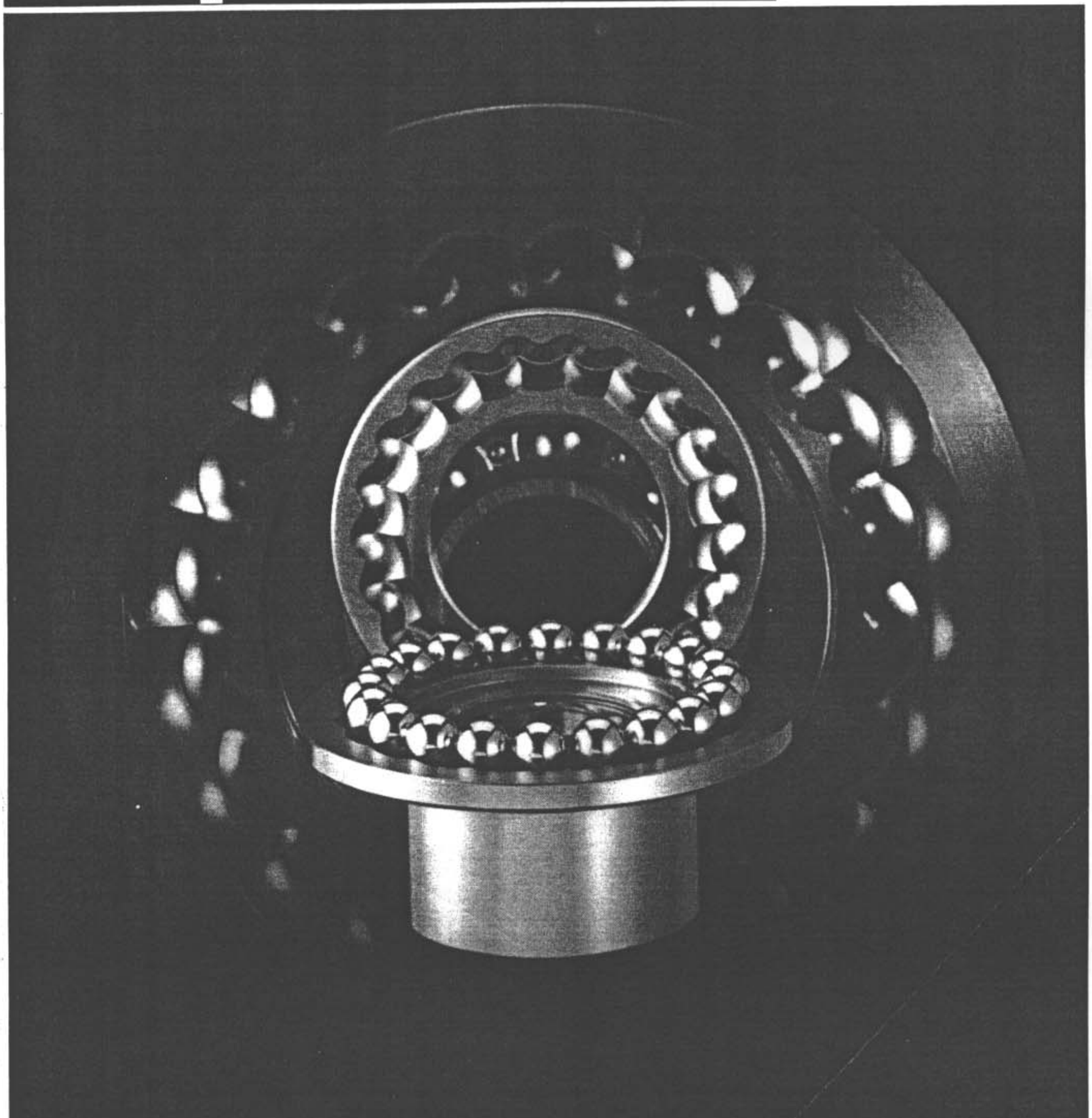
Q-TEN

ZERO BACKLASH
Ball Speed Reducer

Q-TEN SYSTEM



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PRINCIPLE OF OPERATION

FIGURE 1. Putting a ball between two discs, fixing one disc (A) and moving the other disc (B) through an eccentric path of amplitude (E) the ball will roll on both discs with a circular path of diameter (E). Note that disc B does not *rotate* on axis B but merely oscillates on an eccentric path relative to (A).

FIGURE 2. If a rotational motion is now introduced to disc B on axis B while it is following the eccentric path, the ball will move between the discs as shown. The action of rotation and eccentricity generates a series of epicycloidal lobes on disc A and hypocycloidal lobes on disc B.

FIGURE 3. Shows a typical disposition of these lobes on the discs (10 on disc A and 12 on disc B). **Note:** The basic relationship between epicycloidal and hypocycloidal paths around the same pitch circle is that the number of epicycloidal lobes is always 2 less than hypocycloidal lobes.

FIGURE 4. The above motions, and how they are achieved, form the basis for the Q-Ten ball reducer design. Grooves are machined in two discs (epicycloidal in disc A and hypocycloidal in disc B) and the grooves are loaded with the appropriate number of balls which is always one less than the number of hypocycloidal lobes.

When an eccentric motion is applied to disc B by a rotating input, the balls are forced around the path formed by the grooves and this action results in a speed reduction and torque transmission from disc B to disc A.

The built-in Oldham coupling shown in the exploded view allows the input disc to oscillate while constraining it from rotating.

Reduction Ratio Formula

If N is the number of hypocycloidal lobes, then N-2 is always the number of epicycloidal grooves. If the "N" side is the driving disc, then the reduction ratio is given by the formula ratio = 2/N. If the N-2 disc is the driving disc, then Ratio = 2/N-2.

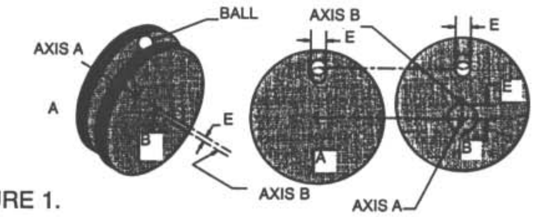


FIGURE 1.

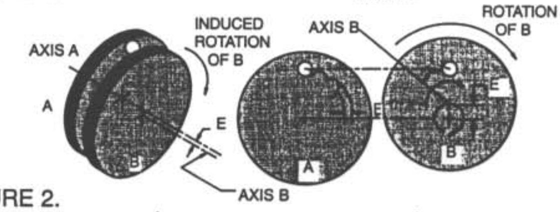


FIGURE 2.

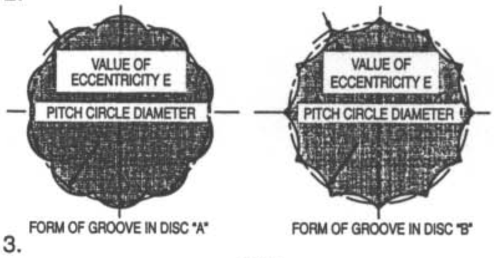


FIGURE 3.

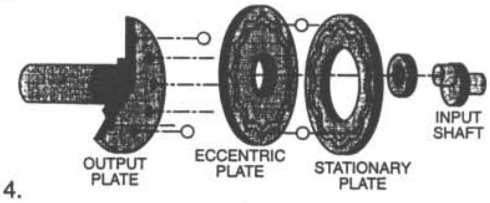
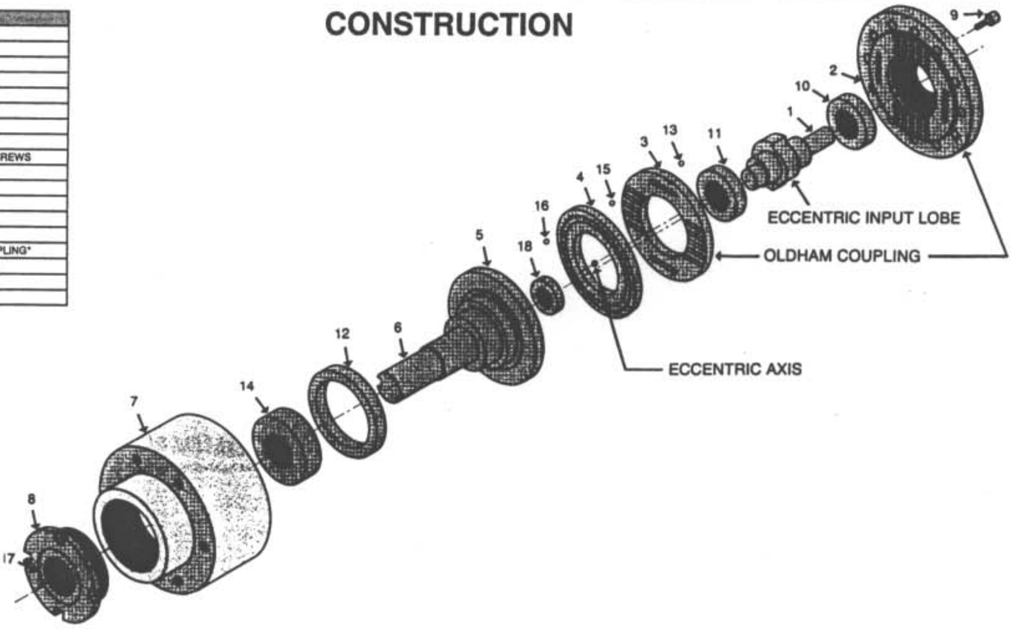


FIGURE 4.

CONSTRUCTION

ITEM	PART NAME / DESCRIPTION
1	INPUT SHAFT
2	FIXED SHAFT
3	OLDHAM COUPLING
4	ECCENTRICITY DISC
5	OUTPUT DISC
6	OUTPUT SHAFT
7	HOUSING
8	NUT TO GIVE PRELOAD
9	12 NUT SOCKET HEAD CAP SCREWS
10	BALL BEARING
11	BALL BEARING
12	BALL BEARING
13	BEARINGS FOR FIXED DISC*
14	ANGULAR BEARING
15	BEARINGS FOR OLDHAM COUPLING*
16	BALLS FOR SPEED REDUCING
17	OIL SEAL
18	BALL BEARING

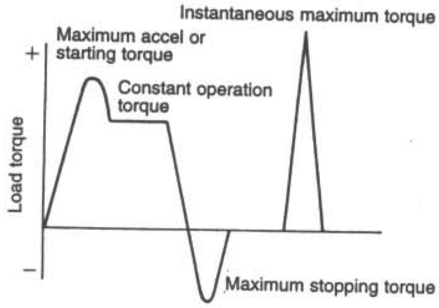


BR Series Specifications

Q-TEN SYSTEM

● PERFORMANCE CHARACTERISTICS

TORQUE DEFINITION



▶ **Maximum transition torque:**
The allowable peak torque applied to the output shaft when normally started from a stop or normally stopped from a running mode.

▶ **Instantaneous maximum torque:**
The allowable maximum instantaneous torque applied to the output shaft when the load is emergency stopped or subjected to an external impact.

Note: Care should be taken that the maximum transition torque not be exceeded during normal operation.

HYSTERESIS

Due to the nature of the design of using rolling balls as opposed to gears or rollers and cams, the amount of backlash in the Q-Ten is virtually zero. This does not mean to say that other factors can and will cause loss of motion. Hysteresis is one of these causes of lost motion. Due to variation in preload, internal contact errors, and internal bearing fit, the amount of hysteresis varies. From a practical standpoint, hysteresis should be considered as part of the final backlash determination.

STOP POSITION REPEATABILITY

Deeming any point as the zero point, the output shaft is turned and then returned. Any error between the zero point and the returned point is called the stop position repeatability. Note that the stop position repeatability is different from the angle transmitting accuracy.

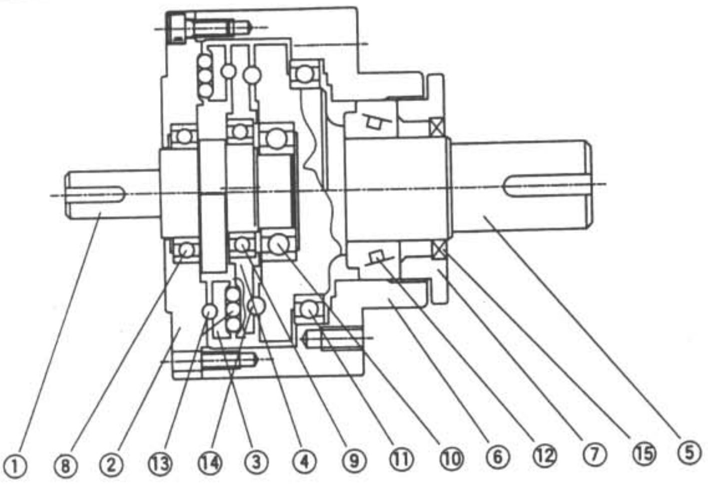
● BR SERIES SPECIFICATIONS

ITEM	UNIT	BR (F) 50	BR (F) 65	BR (F) 85	BR (F) 100	BR (F) 125	BR (F) 160	REMARKS
Reduction Ratio		($\frac{1}{5}$) $\frac{1}{10}$ $\frac{1}{15}$ $\frac{1}{18}$	$\frac{1}{10}$ $\frac{1}{15}$ $\frac{1}{20}$	$\frac{1}{10}$ $\frac{1}{15}$ $\frac{1}{20}$ $\frac{1}{30}$	$\frac{1}{10}$ $\frac{1}{20}$ $\frac{1}{30}$ * $\frac{1}{40}$	$\frac{1}{10}$ $\frac{1}{20}$ $\frac{1}{30}$ * $\frac{1}{50}$	$\frac{1}{10}$ $\frac{1}{20}$ $\frac{1}{30}$ * $\frac{1}{50}$	Standard Ratios
Continuous Torque	N • m (lb • in)	3.9 (34.5)	7.9 (70.0)	19.6 (173.0)	34.3 (304.0)	68.7 (608.0)	98.1 (868.0)	* Defined at Output
Peak Torque	N • m (lb • in)	9.8 (87.0)	14.7 (130.0)	37.3 (330.0)	58.8 (520.0)	117.7 (1042.0)	176.5 (1562.0)	* For Accel/Decel
Max. Instantaneous Torque	N • m (lb • in)	19.6 (173.0)	29.4 (260.0)	73.6 (651.0)	117.7 (1042.0)	235.4 (2083.0)	353 (3124.0)	* E-Stop Condition
Max. Input RPM	R.P.M.	3,000	3,000	3,000	3,000	3,000	2,500	
Tare Torque	N • cm (lb • in)	1.8 (.16)	2.9 (.26)	4.9 (.43)	6.9 (.61)	9.8 (.87)	14.7 (1.3)	Varies Depending on Preload & Ratio
Stopping Repeatability	arc • sec	120	60	45	30	20	20	Repeating at Same Speed, 5% Load
Hysteresis	arc • sec	60	60	45	30	30	20	Return Error at 3% Torque Rating
Rigidity	N • cm (lb • in)	0.098 (.87)	0.39 (3.5)	0.98 (8.7)	1.96 (17.3)	2.94 (26)	3.92 (35.0)	Including Shaft & Bearing Reflection
Thrust Load	N (lbs)	78 (17.5)	294 (66)	588 (132)	980 (220)	1471 (330)	1961 (440)	Output Shaft Side Type SS & SH Only!
Radial Load	N (lbs)	29 (6.5)	98 (22)	294 (66)	490 (110)	784 (176)	980 (220)	
Weight	lbs	.88	1.8	3.8	8.9	13.4	28.9	Weight of UH Is 85-90% of Those Given

* Characteristics vary with ratios marked by *.
* Design for 80% of torque ratios given.

Ball Drive

● INTERNAL CONSTRUCTION AND PART NAMES

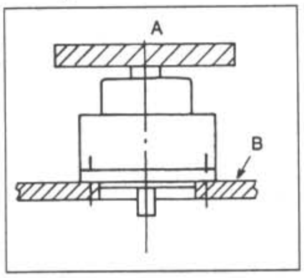


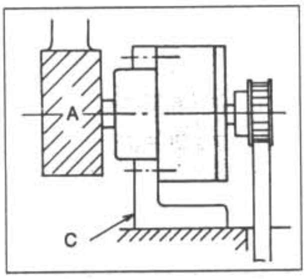
PART NO.	PART NAME
1	INPUT SHAFT
2	FIXED DISC
3	OLDHAM DISC
4	ECCENTRIC DISC
5	OUTPUT SHAFT
6	HOUSING
7	PRELOAD NUT
8	BALL BEARING
9	BALL BEARING
10	BALL BEARING
11	BALL BEARING
12	TAPERED ROLLER BEARING
13	STEEL BALLS (OLDHAM)
14	STEEL BALLS (SPEED REDUCTION)
15	OIL SEAL

● INSTALLATION PROCEDURE

KEY POINTS OF BR-S SERIES INSTALLATION

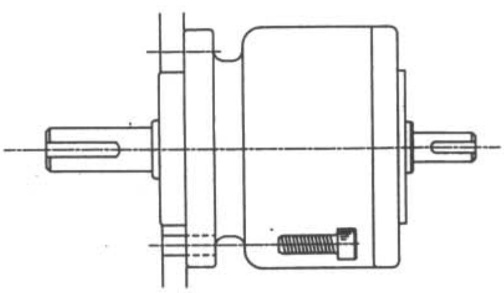
Either of the two faces can be attached as illustrated below. Design the bracket or case as rigid as possible to retain the reducer, and absorb vibration and noise from the reducer. Care must be taken when installing the series BR50, BR65 and BR85. The case of these units is aluminum and overtightening mounting screws can cause damage to the case. A–load, B–base, C–bracket.





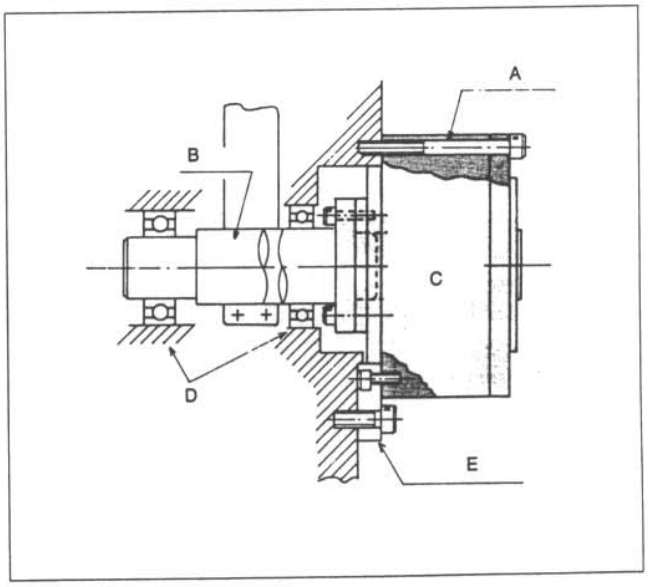
KEY POINTS OF BRF SERIES INSTALLATION

The BRF series is designed for ease of installation using the integral flange to mount the unit to the operating structure. Attach the unit firmly to a structure of high rigidity. The BRF50, BRF65, and BRF85 have an aluminum flange.



KEY POINTS OF BR-U SERIES INSTALLATION

The BR-U series is designed for a compact installation profile, and as such, the output flange is carried by one bearing. Without additional support on the output flange runout will be present in the amount of 0.02 - 0.03 mm. Additional support of the output flange should be provided when rotational accuracy is of concern, or if heavy axial loading or heavy loads are to be encountered. Loads of this type can be expected from use of a pulley or gear.

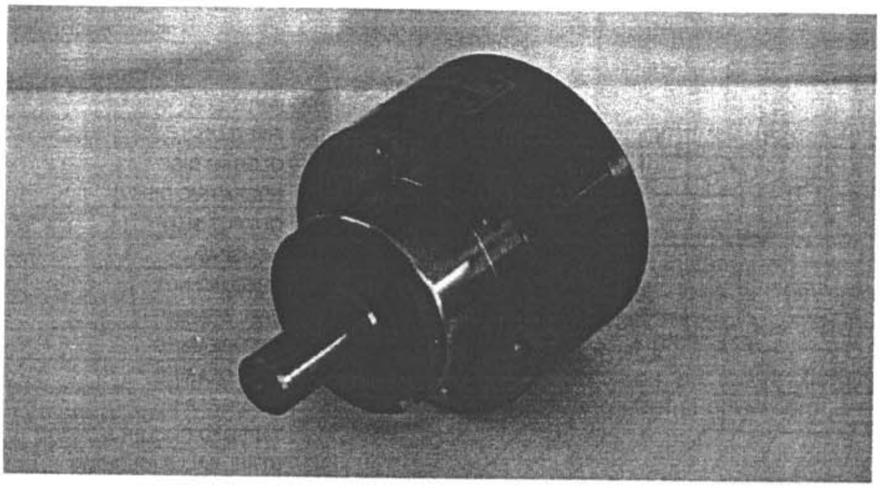


A–through bolt, B–load shaft, C–type UH or US reducer, D–supports (at least one), additional flange or adapter. **Note: Please advise if through hole mounting is to be used.**

Q-TEN SYSTEM

BR-S Series

STANDARD SERIES BALL REDUCER



WHEN ORDERING, PLEASE SPECIFY THE MODEL AS SHOWN BELOW.

BR □□□ SS – □□ .... **Shaft Type Input**

BR □□□ SH – □□ – □□ □ .... **Hollow Type Input**

- K = Key Holding Type / T = Set Screw Holding Type — Refer to page 27 for dimensions
- Hollow Type Input Inside Diameter
- Reduction Ratio: 10, 20, etc.
- Reducer Model Number: 50, 65, etc.

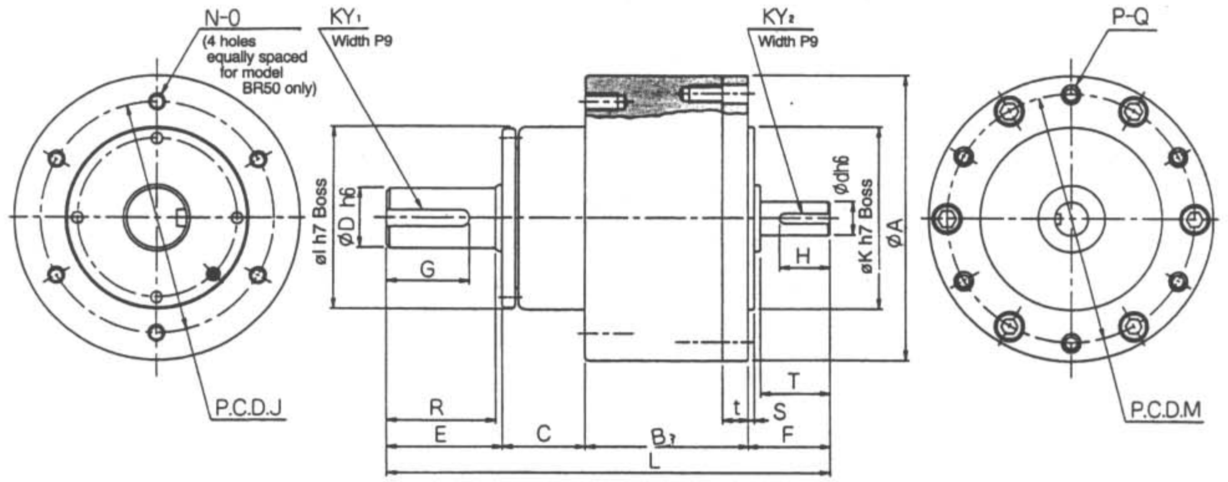
Examples:
BR65SS-10................ Model BR65 / input shaft type / reduction ratio 10
BR100SH-20-14K....... Model BR100 / input hollow type / reduction ratio 20/14mm input bore / key holding type
BR160SH-30-19T....... Model BR160 / input hollow type / reduction ratio 30/19mm input bore / set screw holding type

BR-S SERIES DIMENSIONS

MODEL NO. \ LETTER	A	B	C	d	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
BR50SS BR50SH	50	38	15	8	10	20	19	15	—	30	40	30	92	44	4	M5 × 8mm Deep	6	M3 × 8mm Deep
BR65SS BR65SH	66	51	15	8	12	30	21	20	12	42	56	42	117	56	6	M4 × 8mm Deep	6	M4 × 10mm Deep
BR85SS BR85SH	86	50	25	10	18	35	25	25	15	55	70	55	135	75	6	M5 × 10mm Deep	6	M5 × 10mm Deep
BR100SS BR100SH	100	56	33	12	20	40	30	25	20	65	84	65	159	89	6	M6 × 12mm Deep	6	M5 × 12mm Deep
BR125SS BR125SH	125	65	29	16	30	50	35	30	20	80	100	80	179	113	6	M8 × 15mm Deep	6	M6 × 15mm Deep
BR160SS BR160SH	160	87	45	25	40	60	49	40	30	100	135	100	241	144	6	M10 × 20mm Deep	6	M8 × 20mm Deep

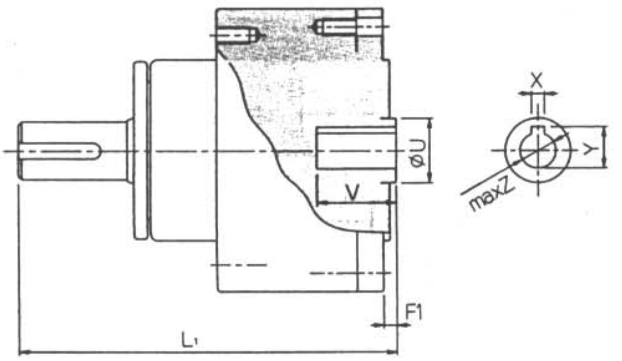
ALL DIMENSIONS ARE METRIC

■ SS TYPE: SHAFT IN/SHAFT OUT

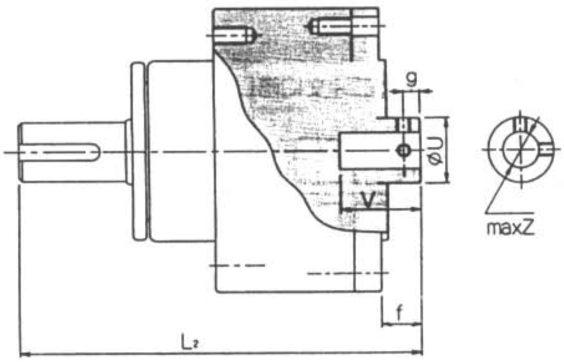


■ SH TYPE: HOLLOW IN/SHAFT OUT

Key Type Holding



Set Screw Type Holding



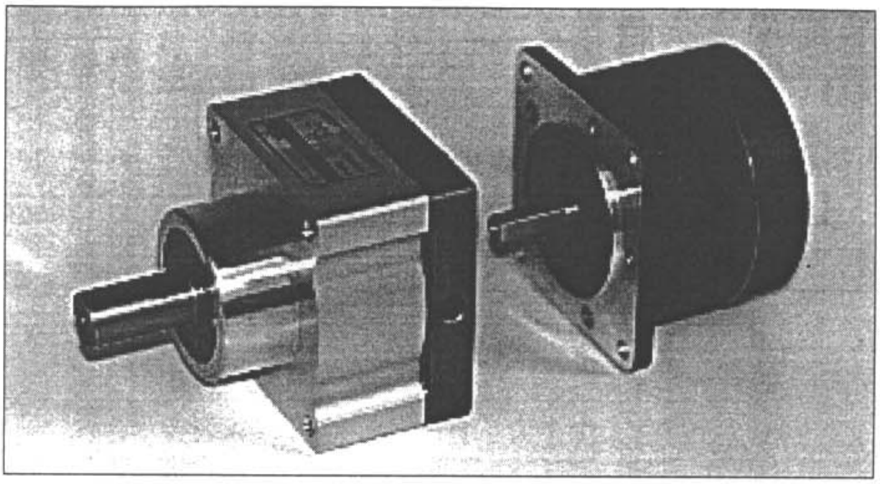
R	S	t	T	KY_1	KY_2
19	2	6	15	3 × 1.8	None
28	2	7	17	4 × 2.5	3 × 1.8
33	2	8	21	5 × 3	3 × 1.8
38	2	10	27	5 × 3	4 × 2.5
48	2	10	32	7 × 4	5 × 3
58	5	13	42	10 × 5	7 × 4

HOLLOW TYPE INPUT

L_1	L_2	U	V	g	f	F_1	X·Y·Z	maxZ
77	83	12	20	4	10	4	Refer to page 27	7
100	106	15	23	4	10	4		8
114	122	20	24	5	12	4		11
132	141	25	28	5	12	3		14
147	156	30	30	5	12	3		20
199	208	40	40	5.5	16	7		28

Q-TEN SYSTEM

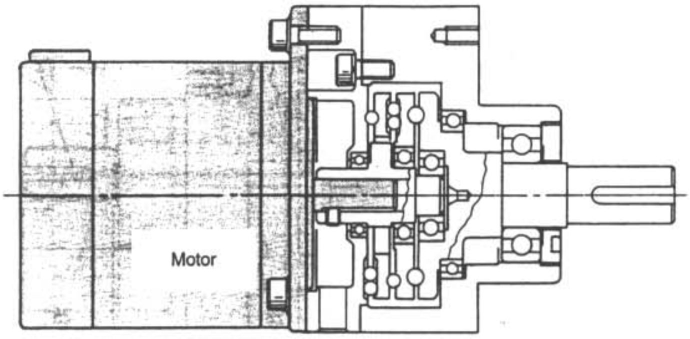
BRA Series



● BRA SERIES SPECIFICATIONS

ITEM	UNIT	5-PHASE STEPPING MOTOR									2-PHASE STEPPING MOTOR				
Model		BRA85			BRA65			BRA35			BRA82		BRA62		
Motor Code		A	B	C	A	B	C	A	B	C					
Motor Model Number		596	599	5913	564	566	569	533	534	535	296	299	264	266	268
Dimension of M on page # 24	MM	64	97	130	42	59	94.5	31	37	45	62	93.5	39	54	76
Head Weight	kg (lbs)	1.1			0.8			0.25			1.1		0.8		
Motor Weight	kg (lbs)	1.5	2.5	3.5	0.5	0.75	1.3	0.17	0.22	0.27	1.5	2.5	0.4	0.6	0.95
Motor Output Torque	N • m (lb • in)	0.69 (6.1)	1.37 (12.1)	2.75 (24.3)	0.14 (1.24)	0.28 (2.5)	0.49 (4.3)	0.039 (0.35)	0.059 (0.52)	0.059 (0.52)	0.83 (7.35)	1.23 (10.9)	0.14 (1.24)	0.29 (2.6)	0.41 (3.6)
Allowable Torque of the Head	N • m (lb • in)	11.8 (104.0)			5.9 (52.0)			0.77 (6.8)			11.8 (104.0)		5.9 (52.0)		
Repeatability	arc • sec	45			60			120			45		60		
Lost Motion +/−	arc • sec	45			60			180			45		60		
Thrust Load	kgf (lbs)	60 (1584.0)			30 (792.0)			2 (53.0)			60 (1584.0)		30 (792.0)		
Radial Load	kgf (lbs)	30 (792.0)			10 (264.0)			1 (26.5)			30 (792.0)		10 (264.0)		
Output Shaft Step Angle	Full Step	0.72° × Reduction Ratio						0.36° × Reduction Ratio			1.8° × Reduction Ratio				
	Half Step	0.36° × Reduction Ratio						0.18° × Reduction Ratio			0.9° × Reduction Ratio				
Reduction Ratios — Standard	Low Ratio	1/10, 1/15, 1/20, 1/30			1/10, 1/15, 1/20			(1/5), 1/10			5:1 ratio has higher noise and vibration level than 10:1 or higher. Accuracy values in table **DO NOT** apply to the 5:1 ratio.				
	High Ratio	1/40, 1/50, 1/60, 1/70			1/30, 1/40, 1/50			1/15, 1/20, 1/30			High reduction ratio assemblies employ partial slide contact construction. Therefore the efficiency of these units is in the range of 70%.				
Reduction Ratios — Special	Low Ratio	CONSULT DISTRIBUTOR			CONSULT DISTRIBUTOR			CONSULT DISTRIBUTOR							
	High Ratio	CONSULT DISTRIBUTOR			CONSULT DISTRIBUTOR			CONSULT DISTRIBUTOR							

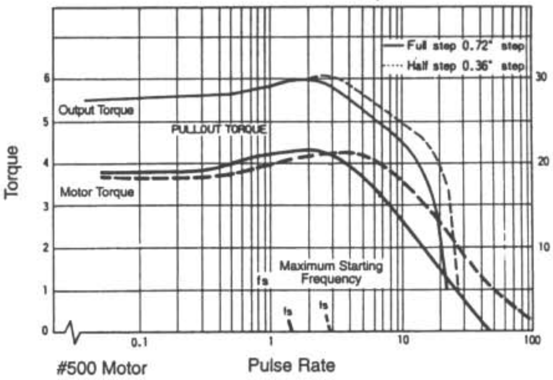
● BRA SERIES INTERNAL CONSTRUCTION



● PERFORMANCE AND CHARACTERISTICS

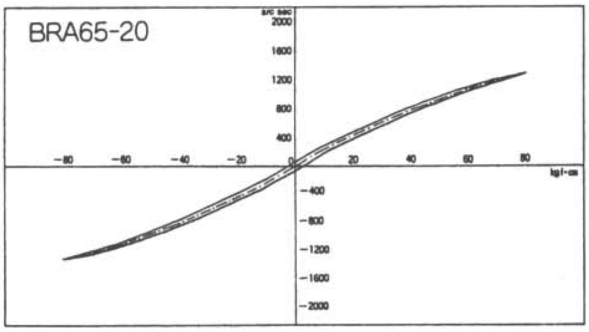
■ TORQUE CHARACTERISTICS

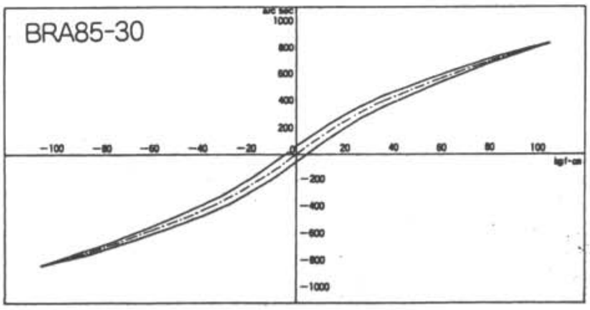
Shown are the maximum output torque of the ball reducer attached to a stepping motor. (motor output torque X ratio X efficiency). Output pulses of the ball reducer do not exactly follow those of the motor. This is due to the natural inertia of the internal ball reducer members. The graph shows the characteristic of the BRA65B-10. According to the graph, the ball reducer steps out of phase at a pulse rate of 20 kpps or over. This is observed on all models, suggesting that load operation at 20 kpps or greater is not recommended.



■ RIGIDITY

The charts show angles of torsion obtained by applying torque to the output shaft with the input shaft fixed.





■ NO LOAD INPUT SHAFT TORQUE

The table on the right shows maximum values. The values may ripple 40% depending on the reduction ratio and preload of the unit.

MODEL	BRA 85	BRA 65	BRA 35
Low Ratio	600gf · cm	500gf · cm	280gf · cm
High Ratio	900gf · cm	650gf · cm	320gf · cm

■ BALL REDUCER OUTPUT TORQUE

Calculated output shaft torque is determined by the motor torque X ratio X efficiency. However, the torque is limited by the torque value given in the specification table. Therefore it is not advised that a larger motor than needed be installed.

Q-TEN SYSTEM

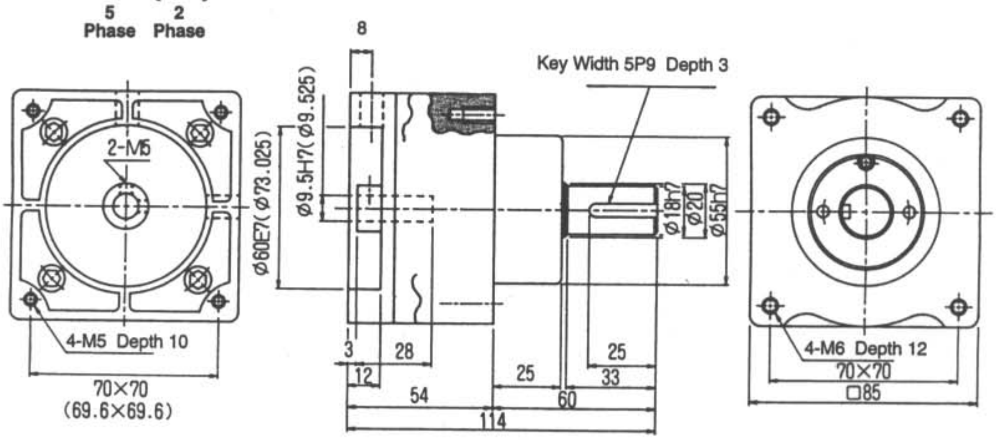
BRA Series Ball Reducer

Square housing and mounting surfaces to match 85 series, 60 series and 38 series stepper motors.

NEMA 23 and NEMA 34 Available Soon

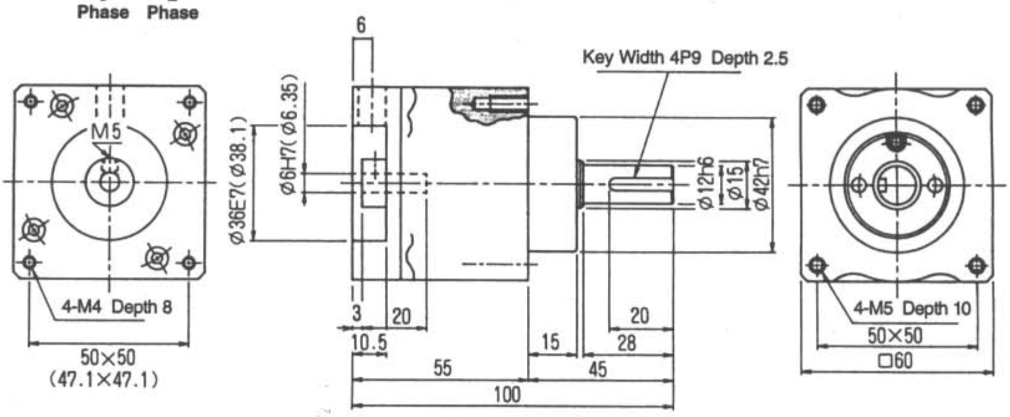
BRA 85 (82)

5 Phase 2 Phase

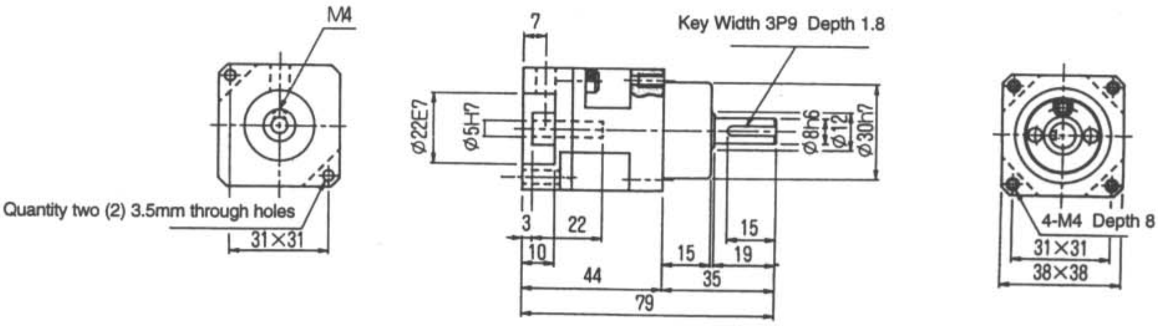


BRA 65 (62)

5 Phase 2 Phase



BRA 35

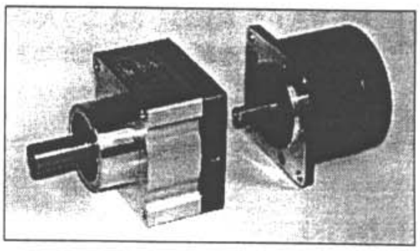


- All dimensions are metric.
- Dimensions in parenthesis ( ) are for the 2 phase stepping motor.
- The motor is attached and the set screws tightened firmly.
- Locktite applied to the set screws will prevent loosening.
- If a motor of different dimensions is being installed please provide the motor and shaft dimensions for proper adapter mounting.
- For applications requiring a reduction higher than the listed ratios consult the section on the BR or BBR series of ball reducers.

Q-TEN SYSTEM

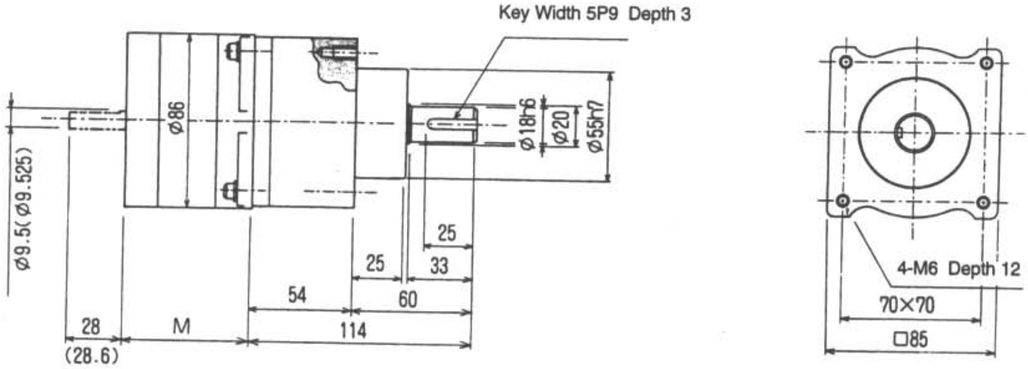
BRA Series Ball Reducer with Motor

Square housing and mounting surface with stepper motor



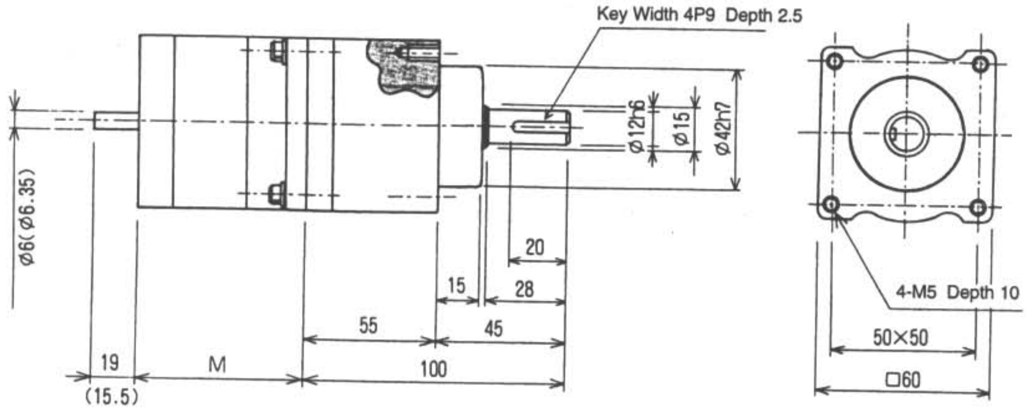
BRA 85 (82)

5 Phase 2 Phase

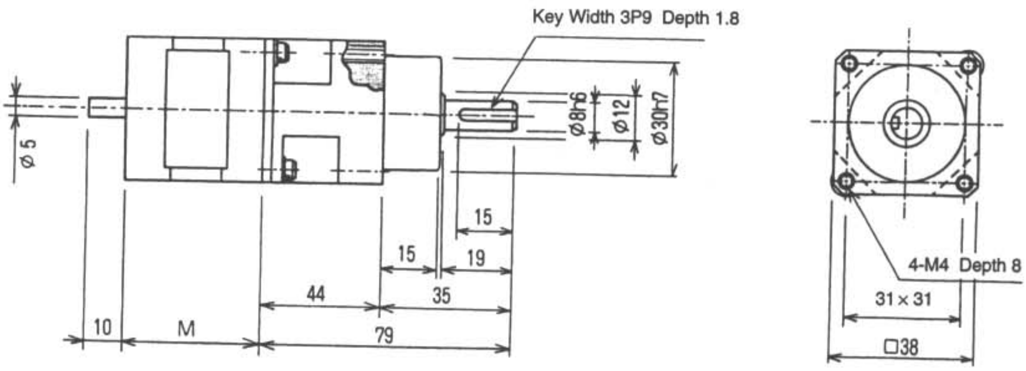


BRA 65 (62)

5 Phase 2 Phase



BRA 35

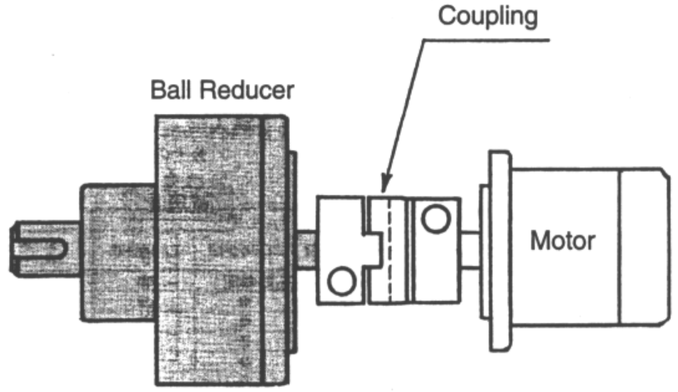


- All dimensions are metric.
- Please refer to motor dimensions given on page 19 for the "M" dimension.
- The shaft shown on the left of the diagrams is a second shaft of a double shafted stepper motor.

SHAFT TYPE INPUT

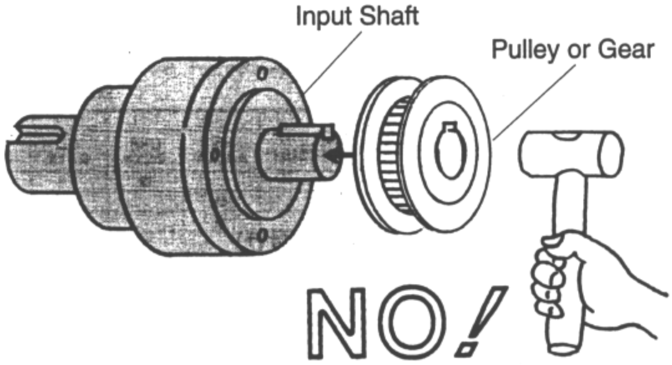
■ IN LINE INPUT

- The ball reducer is connected to the input device with a flexible coupling.
- It is recommended that a servo quality zero backlash coupling be used in this method of torque transmission.
- This coupling can be supplied by your distributor as part of the ball reducer or as a separate item.



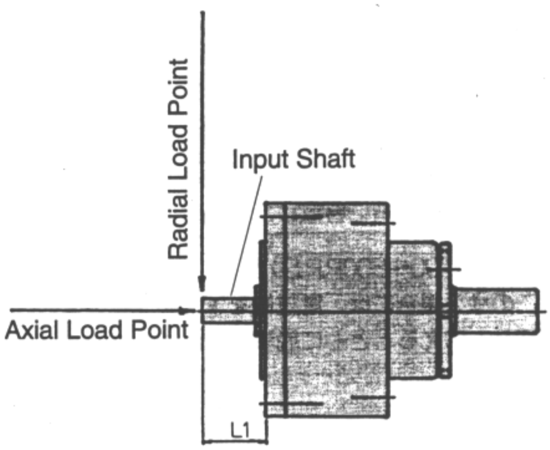
■ PARALLEL INPUT

- The ball reducer is connected to the input device with a gear or timing pulley as illustrated.
- **Avoid excessive force when installing the gear or pulley as shown. Damage to internal parts can result.**
- Excessive axial and radial forces on the input shaft should be avoided.
- Maximum values and location of force applied are provided in the table below.



INPUT SHAFT VALUES

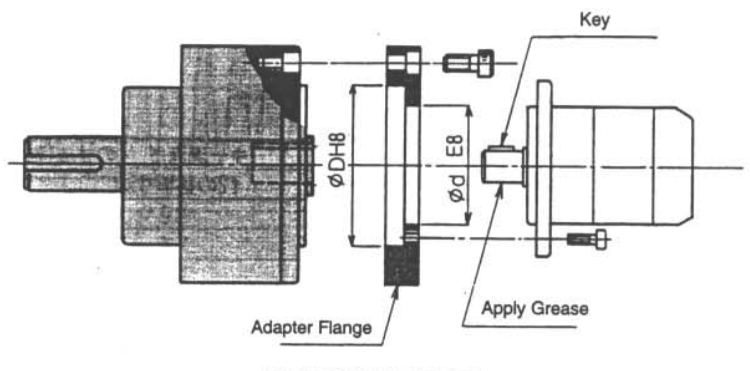
MODEL	THRUST	RADIAL	
	N (lb)	N (lb)	Load Point L1 (mm)
BR 50	29 (6.5)	49 (11.0)	19
BR 65	49 (11.0)	54 (12.1)	21
BR 85	74 (16.6)	108 (24.3)	25
BR 100	98 (22.0)	152 (34.2)	30
BR 125	147 (33.0)	191 (42.9)	35
BR 160	294 (66.1)	441 (99.1)	49



HOLLOW SHAFT TYPE INPUT

■ DIRECT IN LINE INPUT

- The motor can be directly connected to the ball reducer as shown with the hollow input shaft type.
- An adapter flange will be needed in the case of the direct input method with a key type, set screw type or taper collet type.
- The adapter can be customer supplied or supplied by your distributor. Please provide all motor data for dimensional accuracy.
- **Note: Customer supplied flange adapter should be finished to H8 on the ball reducer side of the flange. Adapter should be finished to E8 on the motor side of the flange considering motor shaft deflection.**



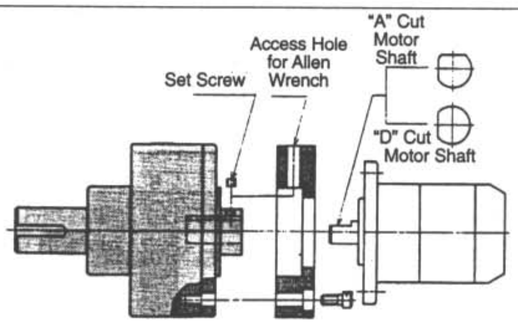
KEYWAY TYPE

KEYWAY TYPE INPUT:

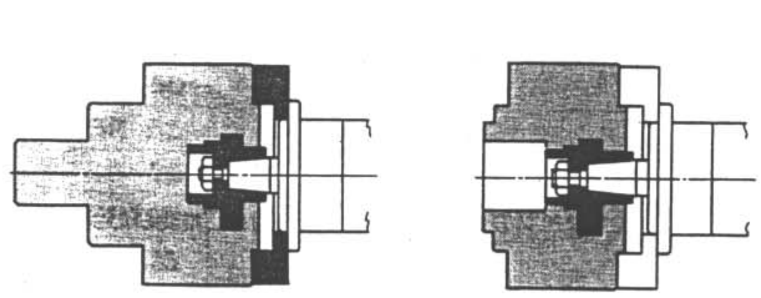
- The tolerance of the key width on the input shaft of the ball reducer is P9 unless otherwise specified.
- Check for proper fit between key and keyway.
- Coat the shaft with grease before inserting the shaft into the hollow input.

SET SCREW TYPE INPUT:

- To assure maximum holding strength of the set screw type installation, the output shaft of the motor should have an "A" cut or "D" cut as shown in the diagram.
- The set screws are tightened in place.
- Locktite can be applied to the threads to prevent the screws from loosening.



SET SCREW TYPE

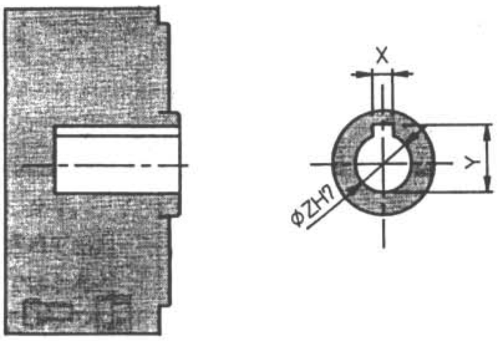


TAPERED SHAFT TYPE

TAPERED SHAFT TYPE INPUT:

- Motor specifications must be provided for the use of this type of input locking mechanism.
- The coupling angle and length will be adapted to the input shaft data provided.
- Note that this coupling is designed so that the tightening nut must be accessed through the output shaft side of the ball reducer as shown in the diagram.

■ KEY TYPE INPUT



The standard keyway widths (X) are given in the table below. If non-standard dimension keyways are required, please provide the X, Y, and Z dimensions required. Available non-standard keyway width tolerance is Js9 only.

KEYWAY INPUT DIMENSION TABLE

Unit: mm

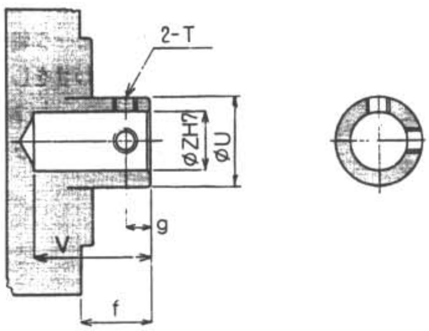
KEYWAY WIDTH X		KEYWAY DEPTH Y (SHAFT DIA. + t2)		APPLICABLE BORE DIAMETER Z
NOMINAL X	TOLERANCE (P 9)	NOMINAL t2	TOLERANCE	
2	-0.006 -0.031	1.0	+0.1 -0.0	From 6mm to 8mm, etc.
3		1.4		8 to 10
4	-0.012 -0.042	1.8		10 to 12
5		2.3		12 to 17
6		2.8		17 to 22
7	-0.015 -0.051	3.0	+0.2 -0.0	22 to 25
8		3.3		22 to 30

Conforming to JIS B 1301 sunk keys.

Example: Keyway dimensions for an input shaft bore of "Z" diameter = 10mm. X = 3P9, Y = 10 + 1.4 = 11.4, Z = 10H7.

■ SET SCREW TYPE INPUT

Ball reducer standard shapes and dimensions are referenced in this section. Please specify our standards as much as possible. If non-standard shapes and/or dimensions are required, please provide a drawing defining dimensions as required by the table below. These are non-standard and as such will require a factory quotation.



SET SCREW INPUT DIMENSION TABLE

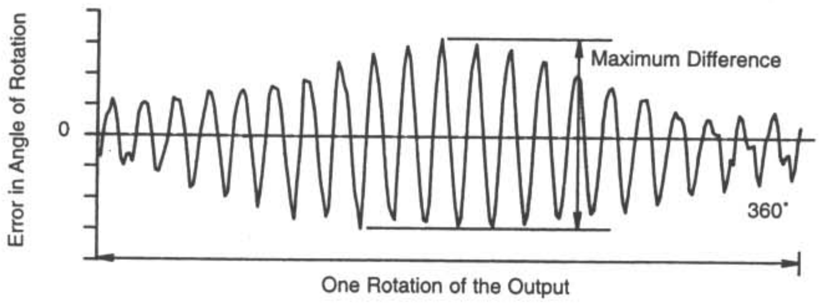
MODEL NO. \ CODE	U	V	g	f	MAX Z	SET SCREW DIAMETER "T" FOR EACH INPUT SHAFT BORE DIAMETER ØZ: 4	5	6	7	8	9	10	11	12	14	16	17	18	19	20	22	24	25	28
BR (F) 50 BBR (F) 85	12	20	4	10	7		M3																	
BR (F) 65 BBR (F) 100	15	23	4	10	8				M4															
BR (F) 85 BBR (F) 125	20	24	5	12	11																			
BR (F) 100 BBR (F) 160	25	28	5	12	14																			
BR (F) 125	30	30	5	12	20									M5										
BR (F) 160	40	40	5.5	16	28																	M6		

Example: The diameter of the set screw for an input bore diameter "Z" of model BR65 where "Z" = 7mm.
Set screw diameter = M4.

● ANGULAR TRANSMITTING ACCURACY

Angular transmitting accuracy is the difference between the theoretical angle of rotation and the actual angle of rotation of the output shaft when the input shaft is rotated to provide one revolution of the output shaft. This maximum difference of one rotation of the output shaft is defined as the angular transmitting accuracy.

$\theta er = |\theta_2 - \theta_2'| = |\frac{\theta'}{R} - \theta_2'|$ R: Reduction Ratio



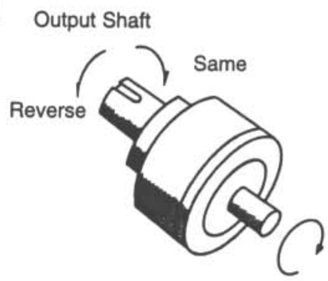
BR-S, BR-U, BRF, AND BRA SERIES

MODEL NUMBER	BR50	BR (BRA) 65	BR (BRA) 85	BR100	BR125	BR160
Angular transmitting accuracy in arc min.	16 Maximum	15 Maximum	10 Maximum	7 Maximum	6 Maximum	6 Maximum

BBR-S AND BBR-U SERIES

MODEL NUMBER	BBR100	BBR125	BBR160
Angular transmitting accuracy in arc min.	8 Maximum	7 Maximum	7 Maximum

● OUTPUT SHAFT ROTATION DIRECTION



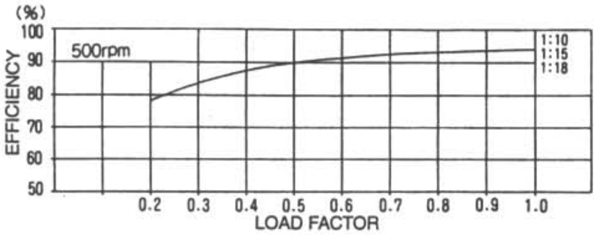
Rotation Direction The direction of rotation of the output shaft when viewed from the input shaft end as shown in the diagram is given in the table below.

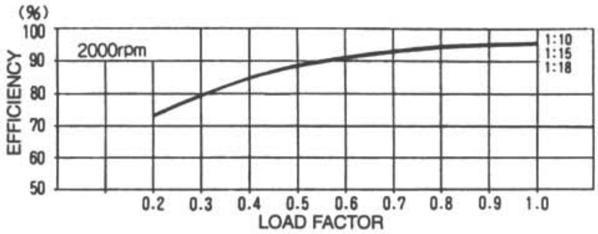
MODEL \ REDUCTION RATIO	(5)	10	12	15	18	20	24	25	30	35	36	40	45	50	60	70	80
BRA 35	Reverse	Reverse	Reverse	Reverse	Reverse	Same	Same	Same	Same								
BR 50	↓	↓	↓	Same	Same	Reverse	↓	↓	↓	Same	Same	Reverse					
BR 65	↓	↓	↓	Reverse	↓	↓	Reverse	Reverse	↓	↓	↓	↓	Same	Same			
BR 85	↓	↓	↓	↓	Reverse	↓	↓	↓	↓	Reverse	↓	Same	Reverse	↓	Reverse	Same	
BR 100	↓	↓	↓	↓	↓	↓	↓	Same	Reverse	↓	↓	Reverse	Same	↓	Same	Reverse	Same
BR 125	↓	↓	↓	↓	↓	↓	↓	Reverse	↓	↓	↓	↓	Reverse	Reverse	Reverse	↓	Reverse
BR 160	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	Reverse	↓	↓	↓	↓	↓	↓

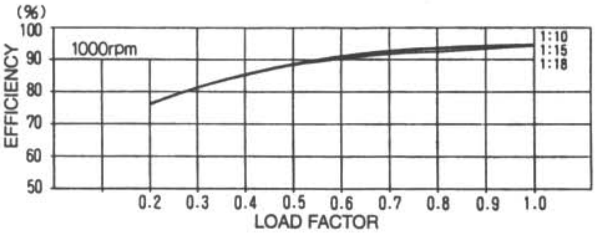
● EFFICIENCY

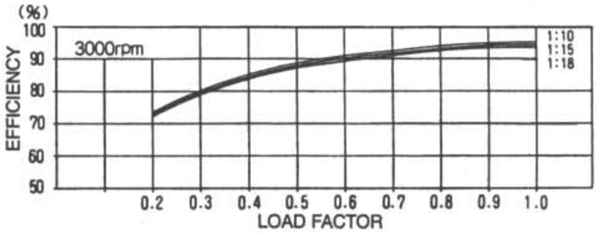
The following graphs show ball reducer efficiency at each load factor per rotation frequency of the input shaft for each model.

BR50

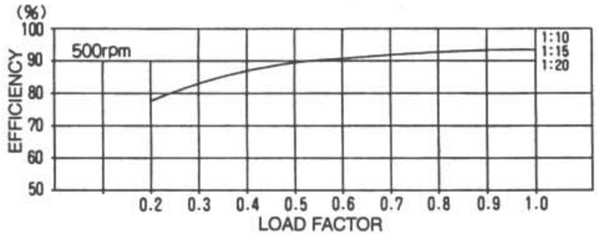


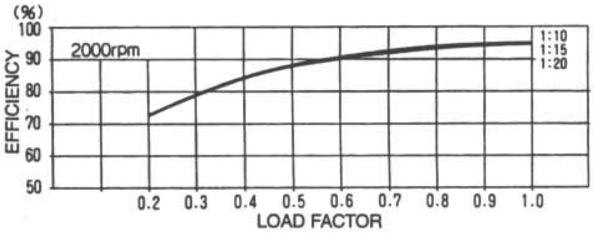


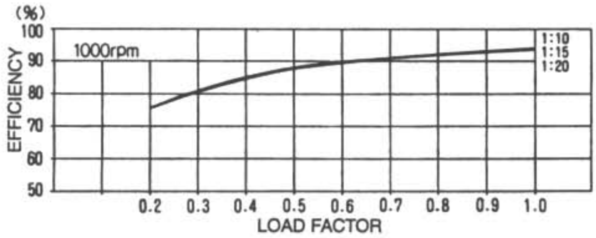


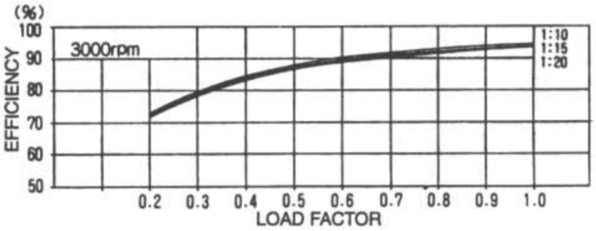


BR65

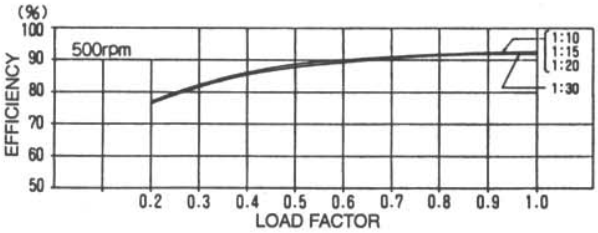


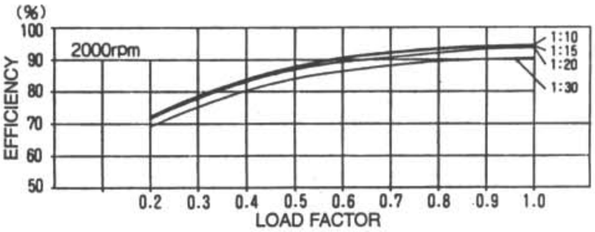


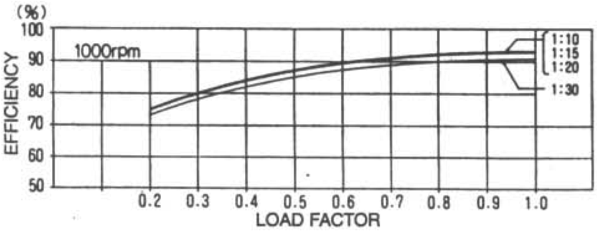


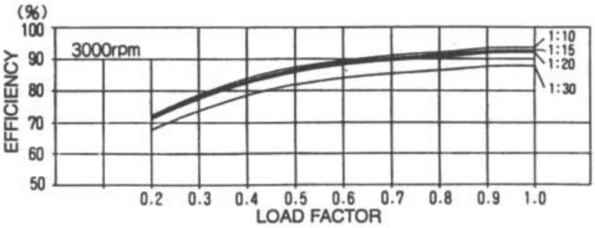


BR85

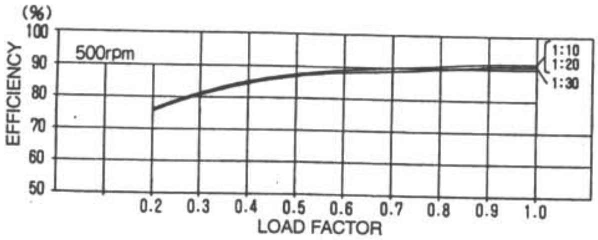


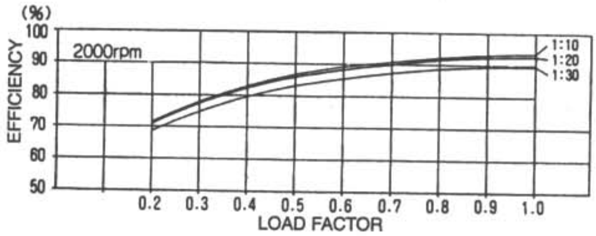


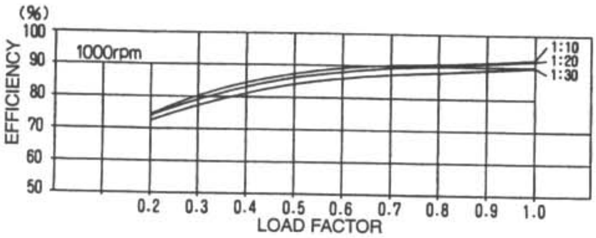


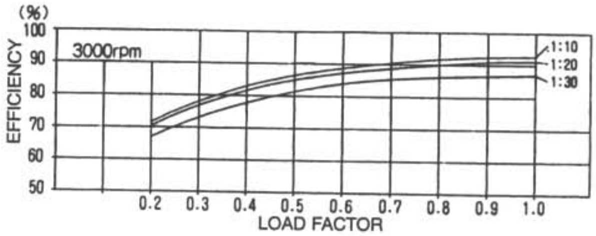


BR100

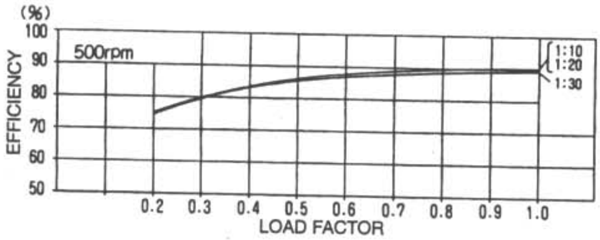


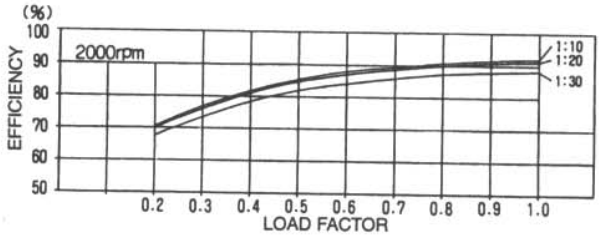


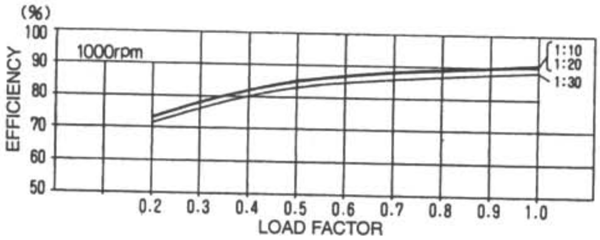


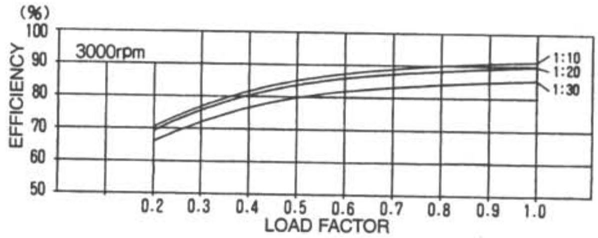


BR125









BR160