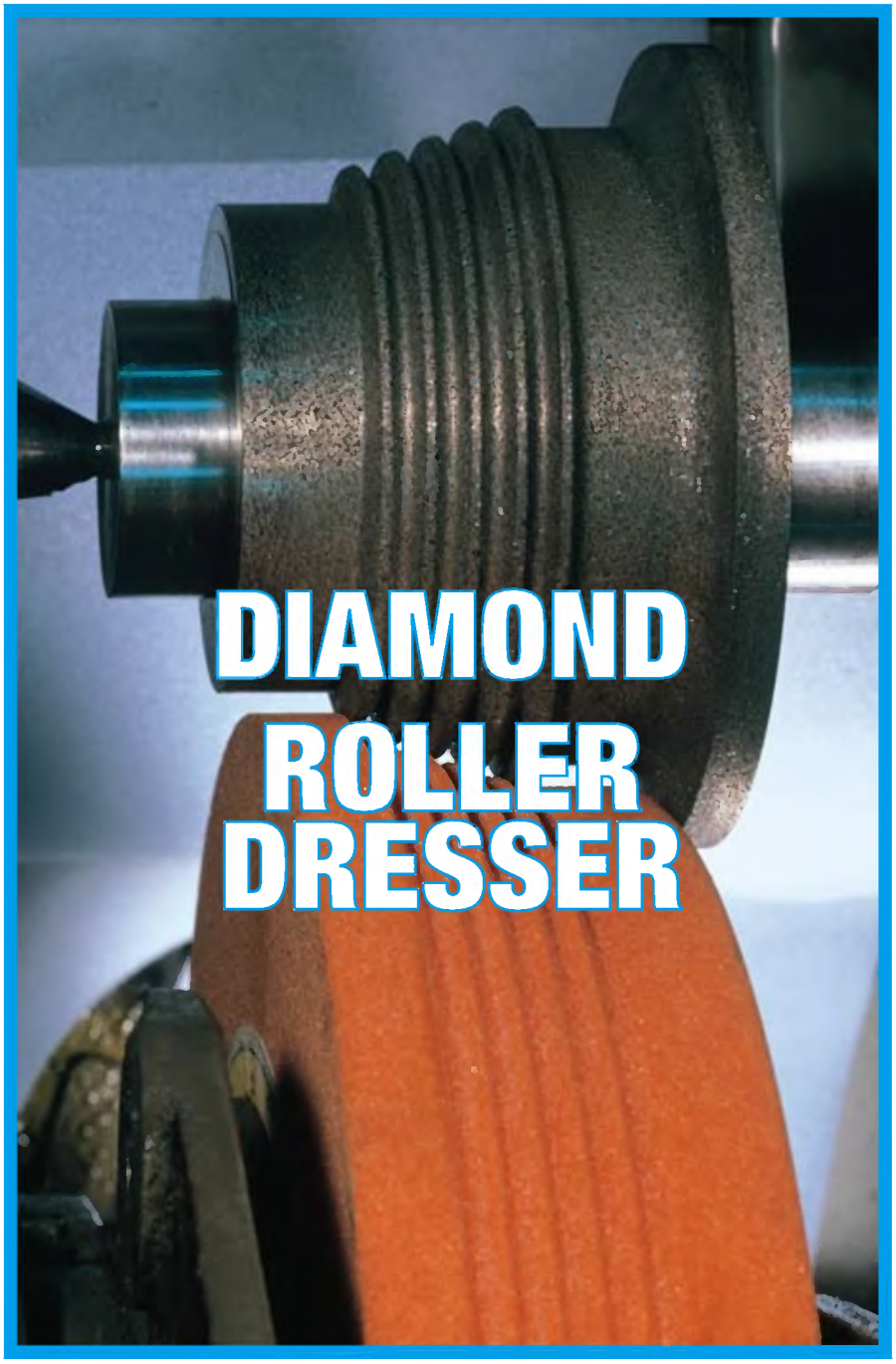
DIAMOND
ROLLER
DRESSER

Diamond Roller Dressers

The dressing and truing of the grinding wheel to the correct form, condition and tolerances during the grinding operation is one of the most important factors in maintaining efficient cutting of the wheel. The efficiency gives good control over productivity and quality of components especially in mass production.

Diamond Roller Dressers have been developed to remedy the disadvantages of conventional single point or multi-point diamond tools; down time for wheel dressing and tool changes are virtually eliminated as are inconsistencies in quality caused by variations between operators, all of which result in substantial savings on production costs.

Dressing with diamond roller dressers offers distinct and substantial advantages over the conventional dressing methods as described below:

a) Complicated forms can be imparted to a grinding wheel in a few seconds giving high productivity and more efficient operation of the grinding machine.

b) The ability to hold high tolerance forms over a long time due to the inherent durability of an Asahi Diamond Roller Dresser enabled it to frequently redress a grinding wheel consistently and accurately. Low scrap rates result in big cost reductions.

c) Highly automated grinding operations are feasible due to the inherently simple dressing techniques of diamond roller dressers. Set up time involved by conventional dressing tool methods are virtually eliminated, thus relieving the work load of operators.

Asahi Diamond is able to manufacture high quality diamond roller dressers by utilising its "know-how" gained by close and systematic analysis of numerous customer results in practical dressing as well as having conducted extensive laboratory tests based on its long and rich experience in this field.

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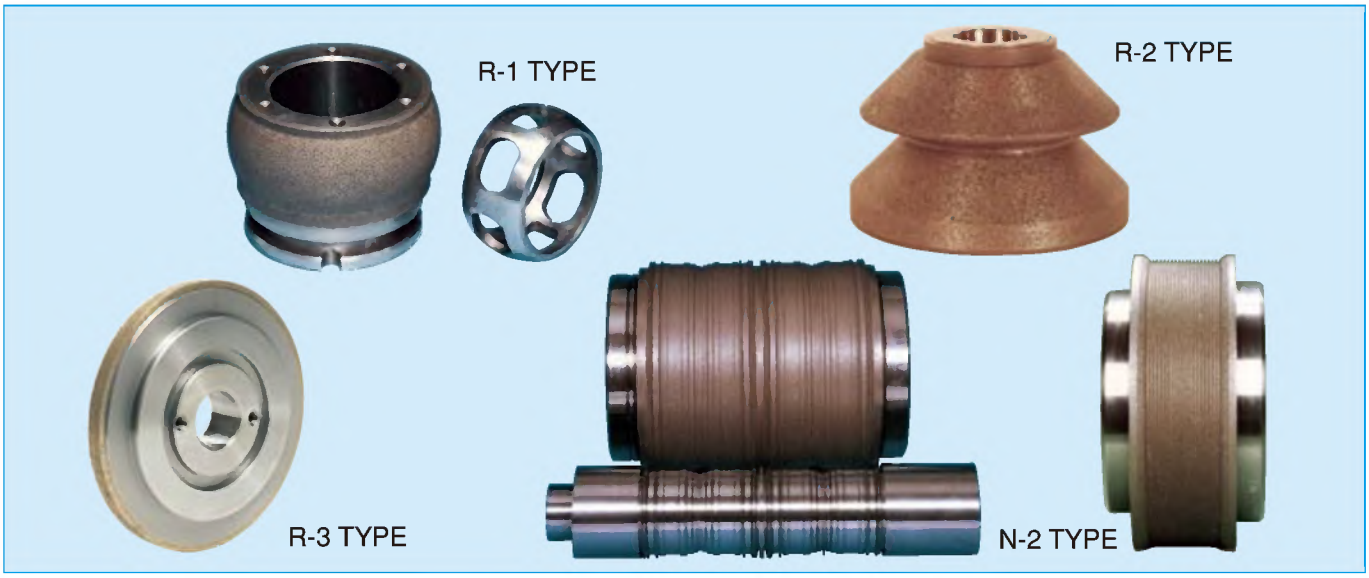
Types of Diamond Roller Dressers

Diamond Roller Dressers are manufactured by the two basic methods - the metal sintering or infiltration method and the electro-deposition method.

THE METAL SINTERING METHOD produces a long lasting tough wear resistant matrix which can withstand the corroding effects of the matrix holding the diamond, which is associated with frequent heavy dressing operations.

THE ELECTRO-DEPOSITION produces roller dressers having small and sophisticated profiles and conforming to the high tolerances.

Asahi Diamond provides three types of metal sintered roller dressers - as specified below by the code numbers R-1, R-2, R-3, - and one type of electro-deposited roller dresser - as specified below by the code number N-2 - this is manufactured by the reverse electro-deposition method and is able to conform to the highest tolerances in order to meet all industrial requirements.



Product Code and Characteristics.

Basic method	Code	Characteristics
Metal Sintering	R-1	Diamonds hand set. Most commonly used.
	R-2	Diamonds mechanically set. Most durable and effective under heavy conditions.
	R-3	Diamonds impregnated to a depth of 1.5 mm to 5.0 mm. Gives abrasive wheels good cutting ability during the flank grinding operation.
Electro deposition	N-2	Diamonds mechanically set. Occupying the major part of the electro-deposited roller dressers. Conforms to the highest tolerances enabling small and sophisticated profiles.

Configuration and Tolerance

Possible geometry and tolerance are primarily and necessarily determined by the design limit related to the actual roller structure, diamond size in relation with the required roller configuration, production technology and economy.

Asahi Diamond has established its own design standard from the close examination of the above factors, whose details are described below:

1) Diameter and impregnation width

Diameter is normally determined from the economical viewpoint, and width of diamond impregnation is fixed by adding 3 to 4 mm to the wheel thickness.

Diameter: Max. 250 mm (commonly 70-100 mm)

Impregnation Width: Max. 230 mm

A gauge face of minimum length 3 mm is provided for precise mounting of a roller and another minimum length of 0.2 mm for ensuring the squareness between a roller and a spindle as shown below. (Fig. 1)

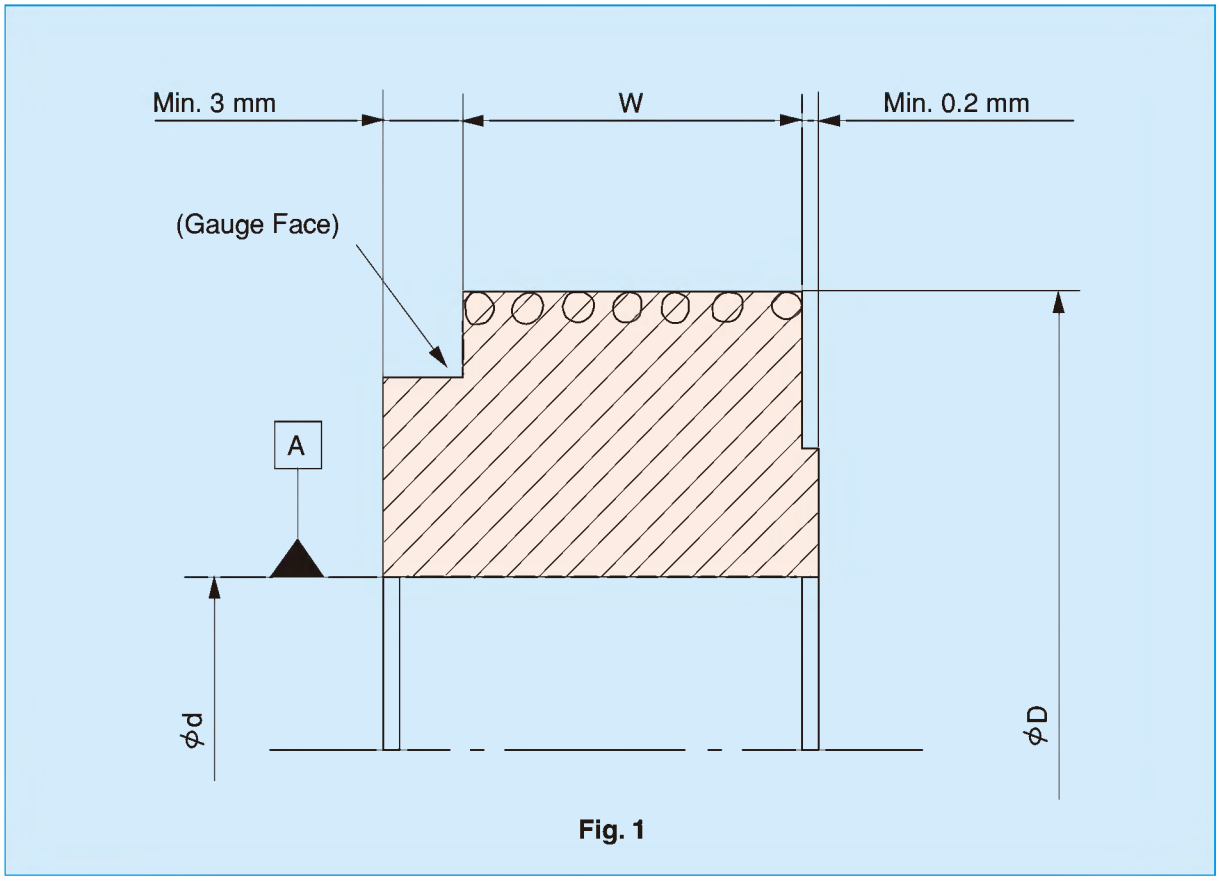


Fig. 1

2) Bore
(Standard tolerance: $\phi d^{+0.005}_{-0}$)

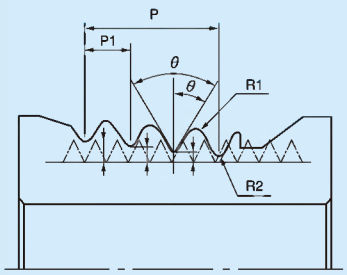
Spindle diameter of a drive unit should be designed on the basis that dressing resistance will be kept below 900 g/mm.

3) Roller Tolerance

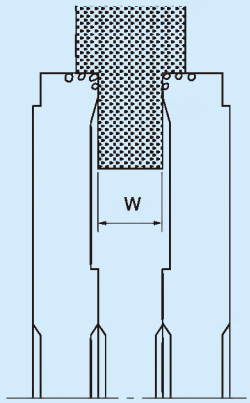
Roller tolerance is ordinarily in the range of 40 to 70% of that allowed on components.

4) Roller Shank

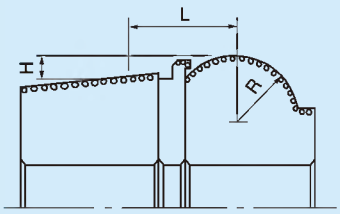
Squareness : ⊥ 0.003A
Parallelism : // 0.002
Alignment of axes : ◎ 0.002 diameter



P	±0.003 < 20 < ±0.005
P1	±0.003
θ	±2′
θ1	±2′
R1	>0.08
R2	>0.04

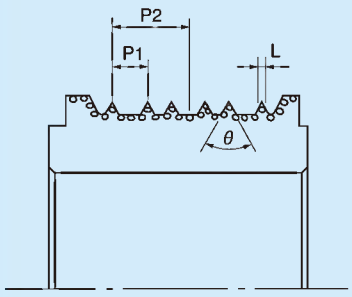


W	±0.005

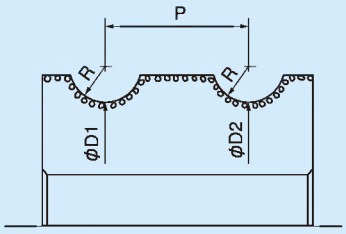


L	±0.03
H	±0.005
R	±0.003
Max. R	=60mm
Waviness:	= 0.002

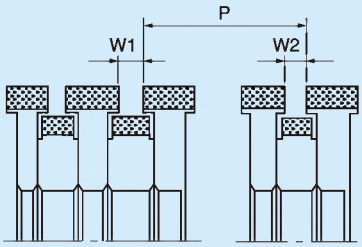
Taper check is done with a standard taper gauge and the contact area must be more than 80%.



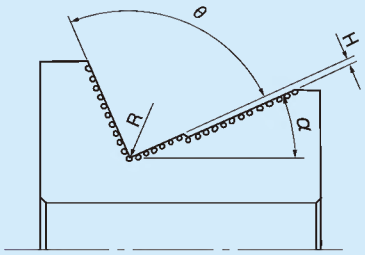
P1	±0.01
P2	±0.005
L	±0.01
θ	±10′



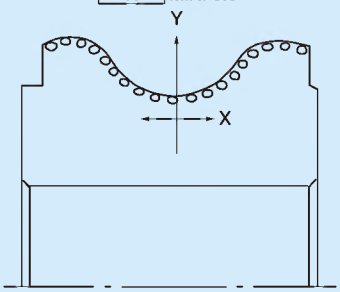
P	±0.003
φD1−φD2	±0.003
Waviness:	= 0.002 ≦120°
	= 0.004 120°~180°
Minimum R	=1mm
R	±0.005



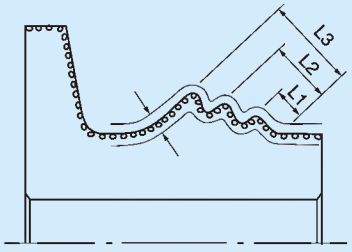
P	±0.01
W1	±0.015
W2	±0.015



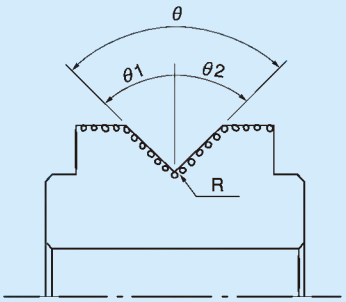
θ	±2′
α	±2′
H	±0.002
R	MIN. 0.3



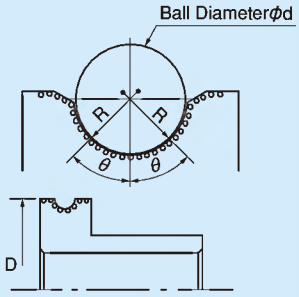
Positional deviation of the Y coordinate from the X coordinate: ±0.005



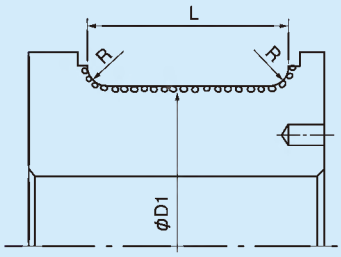
Positional Deviation from the nominal line	= 0.005mm
L	±0.003
LN	±0.003



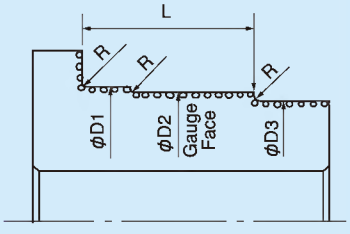
θ	±2′
θ1	±2′
θ2	±2′
R	MIN. 0.3



R / Ball diameterφd	>0.525
R	>1
D	<φ100
R	±0.01



L	±0.015
R	±0.05
Cylindrical	<0.003mm (convex tendency)
Diameter difference when a roller composed of 2-3 parts	<0.005



φD1−φD2	±0.002
φD2−φD3	±0.002
L	±0.05
R	MIN. 0.3

Dressing Methods and Features

Dressing methods are broadly divided into two categories. : Plunge Dressing and Traverse Dressing:

Plunge dressing is done by plunging a roller into a grinding wheel to be dressed and is commonly and effectively applied in form grinding and in production grinding of identical components, especially under the heavy grinding conditions, including shoulder grinding, that often causes excessive wheel wear in a short period and, as a result, less yield per dressing cycle.

Traverse dressing is done by traversing a roller in one direction along its own axis on the grinding wheel to be dressed. This method is effectively and economically applied in universal grinding of components in various shapes with wide and simple shape wheels - small and simple shape rollers are usable. The traverse dressing has the disadvantage of a longer dressing time required in comparison with plunge dressing method but is 2 - 3 times faster than dressing with single point diamond dressers.

Plunge Dressing

Most common setting: Axes of roller, wheel and workpiece in parallel (Fig. 2).

Advantages : Easy checking of geometric accuracy due to a roller and workpiece in identical shape.
Possible uses of relatively simple dressing units.

Disadvantages : Liable to burning and/or roughening corners and end pieces of workpiece perpendicular to the workpiece axis. This could be overcome by adjusting diamond grit size, distribution and concentration to a certain degree.

Setting roller axis and wheel axis in parallel but not with workpiece axis. (Fig. 3).

Advantages : Will minimize burning at corners and on end pieces, especially when cutting is perpendicular to the wheel axis.

Disadvantages : Difficult checking of geometric accuracy due to difference in shape between a roller and workpiece.

Setting none of the axes in parallel (Fig. 4).

Advantages : Effective to minimize burning and roughening corners and end pieces. Easy checking of geometric accuracy due to roller and workpiece in identical shape.

Traverse Dressing

Form Dressing with formed roller by plunging into a wheel and then traversing the roller to its own axis (Fig. 5).

Advantages : Possible reduction of dressing resistance with coarser diamond.
Improving cylindrical surface finish.
Minimizing dull cutting edges.
Longer roller life.

V-Shape forming with cup roller by traversing upward and downward. (Fig. 6).

Dressing with cup roller, effective on wheels for internal grinding and camshaft grinding. (Fig. 7).

Step Forming with Hydraulic Profiling units. (Fig. 8).

Advantages : Adaptability to various shapes.
Possible dressing two to three times faster than single point dressers.
Free from breakage as encountered with wedge-shaped single point dressers.

Profile and Form Dressing. (Fig. 9).

Driving Methods

There are three driving methods, Brake-type, Free rotating and Self-driving. Among the three the self driving method is the best and the most common, this is due to the practical setting of driving conditions suitable to requirements, including grinding ability, surface finish, accuracy etc. as well as to the reliable mechanism.

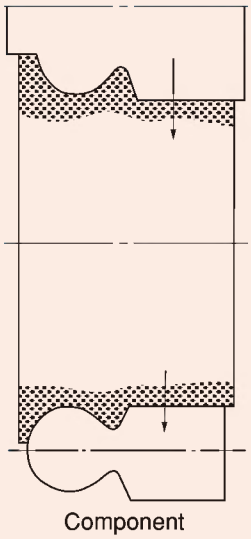


Fig. 2

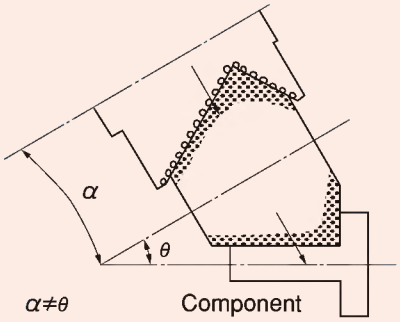


Fig. 3

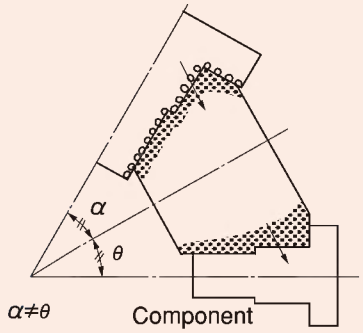


Fig. 4

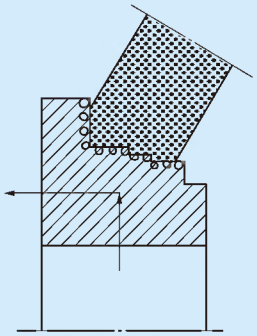


Fig. 5

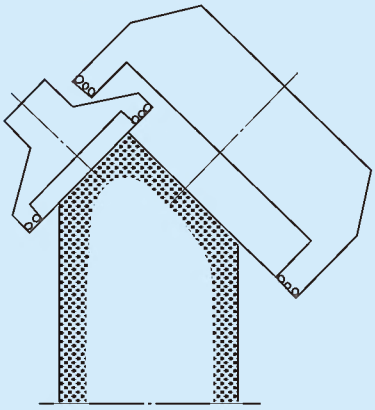


Fig. 6

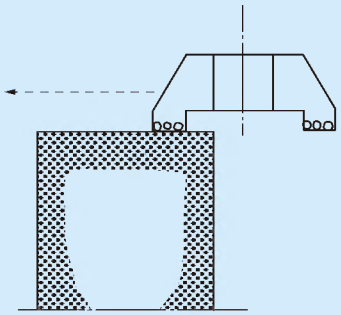


Fig. 7

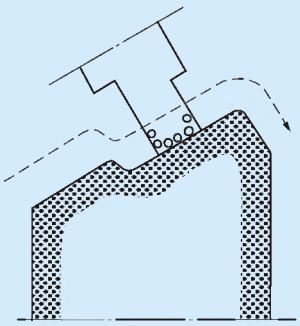


Fig. 8

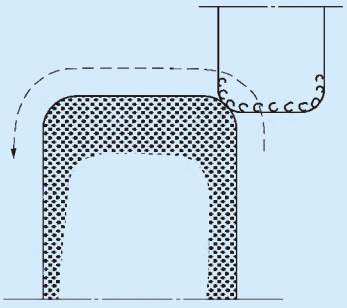


Fig. 9

Operating Conditions

Diamond roller dressers give shearing and compressive forces to abrasives and binding material in abrasives wheels in order to vary their shape and distribution of cutting edges and, as a result, influences wheel performance such as cutting ability, surface finish, and geometry of components etc.

Thus the optimum operating conditions must be set up to obtain the best performance.

The following figures indicate the various influences of dressing conditions on performance of abrasive wheels taken from test results obtained by Mr. T. Murray and Mr. S Malkin.

Dressing Conditions

Diamond Roller	:	Cylindrical Shape, 70 mm dia., 19 mm width. Specifications to Table 1.
Roller Speed (vr)	:	Variable
Infeed/revolution (ar)	:	Variable
Dressing Mode	:	Down Cut (Positive) and Up Cut (Negative)
Dressing Depth	:	0.51 mm in total

Grinding Conditions

Abrasive Wheel	:	32A 46 18 V B, 360 mm dia., 12.7 mm width
Wheel Speed (V)	:	32 m/sec.
Downfeed	:	0.0254 mm/pass
Grinding Mode	:	Wet, surface grinding
Machine	:	Plunge Surface Grinder
Workpiece	:	AISI 1090 H_RC 34, 100 mm length, 9.5 mm width, 50 mm height
Work Feed	:	1.4 m/sec.
Coolant	:	Water Soluble, 5% solution

Table 1. Specification of Test Rollers

Roller number	1	2	3	4	5	6	7
Roller type	(1)S.S.	S.S.	S.S.	S.S.	S.S.	(2)R.S.	R.S.
Dia. Size (U.S. mesh)	20/25	25/30	20/25	25/30	25/35	20/35	30/35
Dia. Density (ct/cm²)	0.22	0.20	0.33	0.31	0.22	-	-
Dia. Concentration (%)	-	-	-	-	-	19	19
No. of Diamond (N/cm²)	30	37	36	44	67	71	130

Note: (1)S.S. for Hand Set Diamond (2)R.S. for Impregnated Diamond

1. Effect of Speed Ratio on Surface Roughness.

Rough surface finish toward a speed ratio of +1 with increased infeed, and finer surface finish toward and in minus area, is obtained as indicated in Fig. 10.

2. Effect of Infeed on Surface Finish.

The biggest infeed provides the lowest grinding resistance, as shown by Fig. 11 for the reason that distribution density of abrasives per unit area is increased with decreased infeed which increases grinding resistance. The tendency is clearly shown by the Figs. 12 & 13.

These figures also indicate that grinding resistance is increased toward and in the minus range of speed ratio under the up-cut conditions.

The optimum infeed must be determined to the fastest possible in relation to requirements on surface finish and may be about 1 mm/min.

3. Effect of Dress-out Time on Grinding Resistance.

The dress-out (Zero-cut) time affects surface finish and grinding resistance, as shown by Fig. 14. Thus the shortest possible dress-out time should be applied for good results. Attention must be paid to dress-out time especially with manual fed machines.

4. Effect of Revolution Ratio on Profile Transfer.

Perfect roller to wheel profile transfer is unfeasible as it is impossible to produce rollers of perfect roundness, completely even and smooth diamond protrusion, and due to run-out of driving spindles which cause irregular wheel profiles, improved transfer can be done by adjusting relationship between roller revolution (Nr) and wheel revolution (N).

5. Recommendation on Operation.

Speed Ratio (Vr/V) in the range of +0.1 to +0.8.

A higher ratio is advantageous but the range from +0.1 to +0.2 is recommended for wheel speed exceeding 45 m/sec.

Cutting Speed (ar) of approx. 1 μm/rev.

Dress-out time in 3 seconds

Revolution Ratio (Nr/N) 0.55 to 0.85 when Nr/N≦1

0.15 to 0.45, 0.55 to 0.85 when Nr/N>1 (integer disregarded)

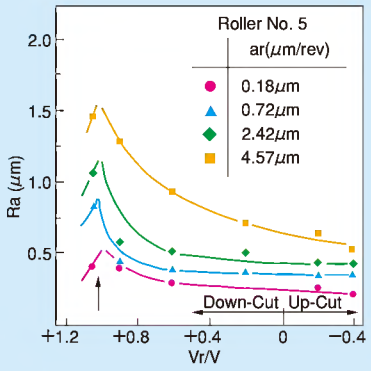


Fig. 10
Surface finish (Ra) VS. Speed Ratio (Vr/V)

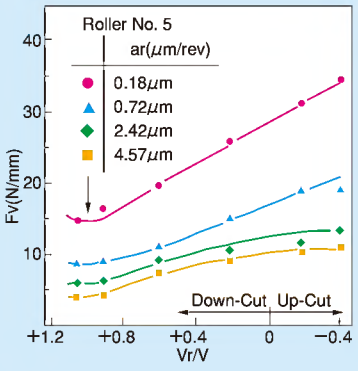


Fig. 11
Normal Grinding Force (FV) VS. Speed ratio (Vr/V)

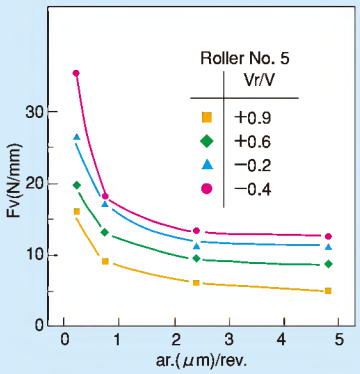


Fig. 12
Normal Grinding Force (FV) VS. Infeed (ar)

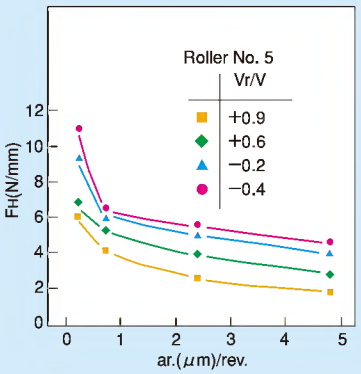


Fig. 13
Horizontal Grinding Force (FH) VS. Infeed (ar)

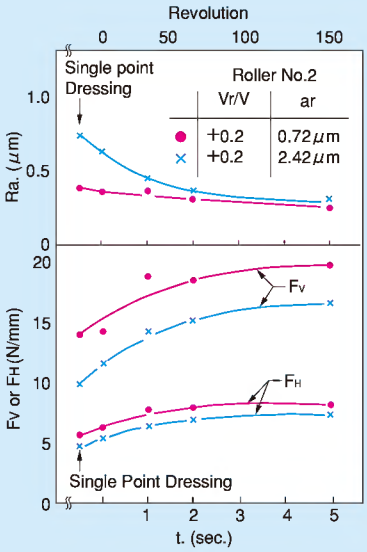


Fig. 14
Dress Out Time VS. Grinding Force (FV or FH) and Surface Finish (Ra)

Trouble and Remedy

Component	Possible Cause	Remedy
Unusual noise inDressing (a) Continuous Noise	●Imbalance between the diamond roller and the grinding wheel ●Excessive dressing resistance	●Check the dynamic balance ●Reduce infeed of the diamond roller ●Increase the speed ratio
(b) Interrupted Noise	●Insufficient rigidity between the drive unit and its sliding parts ●Excessive dressing resistance ●Deformation of grinding wheels	●Check the rigidity ●Reduce infeed of the diamond roller ●Increase the speed ratio ●Apply a larger flange ●Use thicker grinding wheels
Chatter Mark	●Vibration	●Check balance between the diamond roller and the grinding wheel ●Check rotational accuracy of the diamond roller and the grinding wheel ●Check the speed ratio ●Increase the rigidity of the drive unit ●Increase power for driving the diamond roller
Burning	●Insufficient coolant supply ●Loaded grinding wheel ●Imbalance between the diamond roller and the grinding wheel ●Diamond roller of unsuitable specification	●Check coolant quantity and the position and direction of nozzles. ●Increase infeed of the diamond roller ●Reduce the dress-out time ●Increase the wheel removal ●Use softer grinding wheels ●Use more porous grinding wheels ●Use a diamond roller with a lower diamond concentration ●Check diamond protrusion on the diamond roller
Rough Surface Finish	●Insufficient rigidity of the drive unit ●Incorrect dressing conditions ●Contaminated coolant	●Check the rigidity ●Check the rotational accuracy of the diamond dresser ●Check diamond protrusion on the diamond roller ●Extend the dress-out time ●Exchange the coolant
Local Scratch	●Insufficient coolant supply	●Check coolant quantity and the position and direction of nozzles

Diamond Roller Unusual Wear and Breakage

Possible Cause	Remedy
●Insufficient coolant supply	●Check coolant quantity and the position and direction of nozzles
●Excessive infeed and/or traverse	●Ensure optimum coolant supply on the contact area ●Check the mounting accuracy of the diamond roller to the grinding wheel
●Excessive dressing resistance	●Check wear of the roller dresser
●Inaccuracy of the traverse unit	●Check the traverse unit
●Vibration	●Check balance of the grinding wheel ●Check the accuracy of the wheel spindle in the thrust direction

Life of Diamond Roller

The wear pattern of individual diamonds varies considerably according to the crystal orientation as well as to the operating conditions, including coolant supply and pressure. The variation causes uneven diamond protrusion on a diamond roller after a certain period of use and produces variable waviness and surface finish of components. (Fig. 15).

The service life of a diamond roller is determined by tolerance allowed on components as the result. Diamond rollers may be reprofiled and trued unless they are badly worn out or damaged.

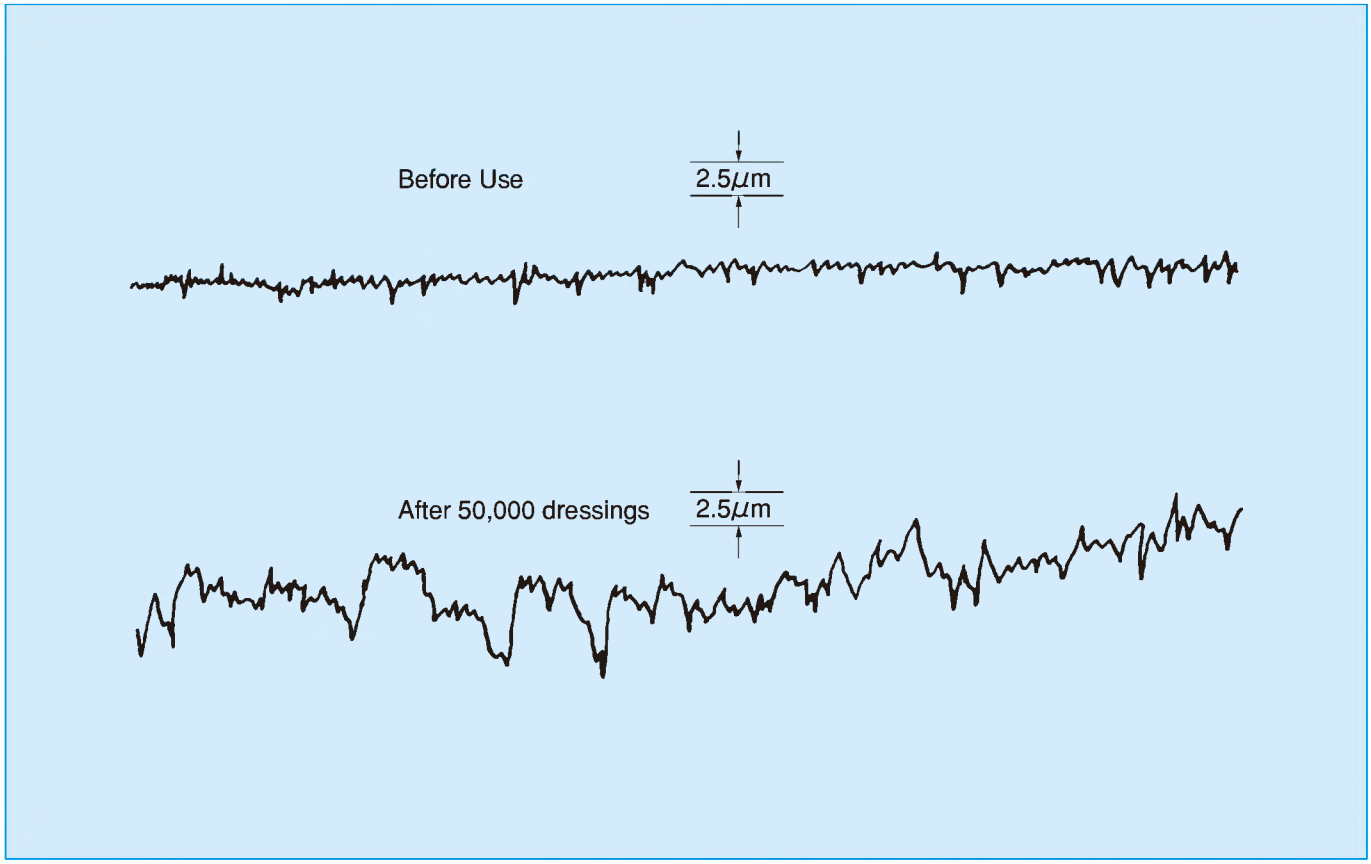
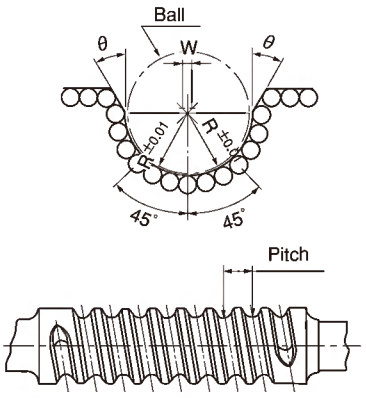


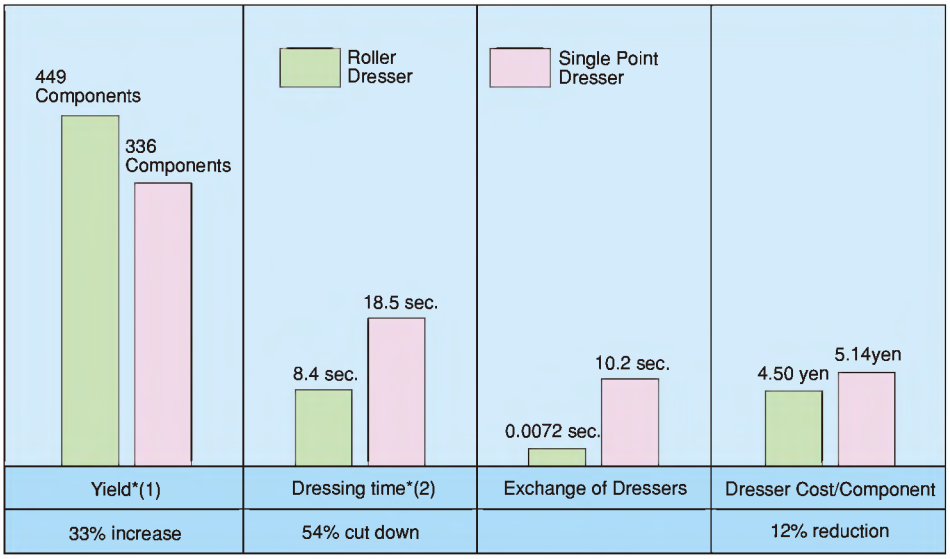
Fig. 15 - Wavines before and after use of a diamond roller dresser.

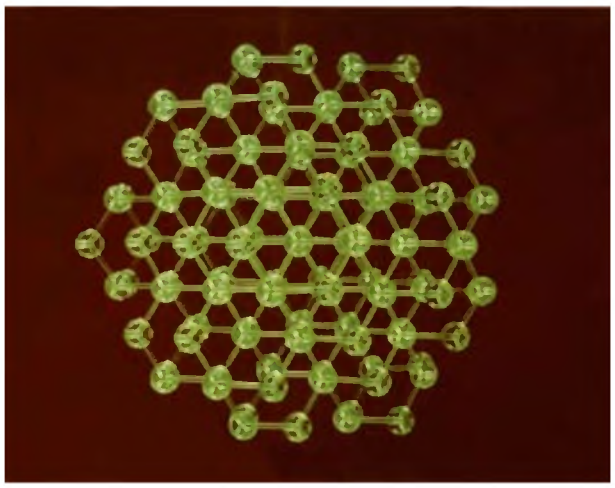
Case History

Finish Grinding of Ball Screws

An increase of 33% in yield was achieved with sharp reduction of time required for dressing, exchanges of dressing tools and inspection of components resulted from consistent and accurate dressing with diamond roller dressers to realize high accuracy and consistencies of component geometry and configuration. An average life of the diamond roller was 100,000 dressings.





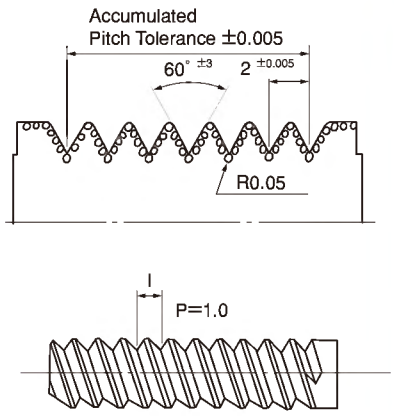


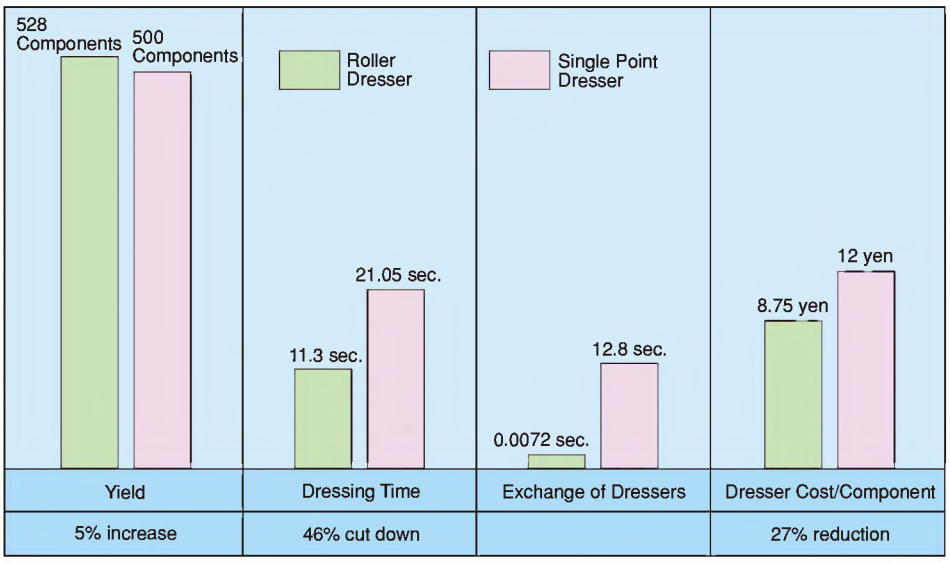
*1) Daily yield (7.5 hours)
*2) Dressing Time/Component

Note: ● φ90 Reverse Plated Diamond Roller Dresser
● Life: 10^5 dressing (1 component/dressing)

Grinding of Triangular Screws

An increase of 5% in yield was achieved in this case although diamond roller dressers have been confirmed as more effective on grinding triangular screws with a screw pitch below 0.5 mm and a screw angle smaller than 60°.





Quotation and Ordering

Quotation and Ordering

When quoting for (and manufacturing) a Diamond Roller Dresser the following information is needed in order that the best service is provided:

1. Component

Name :

Drawing :

Before and after grinding

Composition :

Hardness :

Hardened or Not

Max. Material removal :

Required Finish :

Roughness _____

Waviness _____

Roundness _____

Inspection Method :

2. Grinding machine

Type :

Cylindrical, Angular Slide, Centreless, Surface, Internal, Thread, Other

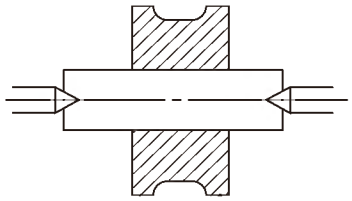
Manufacturer :

Model :

3. Drive Unit

Detailed information preferably with a sketch or a drawing – including shaft diameter and the possible maximum roller size to be mounted on it.

4.Information on the machine and the shaft if a drive unit is not used.



5. Abrasive Wheel

Dimension :

Diameter after use :

Abrasive :

A, WA, GC, C

Grit Size :

36, 46, 60, 80, 100, 120, 180, 220, 320

Hardness :

G, H, I, J, K, L, M, N

Structure :

6, 7, 8, 9, 10, 11, 12

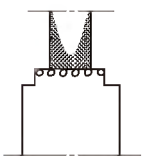
Bonding Material :

Vitrified, Resin, Rubber, others

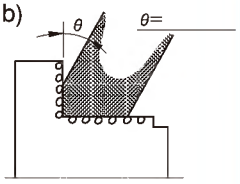
Manufacturer :

6. Position of Diamond Roller Dresser

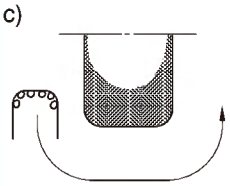
a)



b)



c)



d) Other (please sketch)

7. Dressing Conditions ①

Abrasive wheel speed :

min^{-1} or m/sec.

Diamond roller speed :

min^{-1} or m/sec.

Rotating Direction :

Down Cut

Up Cut

8. Dressing Conditions ②

Infeed :

mm/min. μm/rev

Dressing out time :

sec.

Traverse Speed :

mm/min mm/rev.

Coolant :

Quantity (L/min)

Pressure (Pa)

Oil or water soluble

9.Present Dressing Method

a) Crushing Roller

b) Single Point Dresser

c) Other

10. Other Information

Diamond Roller Drive Unit Model "RDU"

Diamond roller dressers must be rotated with a rigid and accurate machine independently in order to obtain maximum dressing performance unlike crushing rolls
which co-rotate with abrasive wheels.

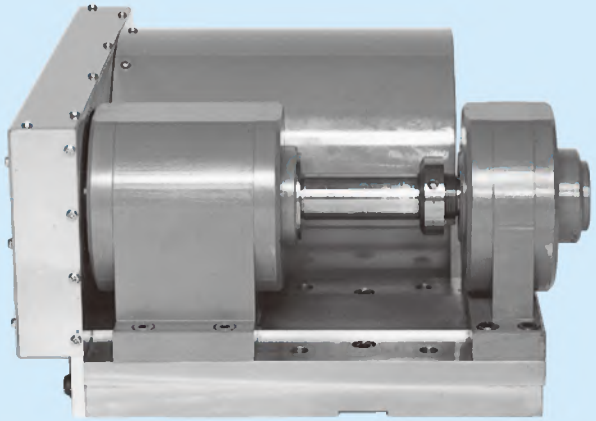
The diamond roller drive Model RDU unit , having back-to-back duplex roller bearing in the fixed bearing box at one end of the spindle and double row cylindrical roller bearing in the movable bearing box at the other, enable long profile transfer intervals as well as precise transfer due to their superiority in rigidity and rotating accuracy over ball bearings.

The diamond roller drive unit Model RDU has another advantage – an easy exchange of diamond rollers with the removable bearing box which does not require taking down the bearing position unlike a split plummer block.

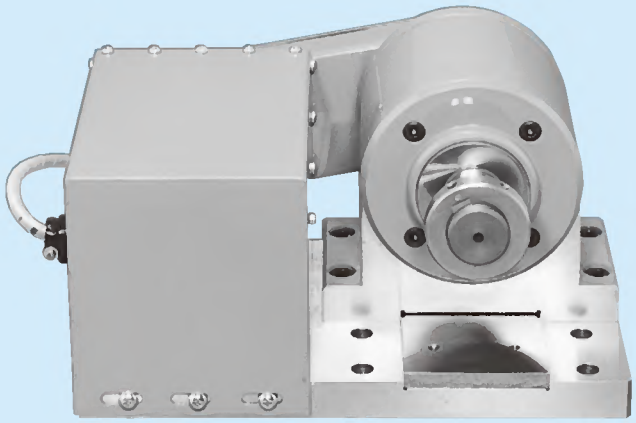
Taper fitting of the tapered end of the spindle into the removable bearing box and fitting of the rail on the table of the unit into the groove provided at the bottom of the bearing box assures easy and precise assembling of the unit.

Asahi Diamond produces three kinds of Diamond Roller Drive Unit Model RDU.

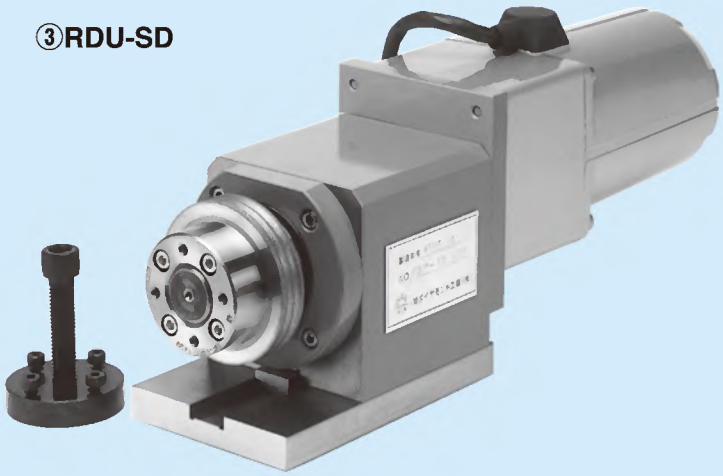
①RDU-W



②RDU-S



③RDU-SD



Specification

Table 1

Type	RDU-W	RDU-S	RDU-SD
Maximum Diamond Roller	120D-80W-30H	120D-30W-30H	100D-30W-25H
Measurement	365W-350L-192H	275W-200L-155H	92W-370L-150H
Spindle Speed	1220min^{-1}	1040min^{-1}	500min^{-1}
(50Hz)	※	※	—
Motor	Three phase induction motor	Three phase induction motor	Three phase induction motor
	200V, 400W, 4P	200V, 90W	200V, 60W gear ratio 1/3
Transmission	V Belt or Timing Belt on request	Polimax Belt 5m 2pieces	Direct drive
Accessories	① Spacers in thickness-each of 20, 30, 40, 50 and 60 mm-5pieces×40D×30H	① Spacers in thickness-each of 5, 10 and 15-3pieces×40D×30H	① Jig for pulling out the roller dresser
	② Jig for removing the movable bearing box on exchange of rollers-1 piece	—	—
	③ Jig for opening the cap of the movable bearing box-1 piece	—	—
Colour	Light green	Light green	Light green
Weight	About 56kg	About 30kg	About 16kg

Table 2

Pole Change Motor	W Type		S Type	
	Output	Spindle Speed	Output	Spindle Speed
2P	400W	2470min^{-1}	150W	2150min^{-1}
4P	400W	1220min^{-1}	90W	1040min^{-1}
6P	200W	800min^{-1}	—	—

※RDU-W & RDU-S Three phase induction motor in table 2, applicable on request.

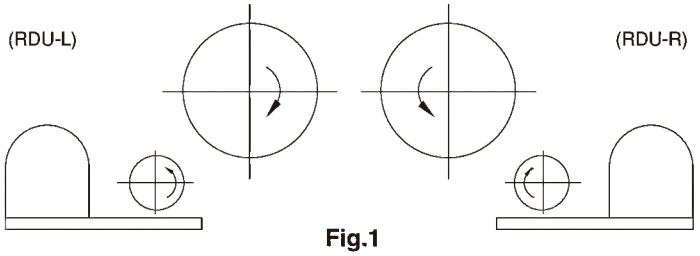


Fig.1

Table 3

Direction \ Type	RDU-W	RDU-S
RIGHT	RDU-WR	RDU-SR
LEFT	RDU-WL	RDU-SL

Note :

A hole in the motor cover, indicating the position for the electric cord, must be specified when ordering - this also can be self-made.

I.D.A.会員

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