpolation       | G12.1, G13.1 ○ (!)          |
| Cylindrical interpolation          |  | ○ (!)                                  |                             |
| Thread cutting/Synchronous cutting |  | ○                                      |                             |
| Multiple threading                 |  | ○                                      |                             |
| Thread cutting retract             |  | ○                                      |                             |
| Feed functions                     | 1st, 2nd reference position return & check   | G27, G28, G30 ○                        |                             |
|                                    | Variable lead thread cutting                 | ○                                      |                             |
|                                    | Continuous thread cutting                    | ○                                      |                             |
|                                    | Circular thread cutting                      | -                                      |                             |
|                                    | 3rd and 4th reference point return           | OPT.                                   |                             |
|                                    | polygon turning                              | OPT.                                   |                             |
|                                    | Helical interpolation                        | OPT.                                   |                             |
|                                    | Rapid traverse override                      | F0/25/50/100% ○                        |                             |
|                                    | Feedrate Override                            | 0-200% (10% unit) ○                    |                             |
|                                    | Jog feed override                            | 0-2000 mm/min ○                        |                             |
| Axillary & Spindle functions       | Feed per minute                              | G98 ○                                  |                             |
|                                    | Feed per revolution                          | G99 ○                                  |                             |
|                                    | Cutting feedrate clamp                       | ○                                      |                             |
|                                    | External deceleration                        | ○                                      |                             |
|                                    | Feed stop                                    | -                                      |                             |
|                                    | Advanced preview control                     | OPT.                                   |                             |
|                                    | Spindle speed override                       | 0~150% ○                               |                             |
|                                    | Constant surface speed control               | G96, G97 ○                             |                             |
|                                    | 1st Spindle orientation                      | ○                                      |                             |
|                                    | Rigid tapping                                | ○                                      |                             |
|                                    | Multi-spindle control                        | ○ (!)                                  |                             |
|                                    | Auxiliary function                           | M8 digit ○                             |                             |
|                                    | Programming functions                        | Program/code                           | EIA/ISO ○                   |
|                                    |  | Optional block skip                    | 1 Piece ○                   |
|                                    |  | Additional block skip                  | Total 0(Only NC function) ○ |

| Item  | Specification                                | OITF                                    |                        |
|---|--|---|------------------------|
| Programming functions                             | Maximum command dimension                    | ± 99999.999mm/(± 9999.9999 inch) ○      |                        |
|   | Program file name                            | 32 characters ○                         |                        |
|   | Sequence number                              | N8 digit ○                              |                        |
|   | Absolute / Incremental programming           | ○                                       |                        |
|   | Decimal point input                          | ○                                       |                        |
|   | Work coordinate system selection             | G52 ~ G59 ○                             |                        |
|   | Direct drawing dimension programming         | ○                                       |                        |
|   | G code system A                              | ○                                       |                        |
|   | G code system B/C(selectable)                | ○                                       |                        |
|   | Chamfering / corner R                        | ○                                       |                        |
|   | Programmable data input                      | G10 ○                                   |                        |
|   | Sub program call                             | Nested holds 10                         |                        |
|   | Custom macro B                               | ○                                       |                        |
|   | Simple canned cycle                          | G90, G92, G94 ○                         |                        |
|   | Tool functions                               | Circular interpolation by R programming | ○                      |
| Multi repetitive canned cycle                     |  | G70 ~ G76 ○                             |                        |
| Multi repetitive canned cycle2                    |  | ○                                       |                        |
| Drilling canned cycle(G80 series)                 |  | ○                                       |                        |
| Tape format for FANUC series 15                   |  | -                                       |                        |
| Tape format for FANUC series 10/11                |  | ○                                       |                        |
| Manual guide oi                                   |  | OPT.                                    |                        |
| Editing op. functions                             |  | Tool number command(t-code function)    | T4-digit ○             |
|   |  | Number of tool offsets                  | 128 Pairs ○            |
|   |  | Tool offset                             | G43, G44, G49 ○        |
|   |  | Tool nose radius compensation           | G40 ~ G42 ○            |
|   |  | Tool geometry / wear offset             | Geometry & wear data ○ |
|   |  | Tool life management                    | ○                      |
|   |  | Tool offset value counter input         | ○                      |
| Seting & display                                  |  | Auto tool offset                        | ○                      |
|   | Direct input of tool offset value measured B | ○                                       |                        |
|   | Part program storage size                    | 512 kb                                  |                        |
|   | No. of Registered programs                   | 400 ea                                  |                        |
|   | Part program editing                         | ○                                       |                        |
|   | Program protect                              | ○                                       |                        |
|   | Background editing                           | ○                                       |                        |
|   | Expanded part program editing                | Copy, Move, Change of NC program ○      |                        |
|   | Status display                               | ○                                       |                        |
|   | Program name display                         | 31 characters ○                         |                        |
|   | Self diagnostic function                     | ○                                       |                        |
|   | Help function                                | Alarm & Operation display ○             |                        |
|   | Running time / Parts number display          | Auto running time & Parts No. display ○ |                        |
|   | Load meter display                           | Spindle & Servo load display ○          |                        |
|   | External message display                     | ○                                       |                        |
| Display of spindle speed and T-code at all screen | ○  |   |                        |
| Tool path graphic display                         | ○  |   |                        |
| Servo setting screen                              | ○  |   |                        |
| Spindle setting screen                            | ○  |   |                        |
| Multi language display                            | ○  |   |                        |
| Data input & output                               | Reader puncher control                       | CH1 interface ○                         |                        |
|   | I/O interface                                | RS-232C ○                               |                        |
|   | Memory card input and output                 | ○                                       |                        |
|   | External key input                           | ○                                       |                        |
|   | External program input                       | ○                                       |                        |
| Other functions                                   | External work number search                  | ○                                       |                        |
|   | USB Memory                                   | Input/Output ○                          |                        |
|   | Data Server                                  | Only 1 path, need option board -        |                        |
|   | MDI / DISPLAY unit                           | 8,4710,4(OPT) ○                         |                        |
|   | PMC system                                   | ○                                       |                        |
| Ethernet function                                 | Embedded ethernet function ○                 |   |                        |