

General specifications

Type	permanent-magnet rotor
Phases	two
Switching sequence	4- or 8-step
Step angles	1.8° (2.5° in 20-3424D144-E05 model)
Winding configurations	two-winding/4-lead; dual bifilar windings/6-lead; four independent windings/8-leads; signified by B, E, and F respectively in model number code. For E designation, use unipolar driver; for B designation, use bipolar driver only; for F designation, use either driver type.
Angular accuracy	±3% of one full step, unloaded, non-cumulative.
Ambient operating temperature	−20°C to 50°C
Maximum case temperature	100°C
Insulation	NEMA Class B
Insulation resistance	1000 MΩ at 500 Vdc and 25°C
Dimensions	2.2" OD, 3.4" OD; and 4.2" OD; motor lengths from 1.5" to 9.6"
Weight	0.8 lb to 26.9 lb
Torque output (at 50 steps per second)	22 oz-in. to 2250 oz-in.

(Consult performance curves for true torque output under load and at various motor speeds, also maximum slewing speeds, resonance regions, motor capabilities with specific drivers, start/stop characteristics, and other information.)

Shaft-load ratings specified for minimum 10,000-hour life*

MOTOR SIZE (IN. OD)	2.2	3.4	4.2
AXIAL-IN (LBS)	1.8	4.5	17.0
AXIAL-OUT (LBS)	10	50	60
RADIAL (LBS)	7	20	25

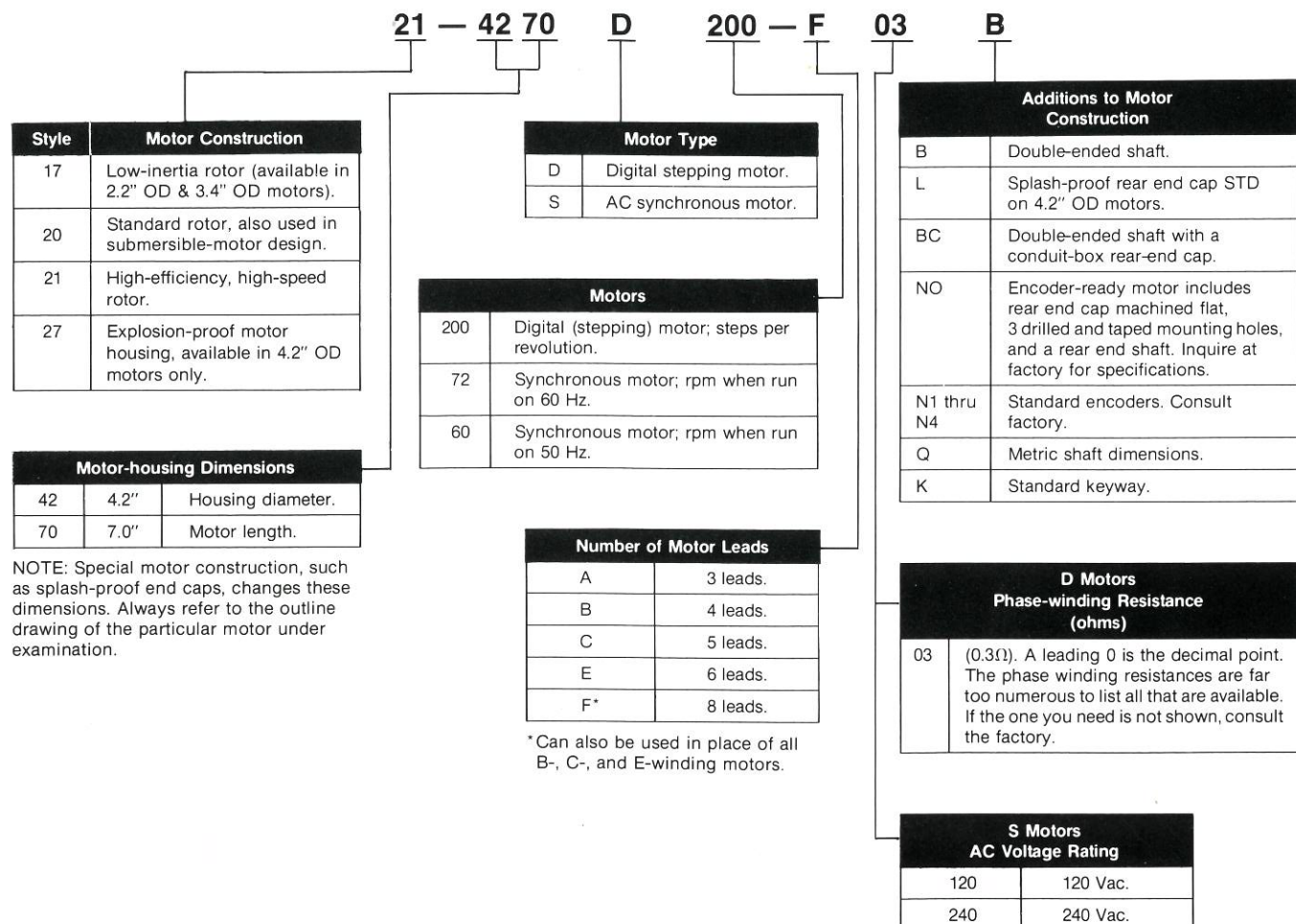
* All Sigma standard stepping motors perform with shaft-position accuracy rated at 3 percent of one step (3.24°) over commanded moves of one step, one thousand steps, one million steps, etc. Radial and axial load-bearing capability can be improved with a slight increase in this percentage figure. Consult factory.

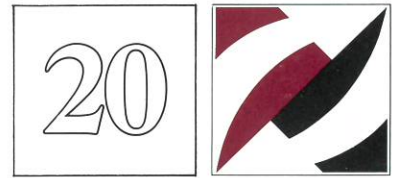
Model number code

The following typical model number illustrates coding configuration, and explains characteristics of Sigma standard motors tabulated throughout this catalog.

Motor tables provided for each Sigma series list models

most-often called for by typical applications, not all Sigma standard motors. For example, winding resistance can be altered to meet specific application requirements. Further information is available from the factory.





General-purpose

Sigma Series 20

This is Sigma's broad line of permanent-magnet stepping motors for general use. More than 20 individual models to choose from with torque output ratings from 25 to 1700 oz-in. and motor speeds to 10,000 steps per second (3000 rpm). The Series 20 is highly regarded for the broad range of

capabilities within its individual models — good low- and high-speed torque, fast settling, minimal ringout, excellent stiffness. Solid rotor construction provides good damping and minimizes oscillation. Compatibility with economical unipolar and bipolar

resistance-limited drivers as well as with more sophisticated chopper, half-step, and microstepping system designs. Sigma Series 20 motors are available in 2.2", 3.4", and 4.2" diameter models, and with one-, two-, and three-stack rotors.

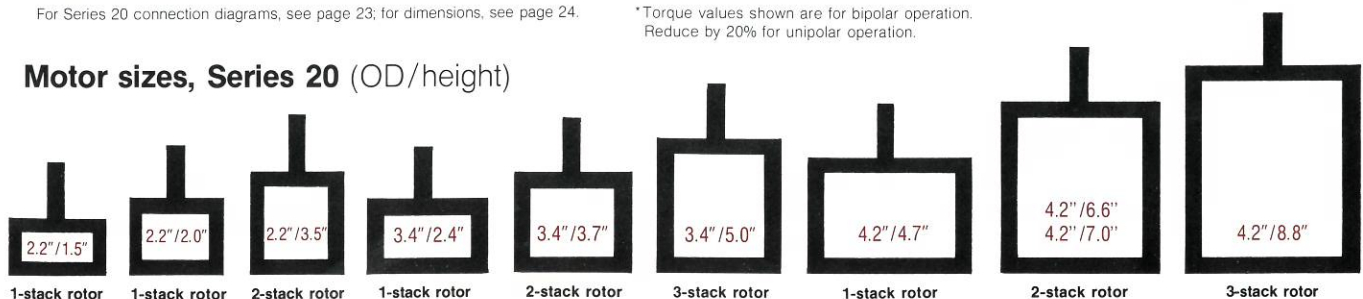
Series 20 ratings and characteristics

Line No.	Motor	# of leads	Torque at 50 sps. oz-in./N-m	Holding torque oz-in./N-m	Detent torque oz-in./N-m	Phase current (amps)		Phase resistance (ohms) $\pm 10\%$	Phase inductance (mH) $\pm 20\%$	Rotor inertia oz-in. ² /10 ⁻⁴ kg-m ²	Weight lbs/kg	Maximum bias power at 25°C (watts)	Performance curve in catalog (✓)
						Unipolar	Bipolar						
1	20-2215D200-E1.5	6	21/0.15	30/0.21	1.9/0.014	1.7	—	1.45	1.20	0.30/0.0055	0.8/0.36	8	✓
2	20-2215D200-E04	6	20/0.14	28/0.20	1.9/0.014	3.1	—	0.42	0.36	0.30/0.0055	0.8/0.36	8	--
3	20-2215D200-B39	4	25/0.18	31/0.22	1.9/0.014	—	0.32	38	68	0.30/0.0055	0.8/0.36	8	--
4	20-2215D200-B075	4	27/0.19	38/0.27	1.9/0.014	—	2.3	0.72	1.20	0.30/0.0055	0.8/0.36	8	✓
5	20-2220D200-E23	6	46/0.32	60/0.42	3.2/0.023	0.47	—	21.8	32	0.64/0.0117	1.2/0.54	10	--
6	20-2220D200-E5.1	6	47/0.33	61/0.43	3.2/0.023	1.0	—	5.2	7.6	0.64/0.0117	1.2/0.54	10	✓
7	20-2220D200-E033	6	48/0.34	63/0.44	3.2/0.023	3.6	—	0.38	0.65	0.64/0.0117	1.2/0.54	10	--
8	20-2220D200-B055	4	58/0.41	75/0.53	3.2/0.023	—	3.0	0.55	1.60	0.64/0.0117	1.2/0.54	10	✓
9	20-2235D200-E2.6	6	95/0.67	120/0.85	7.5/0.053	1.6	—	2.65	3.6	1.30/0.0238	2.4/1.1	14	--
10	20-2235D200-E1.7	6	85/0.60	115/0.81	7.5/0.053	2.0	—	1.68	2.50	1.30/0.0238	2.4/1.1	14	✓
11	20-2235D200-B019	4	115/0.81	150/1.06	7.5/0.053	—	6.1	0.19	0.45	1.30/0.0238	2.4/1.1	14	✓
12	20-3424D200-E1.8	6	117/0.82	157/1.10	16.7/0.118	2.2	—	1.74	3.0	3.0/0.055	3.1/1.4	17	✓
13	20-3424D200-E05	6	115/0.81	155/1.09	16.7/0.118	4.2	—	0.47	0.74	3.0/0.055	3.1/1.4	17	✓
14	20-3424D200-B09	4	143/1.00	195/1.37	16.7/0.118	—	3.1	0.87	3.0	3.0/0.055	3.1/1.4	17	--
15	20-3424D200-B025	4	150/1.06	190/1.34	16.7/0.118	—	6.1	0.23	0.74	3.0/0.055	3.1/1.4	17	✓
16	20-3437D200-E075	6	235/1.66	310/2.19	25.0/0.177	4.0	—	0.76	2.20	5.9/0.108	5.3/2.4	24	--
17	20-3437D200-B038	4	275/1.94	380/2.68	25.0/0.177	—	5.6	0.38	2.20	5.9/0.108	5.3/2.4	24	✓
18	20-3450D200-B06	4	480/3.39	580/4.10	33.3/0.235	—	5.1	0.55	3.9	9.0/0.165	7.6/3.5	29	✓
19	20-4247D200-F1.3	8	* 540/3.81	* 635/4.48	22.6/0.160	3.1	4.4	1.29	3.3	17.4/0.318	10/4.5	25	✓
20	20-4247D200-F044	8	* 630/4.45	* 725/5.12	22.6/0.160	5.2	7.5	0.46	1.40	17.4/0.318	10/4.5	25	--
21	20-4266D200-F1.2	8	*1100/7.77	*1290/9.11	43.9/0.310	3.7	5.3	1.21	4.7	35.2/0.644	16/7.3	34	--
22	20-4266D200-F06	8	*1210/8.54	*1425/10.1	43.9/0.310	5.3	7.5	0.61	3.0	35.2/0.644	16/7.3	34	--
23	20-4266D200-F03	8	*1090/7.70	*1310/9.25	43.9/0.310	7.5	10.6	0.30	1.05	35.2/0.644	16/7.3	34	--
24	20-4270D200-F1.2	8	*1100/7.77	*1290/9.11	43.9/0.310	3.7	5.3	1.21	4.7	35.2/0.644	17/7.7	34	--
25	20-4270D200-F06	8	*1210/8.54	*1425/10.1	43.9/0.310	5.3	7.5	0.61	3.0	35.2/0.644	17/7.7	34	--
26	20-4270D200-F03	8	*1090/7.70	*1310/9.25	43.9/0.310	7.5	10.6	0.30	1.05	35.2/0.644	17/7.7	34	✓
27	20-4288D200-F03	8	*1700/12.0	*2200/15.5	68.0/0.480	9.3	13.2	0.26	1.01	56.1/1.03	23.5/10.7	45	✓

For Series 20 connection diagrams, see page 23; for dimensions, see page 24.

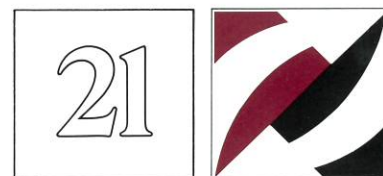
*Torque values shown are for bipolar operation. Reduce by 20% for unipolar operation.

Motor sizes, Series 20 (OD/height)



High-speed, high-torque

Sigma Series 21



Sigma Series 21 stepping motors attack a common limitation in standard stepping-motor performance — reduced torque output at high motor speeds. Laminated-and-bonded rotor construction in the Series 21 serves to increase torque output as well as the motors' torque-to-inertia ratios through-

out their operating ranges, even beyond 15,000 steps per second (4,500 rpm). Reduced flux leakage and iron losses contribute to increased overall efficiency, cut down on heat buildup, and bring a higher peak power to high-speed, high-load applications. Available in 2.2" OD, 3.4" OD, and 4.2" OD

models with up to three-stack rotors, the Series 21 reaches out to high-speed applications with usable torque that's simply unattainable in industry-standard motors. System design assistance available.

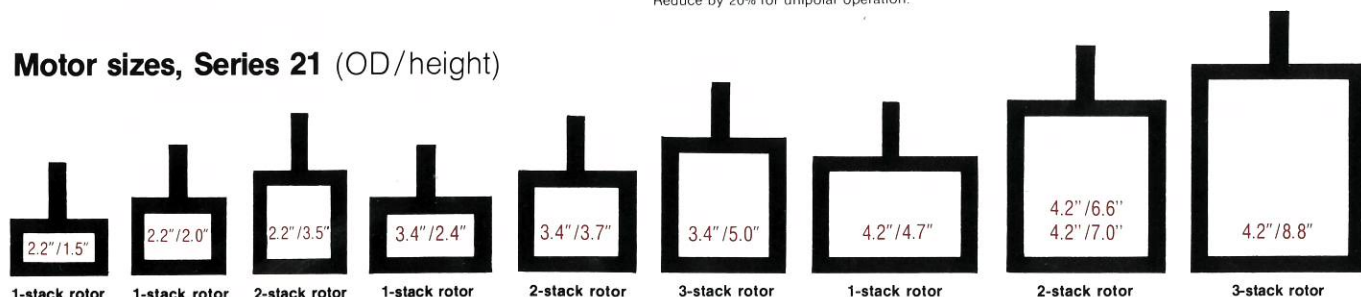
Series 21 ratings and characteristics

Line No.	Motor	# of leads	Torque at 50 sps. oz.-in./N-m	Holding torque oz.-in./N-m	Detent torque oz.-in./N-m	Phase current (amps)		Phase resistance (ohms) $\pm 10\%$	Phase inductance (mH) $\pm 20\%$	Rotor inertia oz.-in. ² /10 ⁻³ kg-m ²	Weight lbs/kg	Maximum bias power at 25°C (watts)	Performance curve in catalog (✓)
						Unipolar	Bipolar						
1	21-2215D200-E1.5	6	26/0.18	31/0.22	1.4/0.010	1.7	—	1.45	1.52	0.42/0.0077	0.85/0.38	8	--
2	21-2215D200-B075	4	35/0.24	41/0.29	1.4/0.010	—	2.3	0.72	1.52	0.42/0.0077	0.85/0.38	8	--
3	21-2215D200-B02	4	38/0.27	50/0.35	1.4/0.010	—	4.3	0.22	0.47	0.42/0.0077	0.85/0.38	8	--
4	21-2220D200-E5.1	6	55/0.39	69/0.49	5.0/0.035	1.0	—	5.2	9.2	0.67/0.0123	1.25/0.56	10	--
5	21-2220D200-E033	6	56/0.40	72/0.51	5.0/0.035	3.6	—	0.38	0.58	0.67/0.0123	1.25/0.56	10	--
6	21-2220D200-B055	4	65/0.46	83/0.59	5.0/0.035	—	3.0	0.55	2.2	0.67/0.0123	1.25/0.56	10	--
7	21-2220D200-B016	4	65/0.46	88/0.62	5.0/0.035	—	5.3	0.18	0.59	0.67/0.0123	1.25/0.56	10	✓
8	21-2235D200-E037	6	103/0.73	140/1.00	9.0/0.064	4.4	—	0.36	0.94	1.5/0.027	2.4/1.1	14	--
9	21-2235D200-B019	4	140/0.99	180/1.27	9.0/0.064	—	6.1	0.19	0.94	1.5/0.027	2.4/1.1	14	✓
10	21-3424D200-E05	6	140/0.99	180/1.27	5.6/0.040	4.2	—	0.47	1.68	3.2/0.059	3.1/1.4	17	--
11	21-3424D200-B025	4	180/1.27	220/1.55	5.6/0.040	—	6.1	0.23	1.68	3.2/0.059	3.1/1.4	17	✓
12	21-3437D200-E075	6	270/1.91	365/2.58	12.5/0.088	4.0	—	0.76	3.9	6.6/0.121	5.5/2.5	24	--
13	21-3437D200-B038	4	330/2.33	460/3.26	12.5/0.088	—	5.6	0.38	3.9	6.6/0.121	5.5/2.5	24	✓
14	21-3437D200-B009	4	350/2.47	475/3.35	12.5/0.088	—	11.5	0.09	0.90	6.6/0.121	5.5/2.5	24	--
15	21-3450D200-E03	6	405/2.87	560/3.95	24/0.172	7.0	—	0.31	1.68	10.7/0.185	7.8/3.6	29	--
16	21-3450D200-B06	4	520/3.67	680/4.80	24/0.172	—	5.1	0.55	6.6	10.1/0.185	7.8/3.6	29	✓
17	21-3450D200-B015	4	580/4.10	680/4.80	24/0.172	—	9.8	0.156	1.68	10.1/0.185	7.8/3.6	29	✓
18	21-4247D200-F1.3	8	* 500/3.53	* 570/4.03	21/0.147	3.1	4.4	1.29	7.1	19.3/0.353	10.2/4.6	25	✓
19	21-4247D200-F03	8	* 525/3.72	* 575/4.06	21/0.147	6.3	8.8	0.32	1.81	19.3/0.353	10.2/4.6	25	✓
20	21-4266D200-F1.2	8	* 990/6.99	*1120/7.91	38/0.265	3.7	5.3	1.21	12.1	37.1/0.679	19/8.6	34	--
21	21-4266D200-F03	8	* 960/6.78	*1160/8.19	38/0.265	7.5	10.5	0.30	2.6	37.1/0.679	19/8.6	34	--
22	21-4266D200-F022	8	* 910/6.43	*1100/7.80	38/0.265	9.0	12.7	0.21	1.60	37.1/0.679	19/8.6	34	--
23	21-4270D200-F1.2	8	* 950/6.71	*1120/7.91	38/0.265	3.7	5.3	1.21	12.1	37.1/0.679	19/8.6	34	✓
24	21-4270D200-F03	8	*1020/7.2	*1160/8.19	38/0.265	7.5	10.5	0.30	2.6	37.1/0.679	19/8.6	34	--
25	21-4270D200-F022	8	* 910/6.43	*1100/7.80	38/0.265	9.0	12.7	0.21	1.60	37.1/0.679	19/8.6	34	--
26	21-4288D200-F03	8	*1480/10.5	*1850/13.1	56/0.392	9.3	13.2	0.26	2.5	59.2/1.083	24/10.7	45	✓

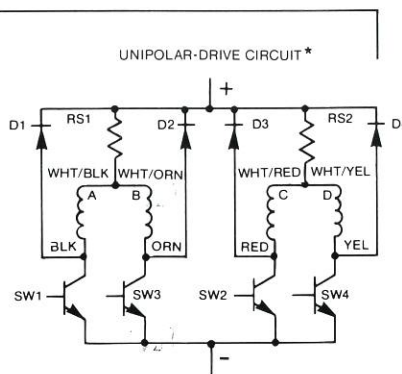
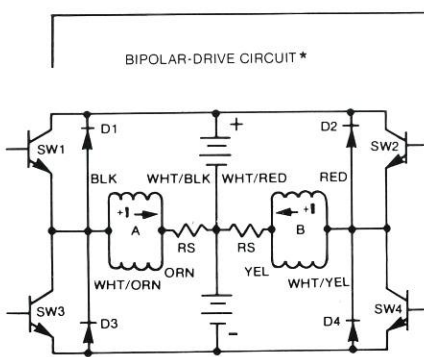
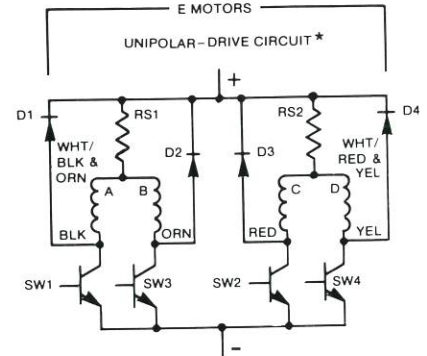
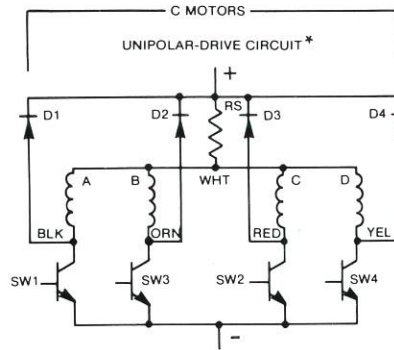
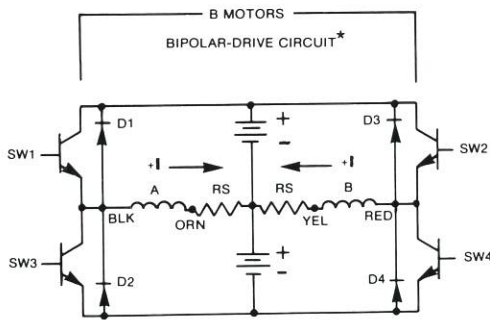
* For Series 21 connection diagrams, see page 23; for dimensions, see page 24.

* Torque values shown are for bipolar operation. Reduce by 20% for unipolar operation.

Motor sizes, Series 21 (OD/height)



Series 17, 20, 21, explosion-proof 27, and submersible motor connection diagrams.



*SERIES RESISTORS (RS) NOT REQUIRED FOR CHOPPER DRIVERS.

Unipolar and bipolar phase-current sequences

UNIPOLAR PHASE-CURRENT SEQUENCE

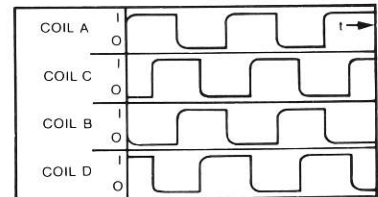
CLOCKWISE*	COUNTERCLOCKWISE*
A + D	A + D
A + C	B + D
B + C	B + C
B + D	A + C
A + D	A + D

*WHEN VIEWED FROM MOUNTING END OF MOTOR

Colored lead/numbered terminal cross-reference table

	2.5" OD submersible motor pin number	Splashproof motor terminal number 3.4" OD/4.2" OD	Explosion-proof motor terminal number
B motors/4-lead			
black	1	2 / 1	4
orange	2	3 / 3	3
red	5	1 / 2	6
yellow	4	4 / 4	5
C motors/5-lead	none		none
white	----	3 / 5	----
black	----	1 / 1	----
orange	----	5 / 3	----
red	----	2 / 2	----
yellow	----	4 / 4	----
E motors/6-lead			none
white/black/orange	3	3 / 5	----
black	1	1 / 1	----
orange	2	5 / 3	----
white/red/yellow	6	4 / 6	----
red	4	2 / 2	----
yellow	5	6 / 4	----
F motors/8-lead	none	none/----	none
white	----	---- / 6	----
black	----	---- / 1	----
white/orange	----	---- / 5	----
orange	----	---- / 3	----
white/red	----	---- / 4	----
red	----	---- / 7	----
white/yellow	----	---- / 2	----
yellow	----	---- / 8	----

PHASE-CURRENT SEQUENCE FOR CLOCKWISE ROTATION

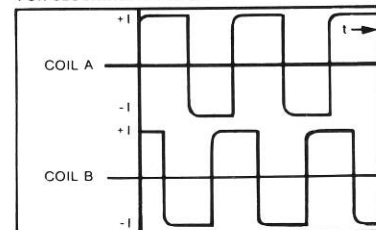


BIPOLAR PHASE-CURRENT SEQUENCE

CLOCKWISE*		COUNTERCLOCKWISE*	
COIL A	COIL B	COIL A	COIL B
+I	+I	+I	+I
+I	-I	-I	+I
-I	-I	-I	-I
-I	+I	+I	-I
+I	+I	+I	+I

*WHEN VIEWED FROM MOUNTING END OF MOTOR

PHASE-CURRENT SEQUENCE FOR CLOCKWISE ROTATION

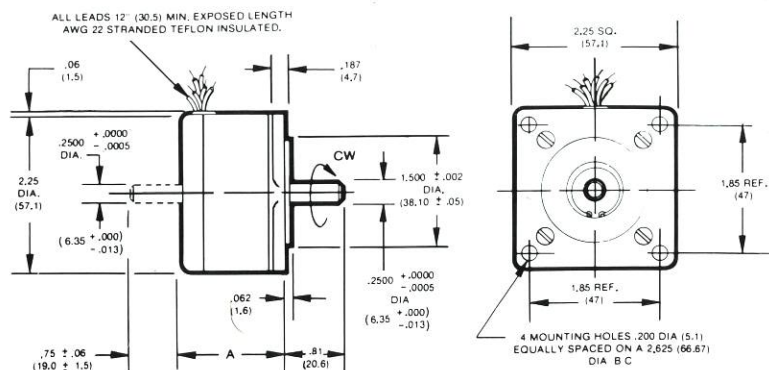


Series 17, 20, 21, and synchronous motors

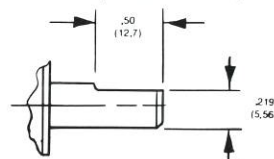
Dimensions and mechanical data

All dimensions in inches and (millimeters).

2.2" OD



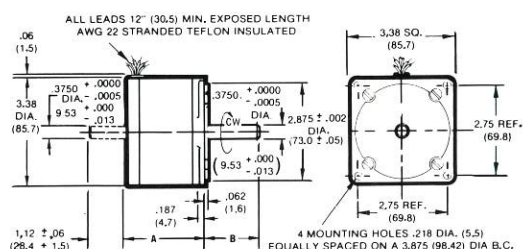
OPTIONAL FLAT ON SHAFT, 2.2" OD MOTORS (CONSULT FACTORY)



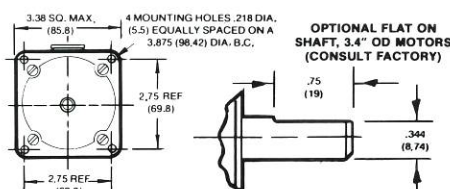
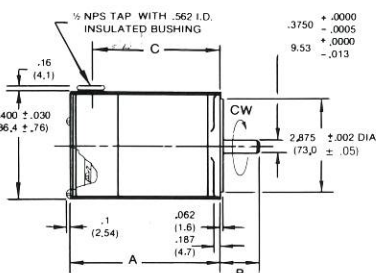
Model No.	A ±.06 (1.5)
2215	1.5(38.7)
2220	2.0(50.8)
2235	3.2(81.3)

3.4" OD

STANDARD



SPLASHPROOF

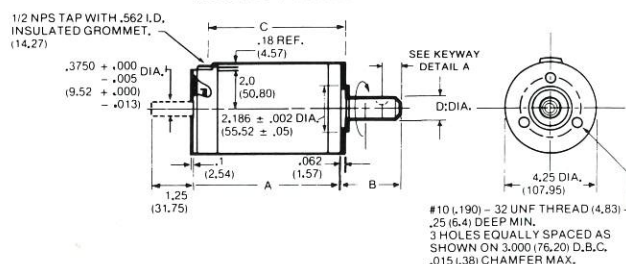


Model No.	A ±.06(1.52)	B ±.04(1.02)	*C ±.06(1.52)
3424	2.4 (61.0) *3.47(88.1)	1.19(30.2)	2.79(70.9)
3437	3.7 (94.0) *4.72(119.9)	1.25(31.75)	4.04(102.6)
3450	5.0 (127.0) *6.0 (152.4)	1.25(31.75)	5.32(135.1)

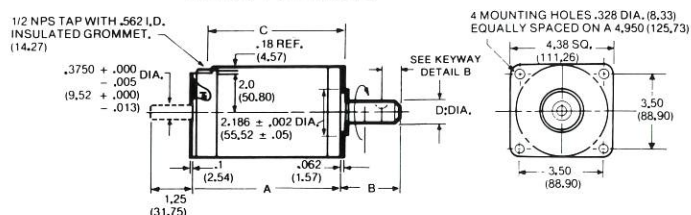
* Splashproof version.

4.2" OD

ROUND FRAME



SQUARE FLANGE



Motor Series	Model No.	A ±.06 (1.52)	B ±.04 (1.02)	C ±.06 (1.52)	D ±.000(00) - .0005 (.013)	See Keyway Detail
round frame						
20	4247	4.74(120.4)	1.25(31.75)	4.18(106.17)	.375(9.53)	*
21	4247	4.74(120.4)	1.25(31.75)	4.18(106.17)	.500(12.7)	A
20,21	4266	6.63(168.4)	1.38(35.05)	6.10(154.9)	.500(12.7)	A
square flange						
20,21	4270	6.94(176.3)	2.19(55.63)	6.38(162.05)	.625(15.88)	B
20,21	4288	8.8(223.5)	2.19(55.63)	8.24(209.5)	.625(15.88)	B

* 20-4247 motors available with optional flat on shaft of the same dimensions as 3.4" OD motors (consult factory).