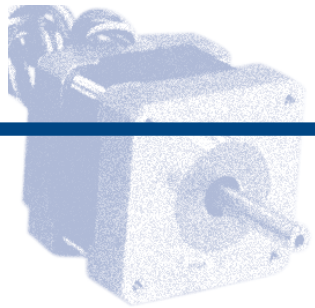
DPM

STEPPING MOTOR

STEP MOTOR



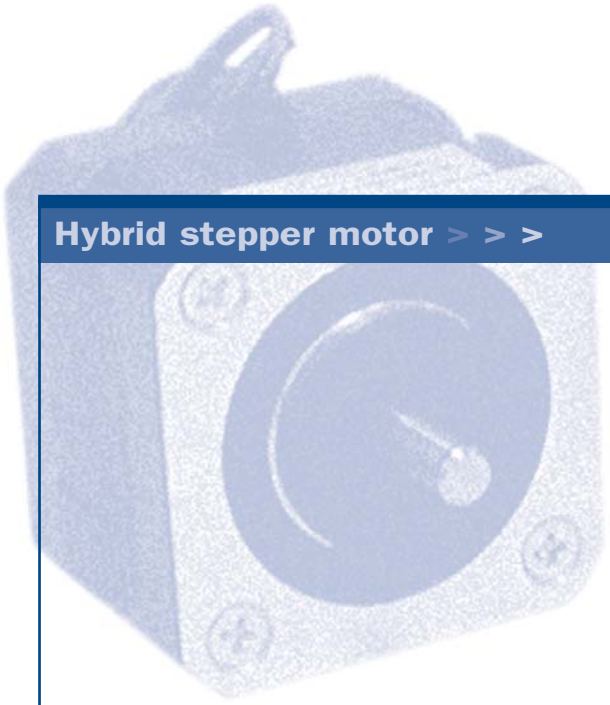
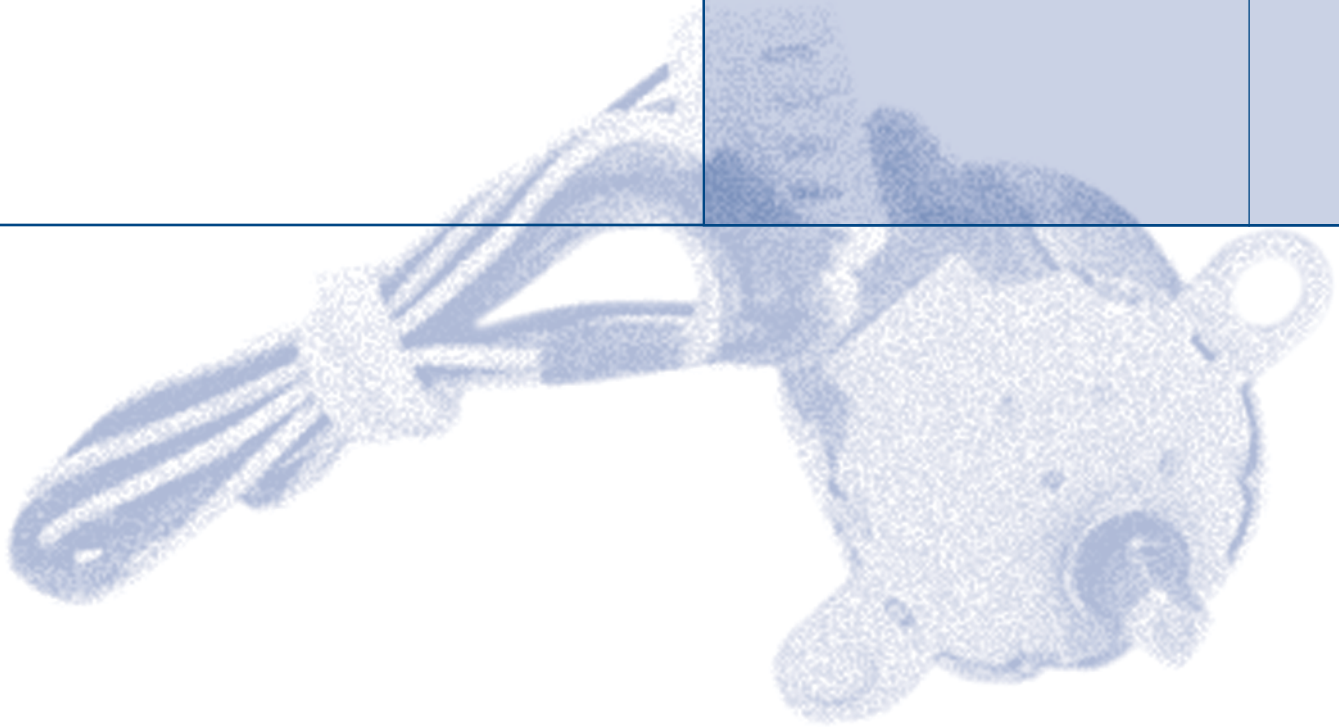


Table of contens



PERIPHERALS

BANKING MACHINES

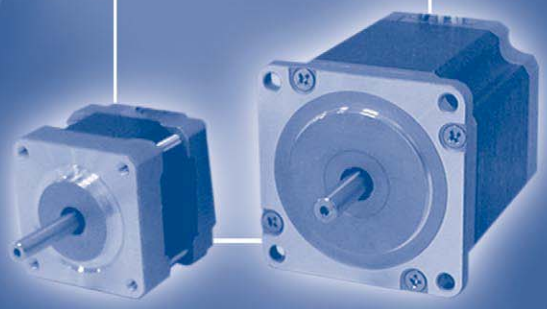
OFFICE AUTOMATION

TELECOMUNICATION

PRINTING MACHINES

MEDICAL EQUIPMENT

DPM



MACHINE TOOLS

INDUSTRIAL AUTOMATION

MACHINES FOR
WOOD WORKING

MACHINES FOR FARM
AND FOOD INDUSTRIES

TEXTILE APPLICATION

SPOT LIGHTS

STEP MOTOR

Codification Number

42	Size in mm.
S	Motor type: S= stepper / SH= stepper high torque
33	Motor lenght in mm.
XXXX	Winding code
A	Shaft configuration: A= 1 shaft / B= 2 shaft
M	M= 400 step/rev
XXXX	Exec: Number Special configuration

SHAFT CONFIGURATION
All motors can be supplied with single or double ended shaft (standard or customized design).

ROTATION
Stepper motors can run clockwise or counterclockwise, depending on the commutation.

BEARING
Hybrid stepper motors fitted with ball bearings.

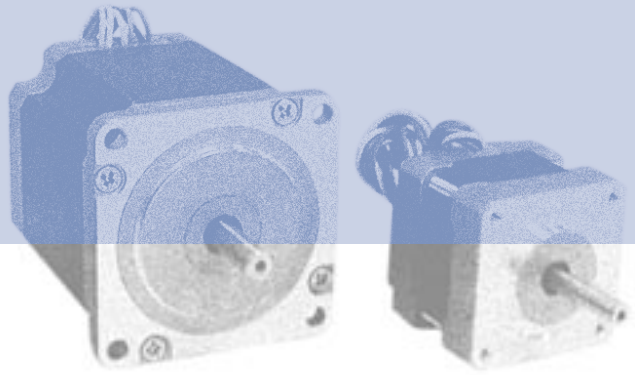
RECOM AMBIENT TEMPERATURE RANGE
-20° C to +40° C.

HOLDING TORQUE
Holding torque is measured with two phases supplied at the rated current.

INSULATION CLASS
Class B.

Test and controls

Delta Precision Motors ltd. Is an ISO9000 professional manufacturer which is devoted to the automation control. Our company persists in providing good products, reasonable price, on time delivery and efficient service.
All our product are controlled in order to maintain an high standard of quality. (On the side the list of the main test for the Stepper motor range).



PRODUCTION FINAL TEST
- Insulation resistance: 500VDC, 100Mohm
- Dielectric strength: 620VAC, 1 sec, 2mA
- Resistance/phase
- Inductance/phase
- Holding torque
- Detent torque
- Direction testing

RUNNING TEST
- Max. running frequency at no load
- Smooth running
- Noise and vibration

APPEARANCE TESTING
- Output shaft
- Lead wires
- Mounting dimension (flange - screw - D-cut - etc)

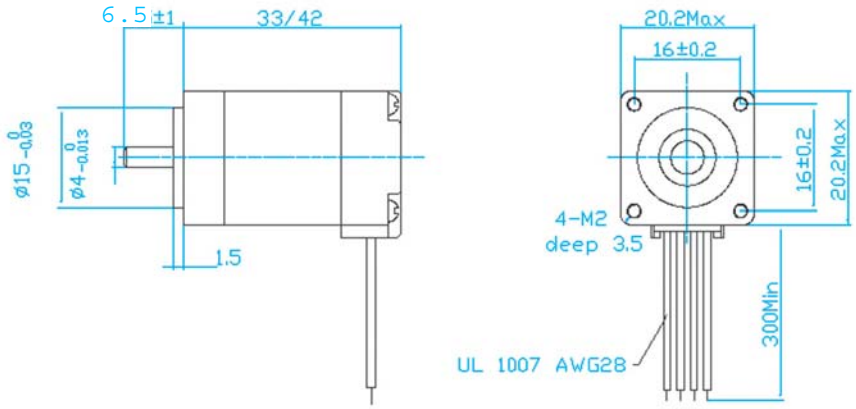
QUALITY CONTROL ADDITIONAL TEST
- Frequency vs torque curve
- No load temperature rising

The technical specifications mentioned are typical

20SH

High Torque Hybrid - 200 step

Step Motor



Dimensions in mm.

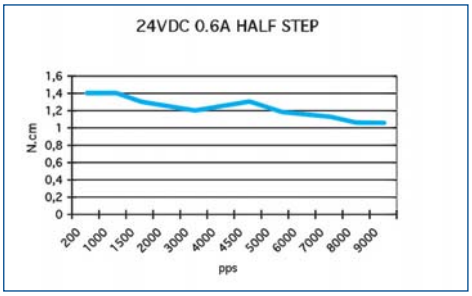
Specifications

	MODEL		20SH33-0604A	20SH42-0804A
1	Step angle		1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%
3	Rated Voltage	V	3,96	4,32
4	Current/Phase	A	0,6	0,8
5	Resistance/Phase	Ω	6,5	5,4
6	Inductance/Phase	mH	1,7	1,5
7	Holding Torque	Ncm	1,75	3,0
8	Rotor Inertia	g-cm²	2	3,6
9	Weight	Kg	0,06	0,08
10	Number of leads	n°.	4	4

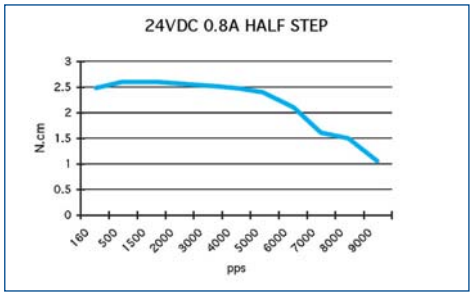
20SH..-.A single shaft • **20SH..-.B** double shaft

Speed vs. Torque Characteristics

20SH33-0604A



20SH42-0804A



Characteristics

Resistance accuracy
± 10%

Inductance accuracy
± 20%

Temperature rise
80° C max. (rated current, 2 phase on)

Ambient temperature
-20° C - + 50° C

Insulation resistance
100 M Ω min., 500 VDC

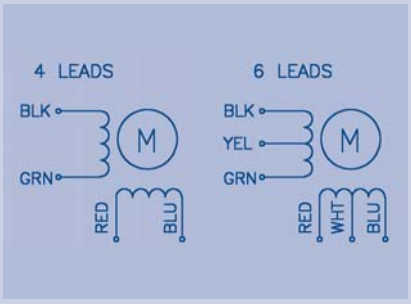
Dielectric strength
500 VAC for one minute

Shaft radial play
0,02 max. (450 g-load)

Shaft axial play
0,08 max. (450 g-load)

Max radial force
28 N (20mm from flange)

Max axial force
10 N



Available Options

Motor modifications:
custom winding, special bearing, special tap.

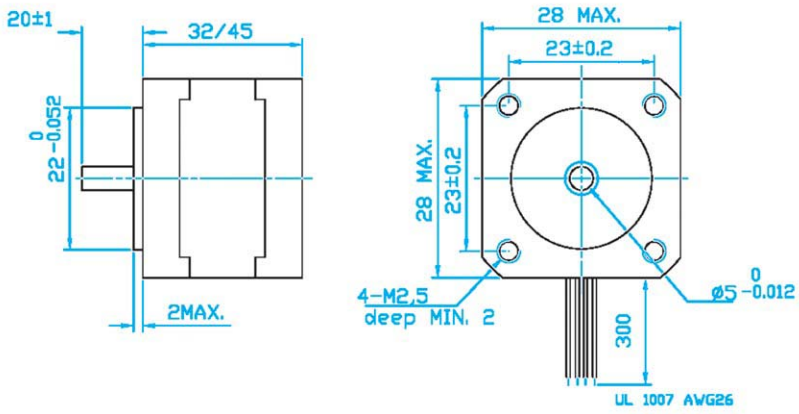
Shaft modifications:
flat, pinion, keyway, length.

Leadwire modifications:
wire type, wire color, wire length, connector installation.

28SH32-45

High Torque Hybrid - 200 step

Step Motor



CE approved

Dimensions in mm.

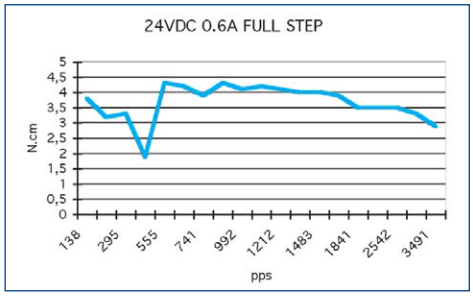
Specifications

	MODEL		28SH32-0956A	28SH32-0674A	28SH45-0956A	28SH45-0674A
1	Step angle		1,8°	1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%	± 5%
3	Rated Voltage	V	2,66	3,8	3,4	6,8
4	Current/Phase	A	0,95	0,67	0,95	0,67
5	Resistance/Phase	Ω	2,8	5,6	3,4	10,1
6	Inductance/Phase	mH	1	4,2	1,2	4,9
7	Holding Torque	Ncm	4,3	6	7,5	9,5
8	Rotor Inertia	g-cm²	9	9	12	12
9	Weight	Kg	0,11	0,11	0,14	0,14
10	Number of leads	n°.	6	4	6	4

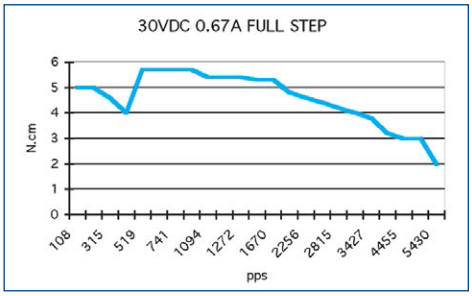
28SH..-.A single shaft • **28SH..-.B** double shaft

Speed vs. Torque Characteristics

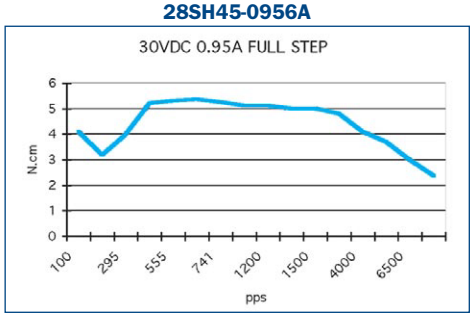
28SH32-0956A



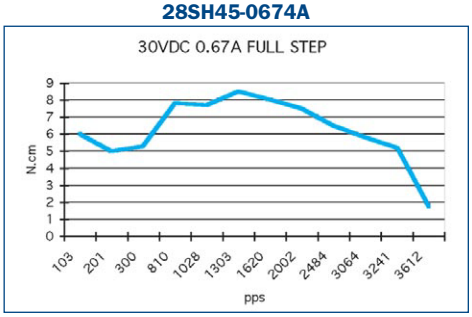
28SH32-0674A



28SH45-0956A



28SH45-0674A



Characteristics

Resistance accuracy
± 10%

Inductance accuracy
± 20%

Temperature rise
80° C max. (rated current, 2 phase on)

Ambient temperature
-20° C - + 50° C

Insulation resistance
100 M Ω min., 500 VDC

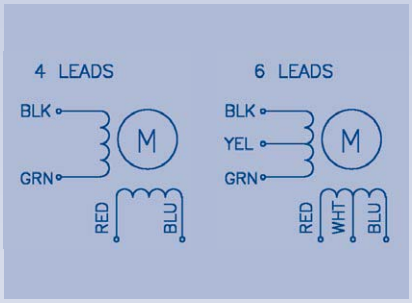
Dielectric strength
500 VAC for one minute

Shaft radial play
0,02 max. (450 g-load)

Shaft axial play
0,08 max. (450 g-load)

Max radial force
28 N (20mm from flange)

Max axial force
10 N

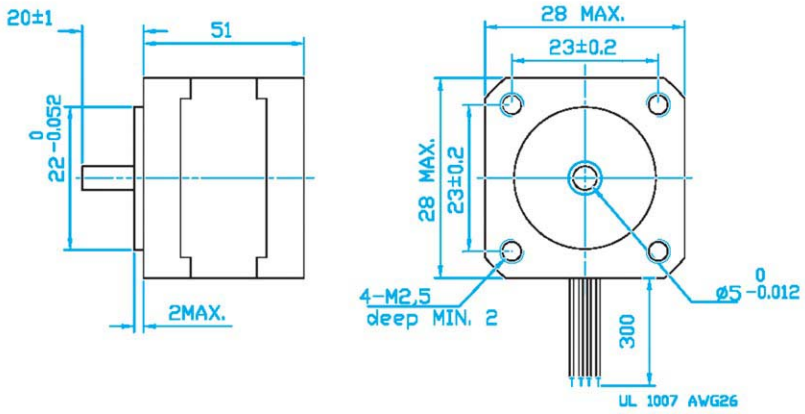


Available Options

Motor modifications:
custom winding, special bearing, special tap.

Shaft modifications:
flat, pinion, keyway, length.

Leadwire modifications:
wire type, wire color, wire length, connector installation.



CE approved

Dimensions in mm.

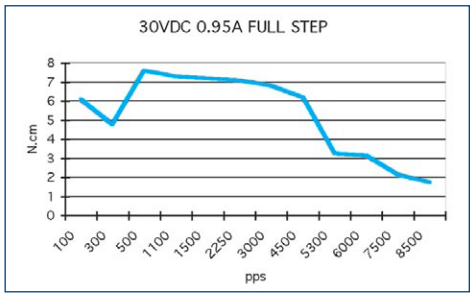
Specifications

	MODEL		28SH51-0956A	28SH51-0674A
1	STEP ANGLE		1,8°	1,8°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%	± 5%
3	RATED VOLTAGE	V	4,4	6,2
4	CURRENT/PHASE	A	0,95	0,67
5	RESISTANCE/PHASE	Ω	4,6	9,2
6	INDUCTANCE/PHASE	mH	1,4	5,7
7	HOLDING TORQUE	Ncm	9	12
8	ROTOR INERTIA	g-cm²	18	18
9	WEIGHT	Kg	0,2	0,2
10	NUMBER OF LEADS	n°.	6	4

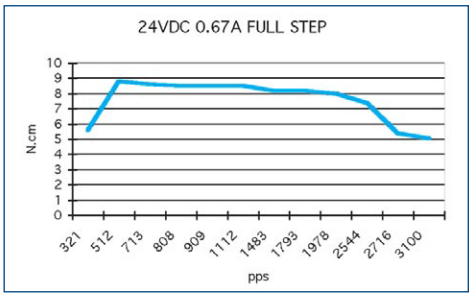
28SH..-.A single shaft • **28SH..-.B** double shaft

Speed vs. Torque Characteristics

28SH51-0956A



28SH51-0674A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C MAX. (RATED CURRENT, 2 PHASE ON)

AMBIENT TEMPERATURE
-20° C - + 50° C

INSULATION RESISTANCE
100 M Ω MIN., 500 VDC

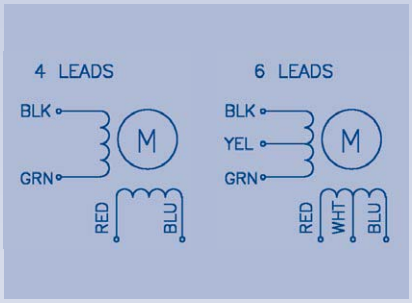
DIELECTRIC STRENGTH
500 VAC FOR ONE MINUTE

SHAFT RADIAL PLAY
0,02 MAX. (450 G-LOAD)

SHAFT AXIAL PLAY
0,08 MAX. (450 G-LOAD)

MAX RADIAL FORCE
28 N (20MM FROM FLANGE)

MAX AXIAL FORCE
10 N



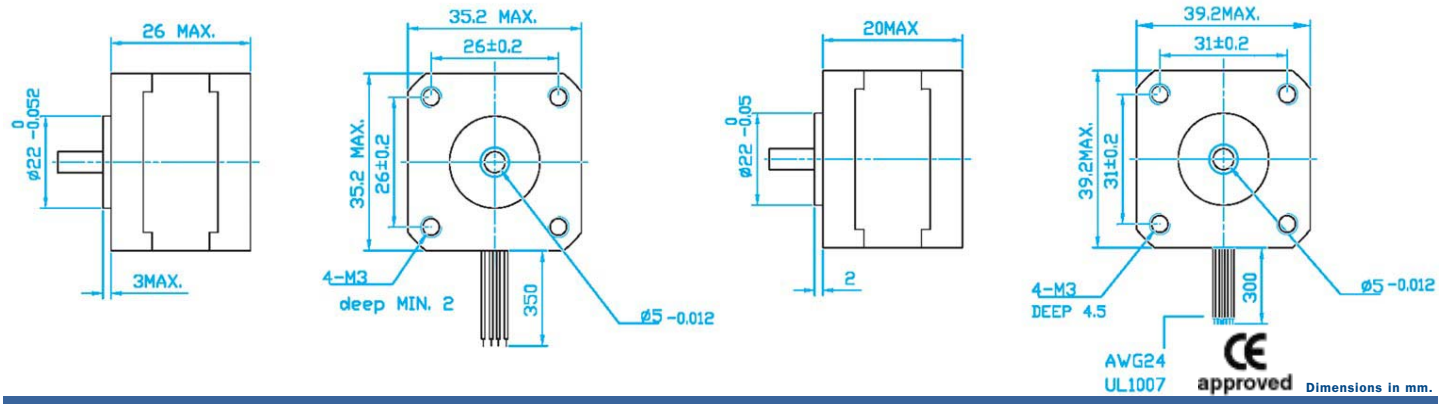
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

35-39SH20-28

Hybrid - 200 step

Step Motor



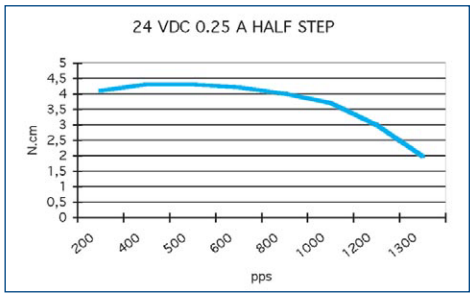
Specifications

	MODEL		35SH26-0306A	35SH26-0804A	39SH20-0404A	39SH20-0506A
1	Step angle		1,8°	1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%	± 5%
3	Rated Voltage	V	11,25	3,84	2,64	6,5
4	Current/Phase	A	0,25	0,8	0,4	0,5
5	Resistance/Phase	Ω	45	4,8	6,6	13
6	Inductance/Phase	mH	13	3	7,5	7,5
7	Detent Torque	mNm	6	6	5	5
8	Holding Torque	Ncm	5	5	6,5	8
9	Rotor Inertia	g-cm²	10	10	11	11
10	Weight	Kg	0,15	0,15	0,12	0,12
11	Number of leads	n°.	6	4	4	6

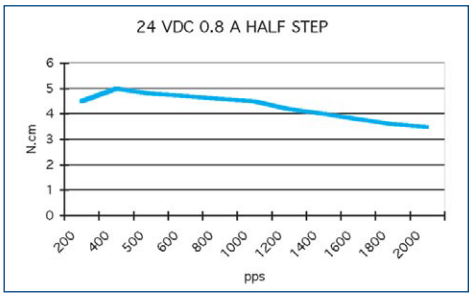
35-39S..-.A single shaft • **35-39S..-.B** double shaft

Speed vs. Torque Characteristics

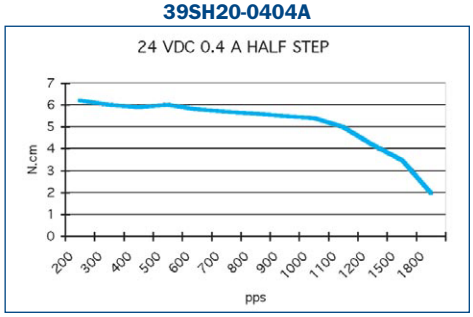
35SH26-0306A



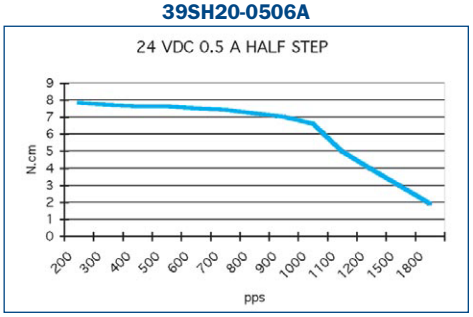
35SH26-0804A



39SH20-0404A



39SH20-0506A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

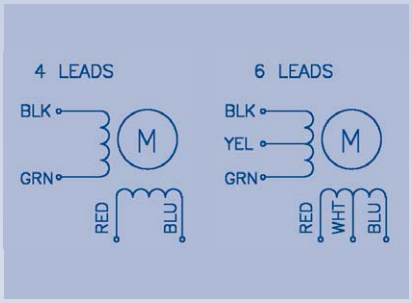
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

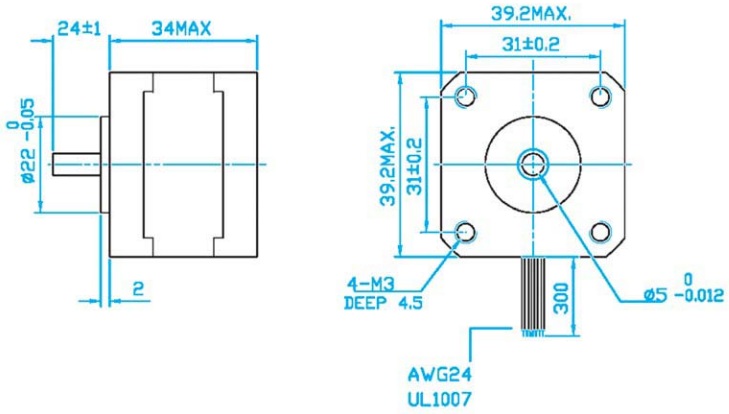
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

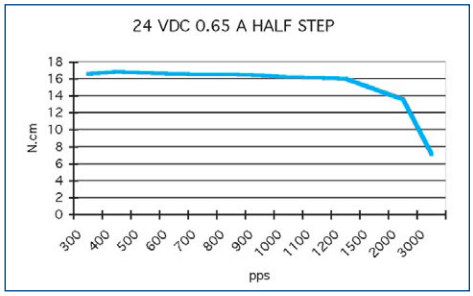
Specifications

	MODEL		39SH34-0654A	39SH34-0404A	39SH34-0604A	39SH34-0306A
1	STEP ANGLE		1,8°	1,8°	1,8°	1,8°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%	± 5%	± 5%	± 5%
3	RATED VOLTAGE	V	4,55	12	9	12
4	CURRENT/PHASE	A	0,65	0,4	0,6	0,3
5	RESISTANCE/PHASE	Ω	7	30	15	40
6	INDUCTANCE/PHASE	mH	9,3	32	16	20
7	DETENT TORQUE	mNm	12	12	12	12
8	HOLDING TORQUE	Ncm	18	21	21	13
9	ROTOR INERTIA	g-cm²	20	20	20	20
10	WEIGHT	Kg	0,18	0,18	0,18	0,18
11	NUMBER OF LEADS	n°.	4	4	4	6

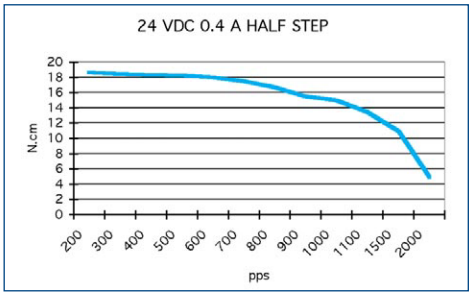
39S..-.A single shaft • **39S..-.B** double shaft

Speed vs. Torque Characteristics

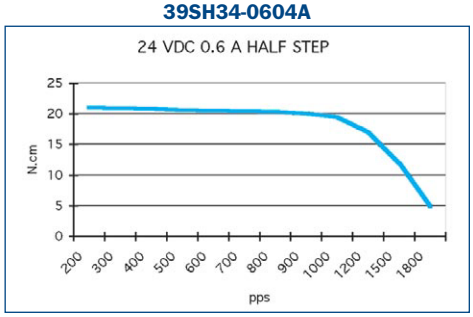
39SH34-0654A



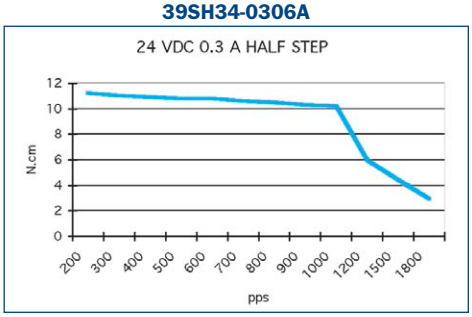
39SH34-0404A



39SH34-0604A



39SH34-0306A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

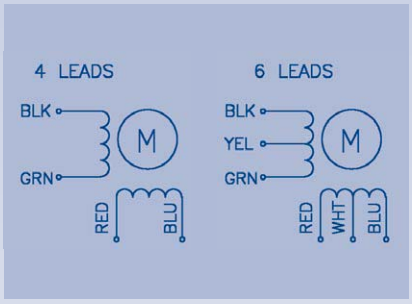
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



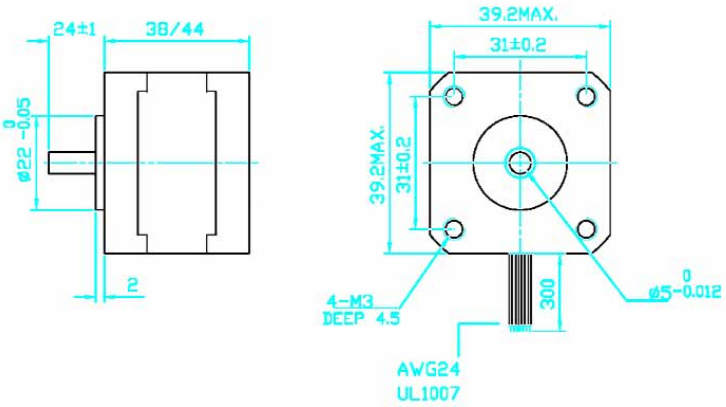
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

39SH38

Hybrid - 200 step

Step Motor



Dimensions in mm.

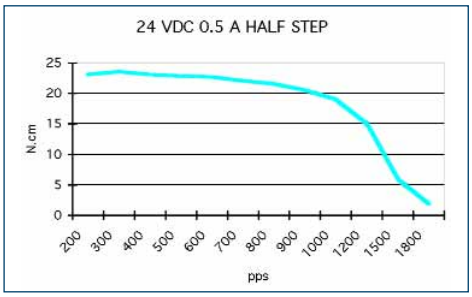
Specifications

	MODEL		39SH38-0504A	39SH38-0806A	39SH38-0304A
1	Step angle		1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%
3	Rated Voltage	V	12	6	12
4	Current/Phase	A	0,5	0,8	0,3
5	Resistance/Phase	Ω	24	7,5	40
6	Inductance/Phase	mH	45	6	100
7	Detent Torque	mNm	18	18	25
8	Holding Torque	Ncm	29	20	28
9	Rotor Inertia	g-cm²	24	24	40
10	Weight	Kg	0,20	0,20	0,25
11	Number of leads	n°.	4	6	4

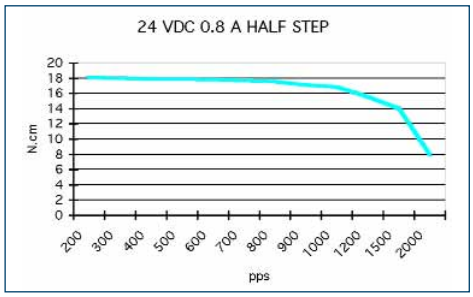
39S..-.A single shaft • **39S..-.B** double shaft

Speed vs. Torque Characteristics

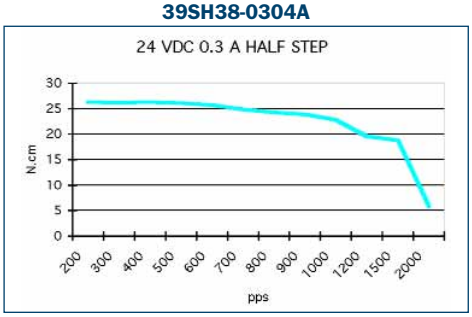
39SH38-0504A



39SH38-0806A



39SH38-0304A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

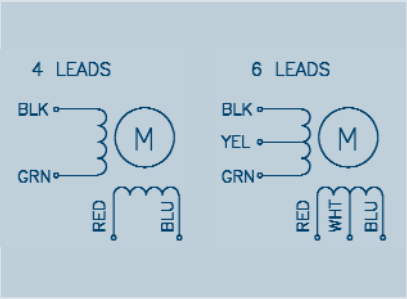
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

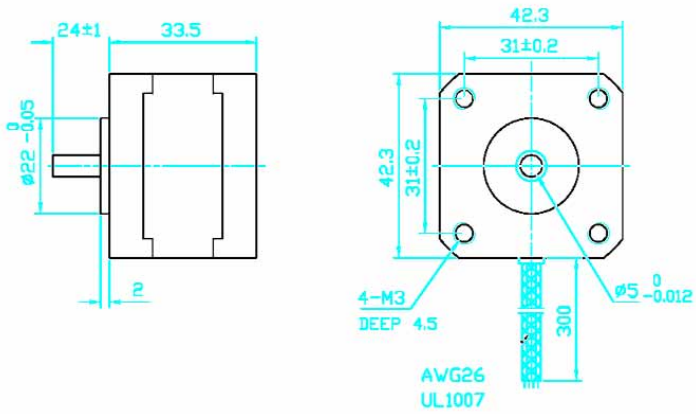
SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

42SH33



Dimensions in mm.

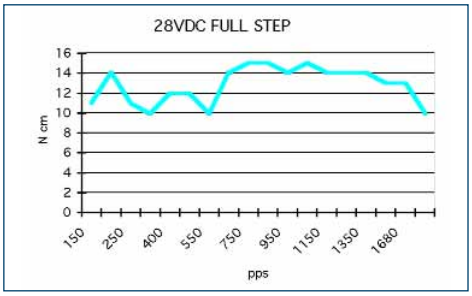
Specifications

	MODEL		42SH33-1AM	42SH33-2AM	42SH33-3AM	42SH33-4AM
1	STEP ANGLE		0,9°	0,9°	0,9°	0,9°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%	± 5%	± 5%	± 5%
3	RATED VOLTAGE	V	4	6	12	2,8
4	CURRENT/PHASE	A	0,95	0,6	0,31	1,33
5	RESISTANCE/PHASE	Ω	4,2	10	38,5	2,1
6	INDUCTANCE/PHASE	mH	2,5	6,1	21	4,2
7	DETENT TORQUE	mNm	20	20	20	20
8	HOLDING TORQUE	Ncm	15,8	15,8	15,8	22
9	ROTOR INERTIA	g-cm²	35	35	35	35
10	WEIGHT Kg		0,22	0,22	0,22	0,22
11	NUMBER OF LEADS	N°.	6	6	6	4

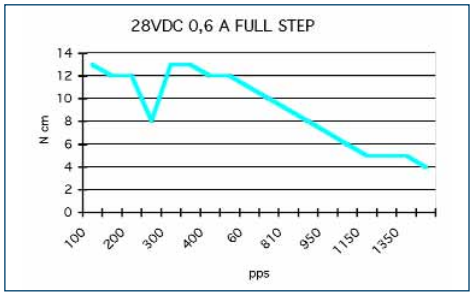
42SH..-.A single shaft • **42SH..-.B** double shaft

Speed vs. Torque Characteristics

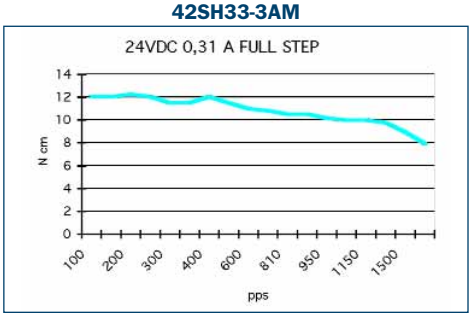
42SH33-1AM



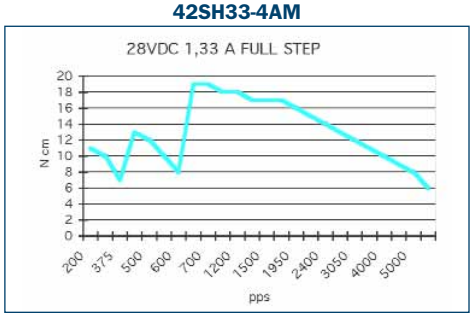
42SH33-2AM



42SH33-3AM



42SH33-4AM



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

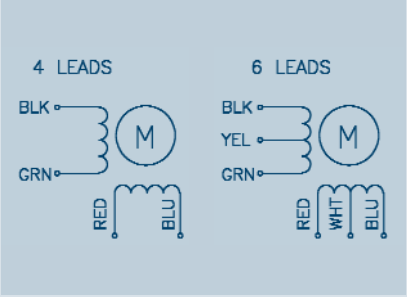
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



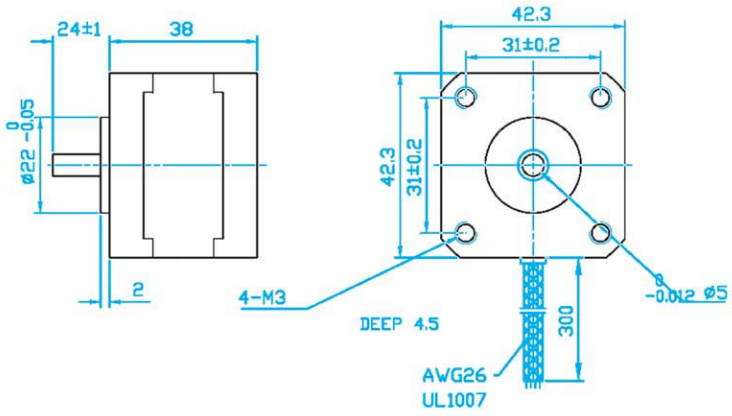
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

42SH38

High Torque Hybrid - 400 step

Step Motor



Dimensions in mm.

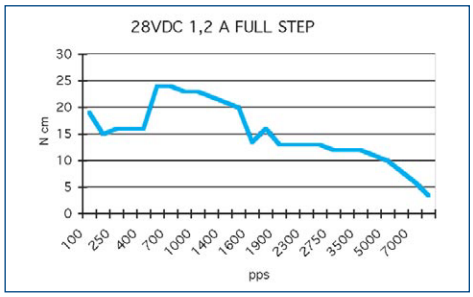
Specifications

	MODEL		42SH38-1AM	42SH38-2AM	42SH38-3AM	42SH38-4AM
1	Step angle		0,9°	0,9°	0,9°	0,9°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	±5%	±5%
3	Rated Voltage	V	4	6	12	2,8
4	Current/Phase	A	1,2	0,8	0,4	1,68
5	Resistance/Phase	Ω	3,3	7,5	30	1,65
6	Inductance/Phase	mH	3,2	6,7	30	3,2
7	Detent Torque	mNm	22	22	22	22
8	Holding Torque	Ncm	25,9	25,9	25,9	36
9	Rotor Inertia	g-cm²	54	54	54	54
10	Weight	Kg	0,28	0,28	0,28	0,28
11	Number of leads	n°.	6	6	6	4

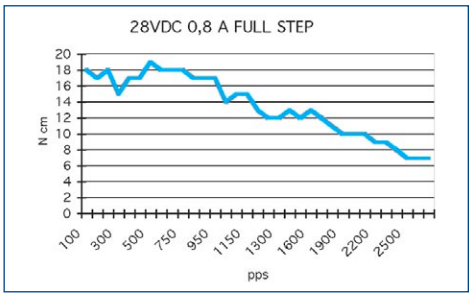
42SH..-.A single shaft • **42SH..-.B** double shaft

Speed vs. Torque Characteristics

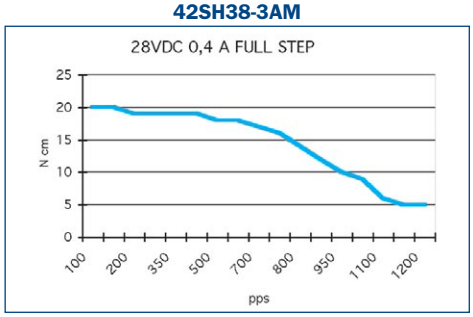
42SH38-1AM



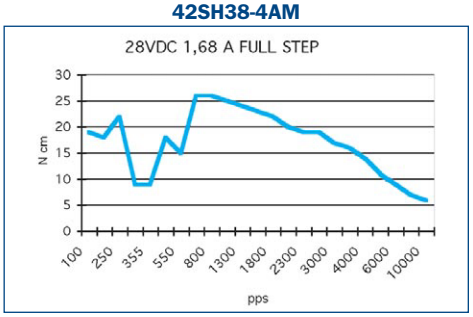
42SH38-2AM



42SH38-3AM



42SH38-4AM



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

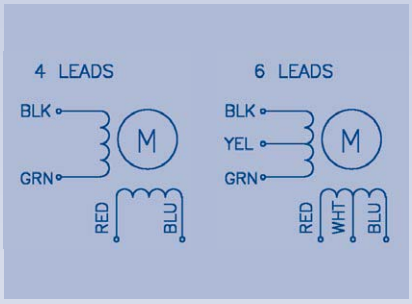
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

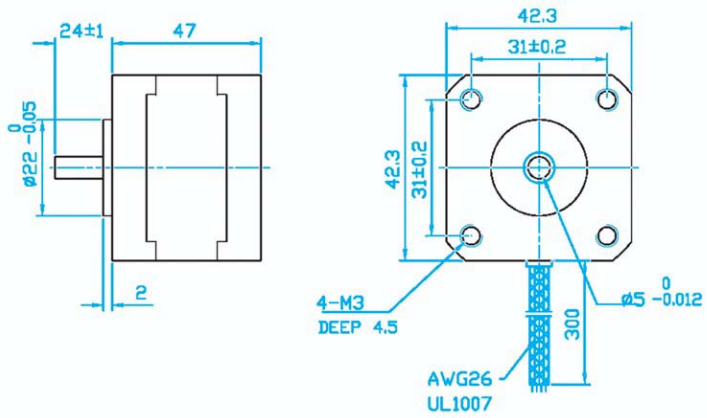
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

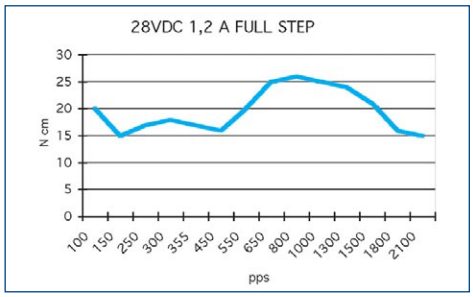
Specifications

	MODEL		42SH47-1AM	42SH47-2AM	42SH47-3AM	42SH47-4AM
1	STEP ANGLE		0,9°	0,9°	0,9°	0,9°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%	± 5%	± 5%	±5%
3	RATED VOLTAGE	V	4	6	12	2,8
4	CURRENT/PHASE	A	1,2	0,8	0,4	1,68
5	RESISTANCE/PHASE	Ω	3,3	7,5	30	1,65
6	INDUCTANCE/PHASE	mH	2,8	6,3	25	2,8
7	DETENT TORQUE	mNm	25	25	25	25
8	HOLDING TORQUE	Ncm	31,7	31,7	31,7	44
9	ROTOR INERTIA	g-cm²	68	68	68	68
10	WEIGHT	Kg	0,35	0,35	0,35	0,35
11	NUMBER OF LEADS	n°.	6	6	6	4

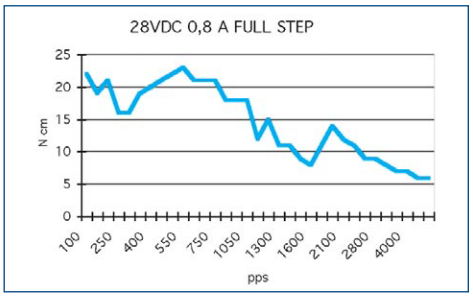
42SH..-.A single shaft • **42SH..-.B** double shaft

Speed vs. Torque Characteristics

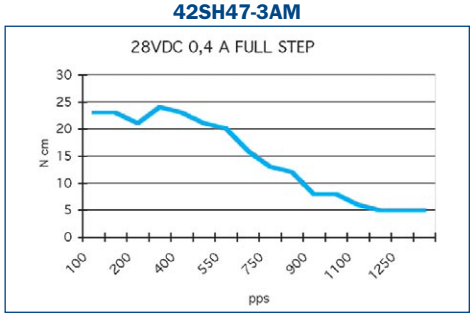
42SH47-1AM



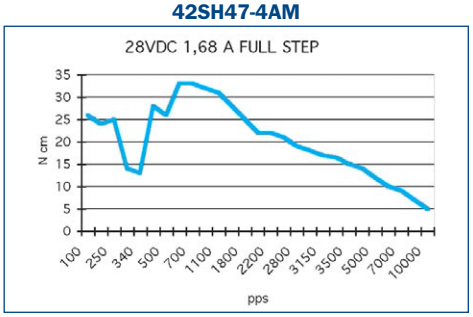
42SH47-2AM



42SH47-3AM



42SH47-4AM



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

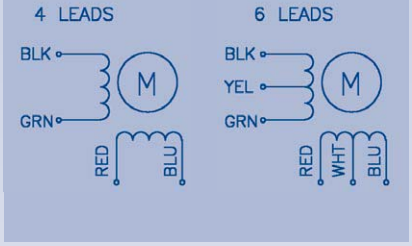
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



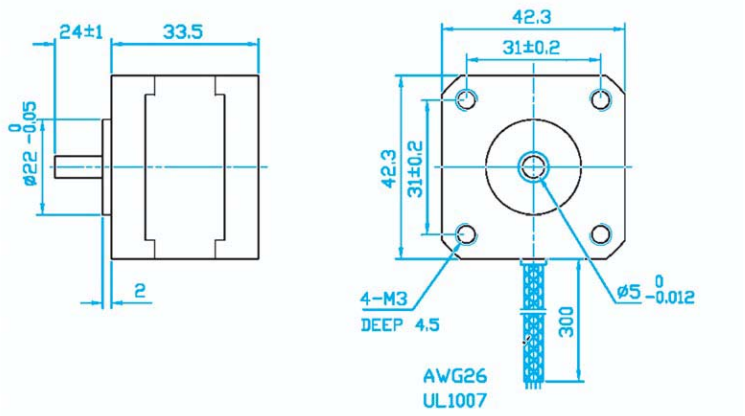
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

42SH33

High Torque Hybrid - 200 step

Step Motor



Dimensions in mm.

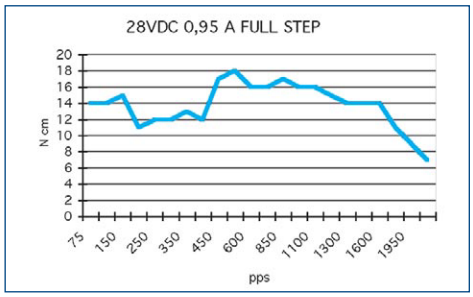
Specifications

	MODEL		42SH33-1A	42SH33-2A	42SH33-3A	42SH33-4A
1	Step angle		1,8°	1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%	± 5%
3	Rated Voltage	V	4	9,6	12	2,8
4	Current/Phase	A	0,95	0,4	0,31	1,33
5	Resistance/Phase	Ω	4,2	24	38,5	2,1
6	Inductance/Phase	mH	2,5	15	21	2,5
7	Detent Torque	mNm	20	20	20	20
8	Holding Torque	Ncm	15,8	15,8	15,8	22
9	Rotor Inertia	g-cm²	35	35	35	35
10	Weight	Kg	0,22	0,22	0,22	0,22
11	Number of leads	n°.	6	6	6	4

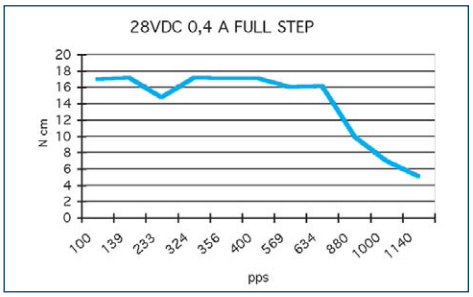
42SH..-.A single shaft • **42SH..-.B** double shaft

Speed vs. Torque Characteristics

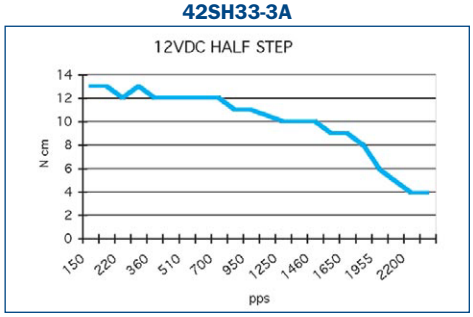
42SH33-1A



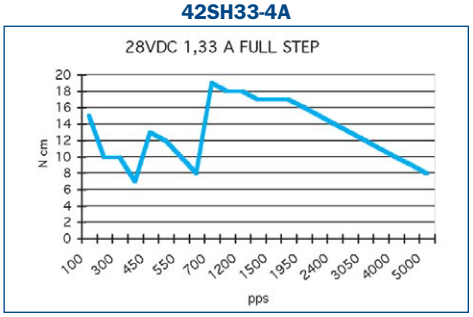
42SH33-2A



42SH33-3A



42SH33-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

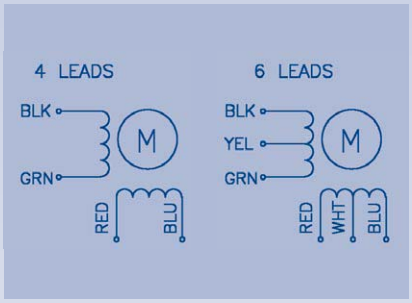
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

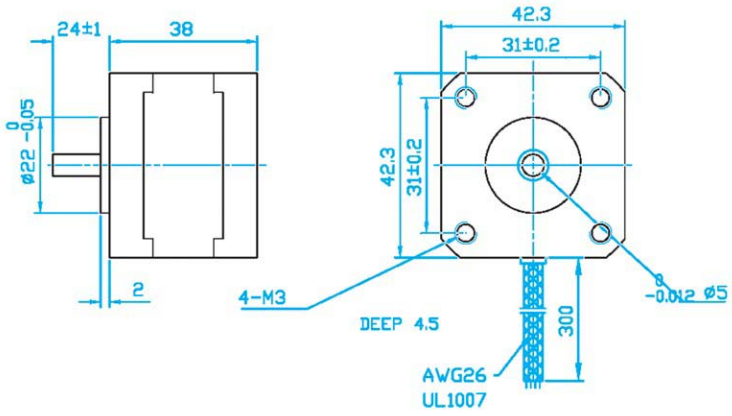
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

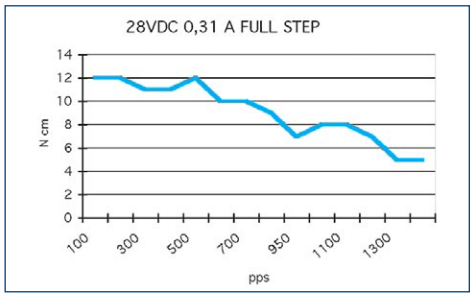
Specifications

	MODEL		42SH38-1A	42SH38-2A	42SH38-3A	42SH38-4A
1	STEP ANGLE		1,8°	1,8°	1,8°	1,8°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%	± 5%	± 5%	± 5%
3	RATED VOLTAGE	V	4	6	12	2,8
4	CURRENT/PHASE	A	1,2	0,8	0,4	1,68
5	RESISTANCE/PHASE	Ω	3,3	7,5	30	1,65
6	INDUCTANCE/PHASE	mH	3,2	6,7	30	3,2
7	DETENT TORQUE	mNm	22	22	22	22
8	HOLDING TORQUE	Ncm	25,9	25,9	25,9	36
9	ROTOR INERTIA	g-cm²	54	54	54	54
10	WEIGHT	Kg	0,28	0,28	0,28	0,28
11	NUMBER OF LEADS	n°.	6	6	6	4

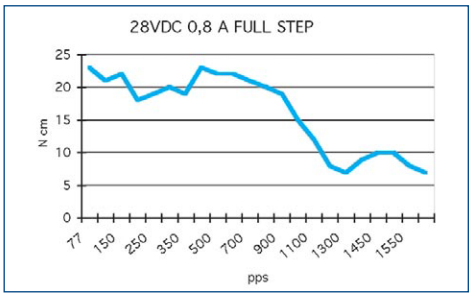
42SH..-.A single shaft • **42SH..-.B** double shaft

Speed vs. Torque Characteristics

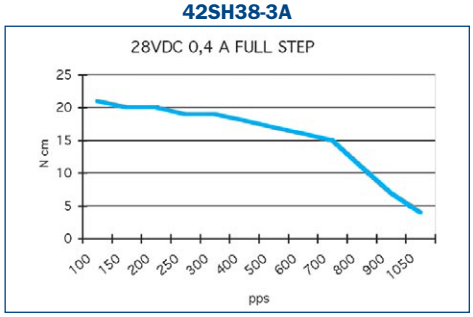
42SH38-1A



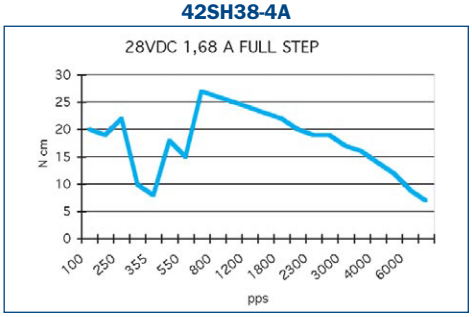
42SH38-2A



42SH38-3A



42SH38-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

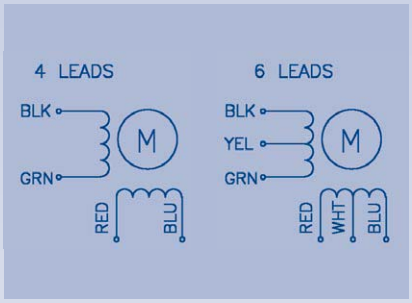
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



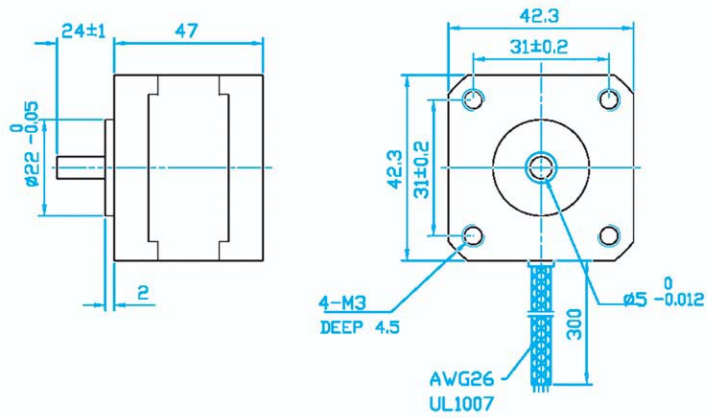
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

42SH47

High Torque Hybrid - 200 step

Step Motor



Dimensions in mm.

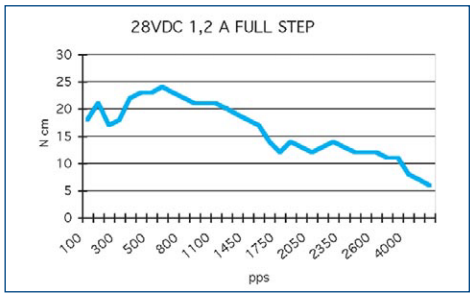
Specifications

	MODEL		42SH47-1A	42SH47-2A	42SH47-3A	42SH47-4A
1	Step angle		1,8°	1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%	±5%
3	Rated Voltage	V	4	6	12	2,8
4	Current/Phase	A	1,2	0,8	0,4	1,68
5	Resistance/Phase	Ω	3,3	7,5	30	1,65
6	Inductance/Phase	mH	2,8	6,3	25	2,8
7	Detent Torque	mNm	25	25	25	25
8	Holding Torque	Ncm	36	31,7	31,7	44
9	Rotor Inertia	g-cm²	68	68	68	68
10	Weight	Kg	0,35	0,35	0,35	0,35
11	Number of leads	n°.	6	6	6	4

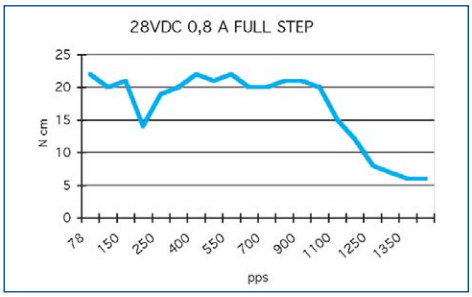
42SH..-.A single shaft • **42SH..-.B** double shaft

Speed vs. Torque Characteristics

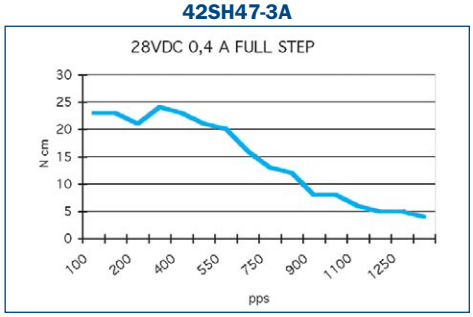
42SH47-1A



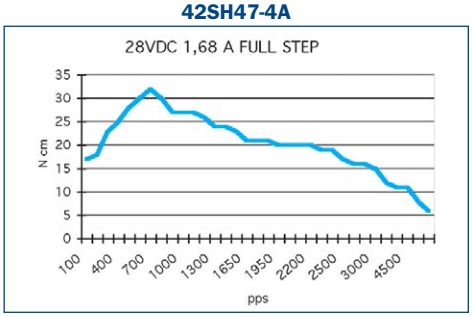
42SH47-2A



42SH47-3A



42SH47-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

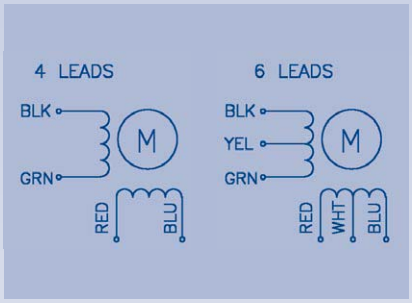
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

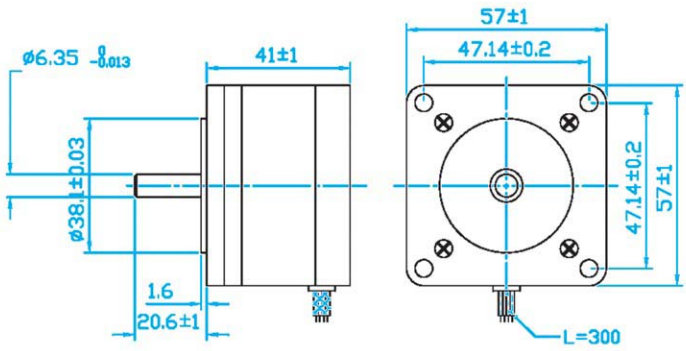
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

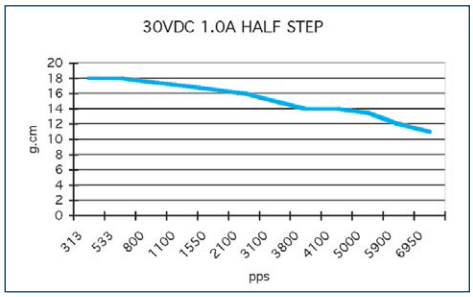
Specifications

	MODEL		57S41-1A	57S41-2A	57S41-4A
1	STEP ANGLE		1,8°	1,8°	1,8°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%	± 5%	± 5%
3	RATED VOLTAGE	V	4	12	2,8
4	CURRENT/PHASE	A	1,1	0,4	1,56
5	RESISTANCE/PHASE	Ω	3,6	30	1,8
6	INDUCTANCE/PHASE	mH	3,6	30	3,6
7	DETENT TORQUE	mNm	18	18	18
8	HOLDING TORQUE	Ncm	28,8	28,8	40
9	ROTOR INERTIA	g-cm²	57	57	57
10	WEIGHT	Kg	0,54	0,54	0,54
11	NUMBER OF LEADS	n°.	6	6	4

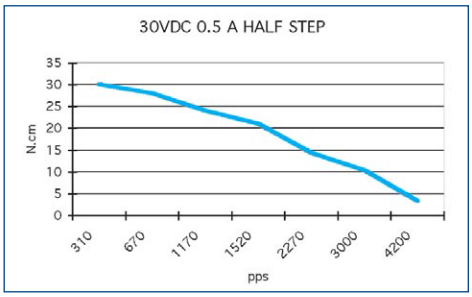
57S..-.A single shaft • **57S..-.B** double shaft

Speed vs. Torque Characteristics

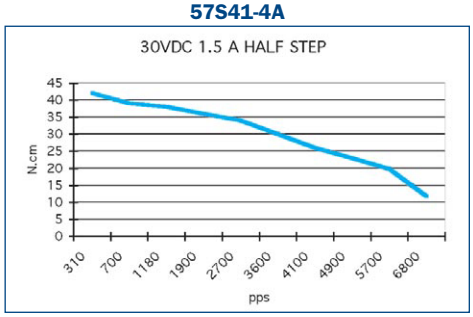
57S41-1A



57S41-2A



57S41-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

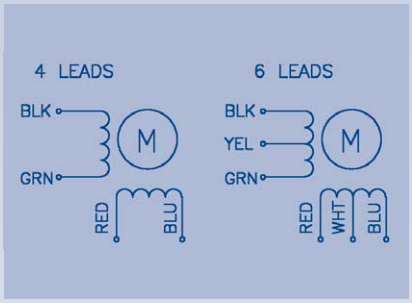
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



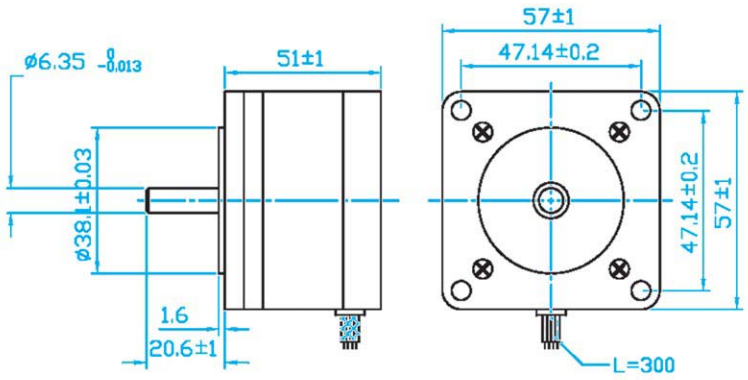
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

57S51

Hybrid - 200 step

Step Motor



Dimensions in mm.

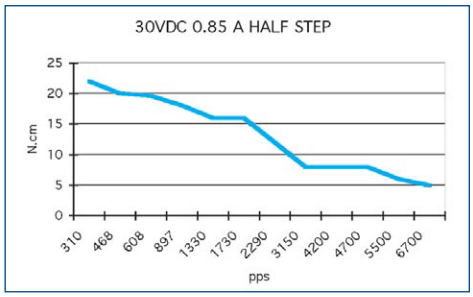
Specifications

	MODEL		57S51-1A	57S51-2A	57S51-4A
1	Step angle		1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	±5%
3	Rated Voltage	V	6	12	1,8
4	Current/Phase	A	0,85	0,42	2,8
5	Resistance/Phase	Ω	7,1	29	0,65
6	Inductance/Phase	mH	9	36	1,6
7	Detent Torque	mNm	35	35	35
8	Holding Torque	Ncm	49,7	49,7	69
9	Rotor Inertia	g-cm²	110	110	110
10	Weight	Kg	0,60	0,60	0,60
11	Number of leads	n°.	6	6	4

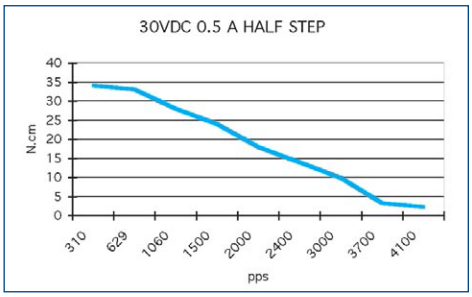
57S..-.A single shaft • **57S..-.B** double shaft

Speed vs. Torque Characteristics

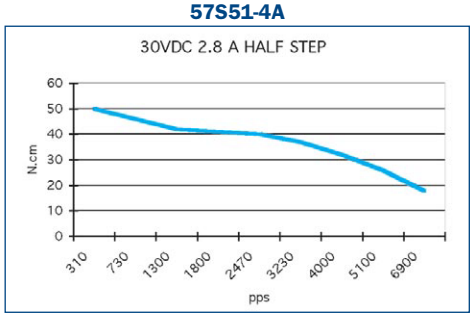
57S51-1A



57S51-2A



57S51-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

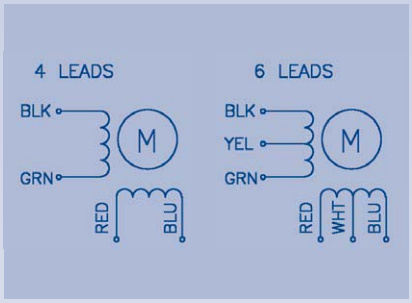
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

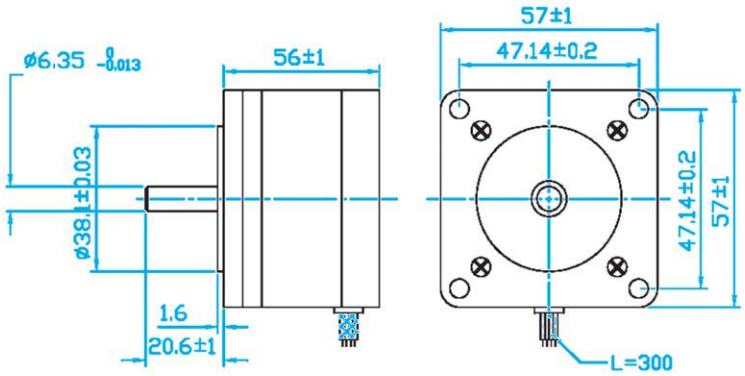
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

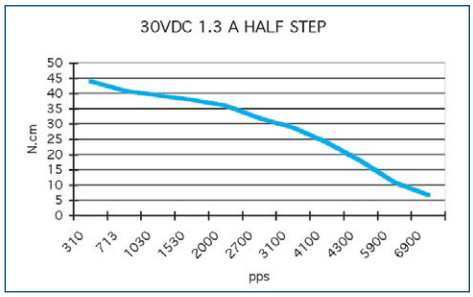
Specifications

	MODEL		57S56-1A	57S56-2A	57S56-4A
1	STEP ANGLE		1,8°	1,8°	1,8°
2	STEP ANGLE ACCURACY				
	(FULL STEP, NO LOAD)	%	± 5%	± 5%	± 5%
3	RATED VOLTAGE	V	6	12	2,8
4	CURRENT/PHASE	A	1,2	0,6	2,55
5	RESISTANCE/PHASE	Ω	5	20	1,1
6	INDUCTANCE/PHASE	mH	8	32	3,6
7	DETENT TORQUE	mNm	42	42	42
8	HOLDING TORQUE	Ncm	60,5	60,5	84
9	ROTOR INERTIA	g-cm²	135	135	135
10	WEIGHT	Kg	0,65	0,65	0,65
11	NUMBER OF LEADS	n°.	6	6	4

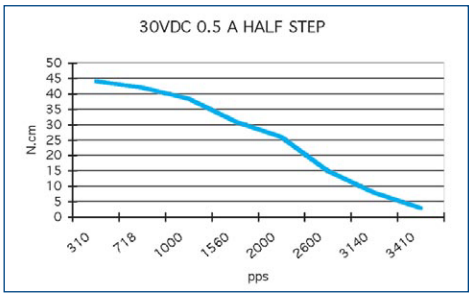
57S..-.A single shaft • **57S..-.B** double shaft

Speed vs. Torque Characteristics

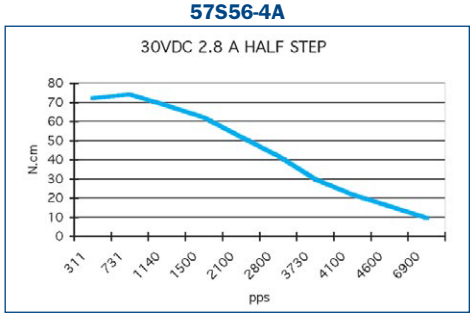
57S56-1A



57S56-2A



57S56-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

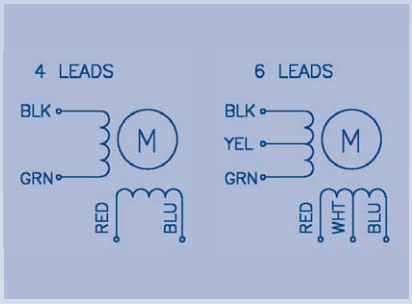
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

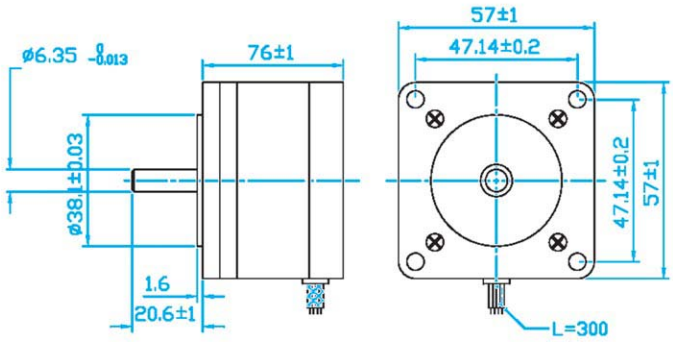
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

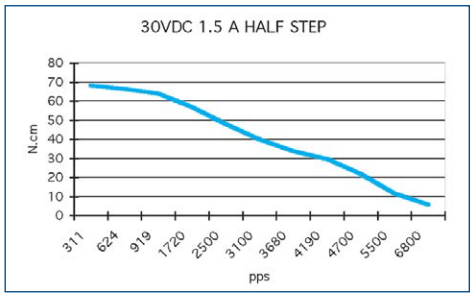
Specifications

	MODEL		57S76-1A	57S76-2A	57S76-4A
1	STEP ANGLE		1,8°	1,8°	1,8°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%	± 5%	± 5%
3	RATED VOLTAGE	V	5,4	12	2,7
4	CURRENT/PHASE	A	1,5	0,68	3,3
5	RESISTANCE/PHASE	Ω	3,6	17,7	0,85
6	INDUCTANCE/PHASE	mH	6	30	3
7	DETENT TORQUE	mNm	72	72	72
8	HOLDING TORQUE	Ncm	90	90	125
9	ROTOR INERTIA	g-cm²	200	200	200
10	WEIGHT	Kg	0,95	0,95	0,95
11	NUMBER OF LEADS	n°.	6	6	4

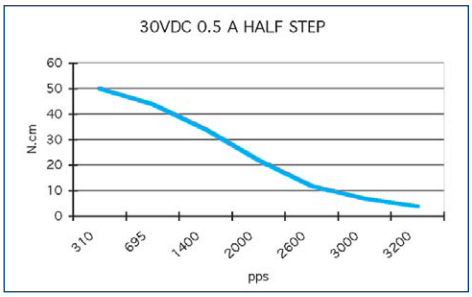
57S..-.A single shaft • **57S..-.B** double shaft

Speed vs. Torque Characteristics

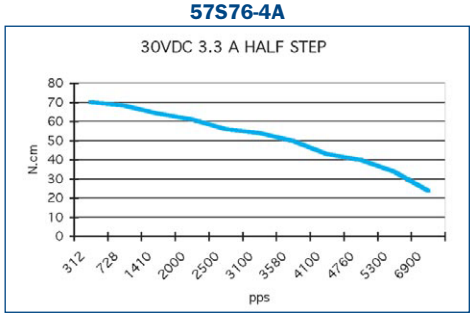
57S76-1A



57S76-2A



57S76-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

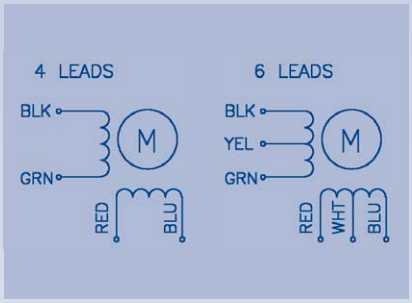
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

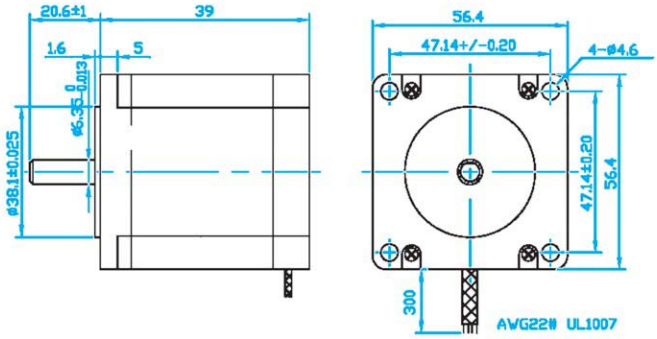
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

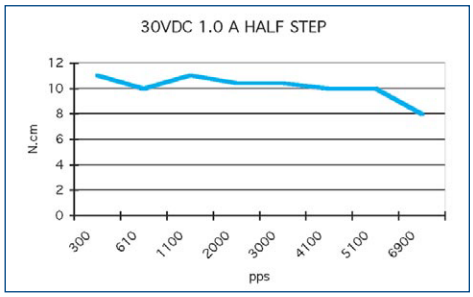
Specifications

	MODEL		57SH39-1AM	57SH39-2AM	57SH39-3AM	57SH39-4AM
1	Step angle		0,9°	0,9°	0,9°	0,9°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%	± 5%
3	Rated Voltage	V	5,7	2,8	1,9	2
4	Current/Phase	A	1	2	3	2,8
5	Resistance/Phase	Ω	5,7	1,4	0,63	0,7
6	Inductance/Phase	mH	5,4	1,4	0,6	1,4
7	Detent Torque	mNm	21	21	21	21
8	Holding Torque	Ncm	39	39	39	55
9	Rotor Inertia	g-cm²	120	120	120	120
10	Weight	Kg	0,45	0,45	0,45	0,45
11	Number of leads	n°.	6	6	6	4

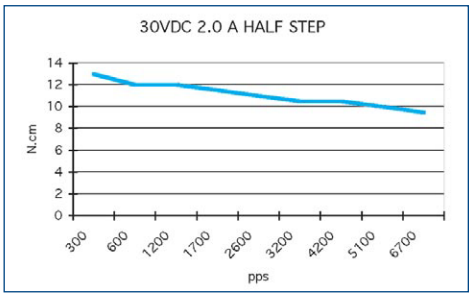
57SH..-.A single shaft • **57SH..-.B** double shaft

Speed vs. Torque Characteristics

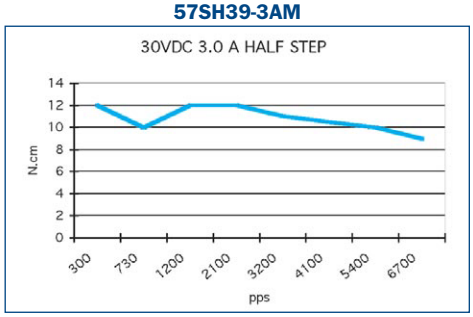
57SH39-1AM



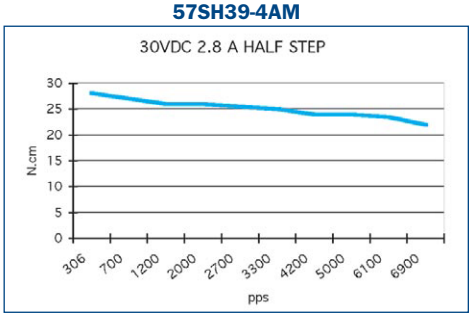
57SH39-2AM



57SH39-3AM



57SH39-4AM



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

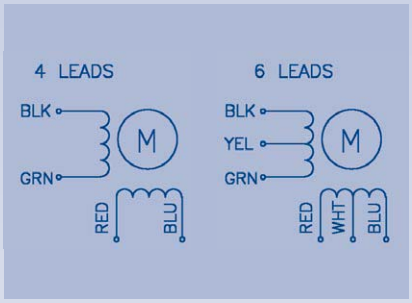
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



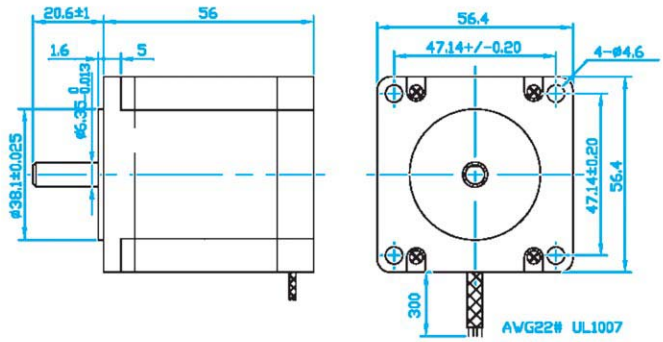
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

57SH56

High Torque Hybrid - 400 step

Step Motor



Dimensions in mm.

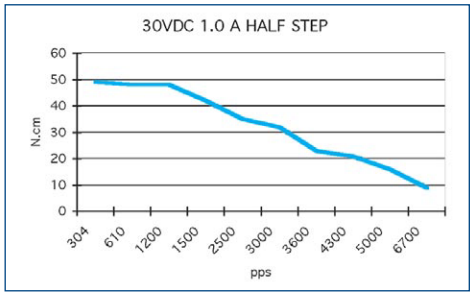
Specifications

	MODEL		57SH56-1AM	57SH56-2AM	57SH56-3AM	57SH56-4AM
1	Step angle		0,9°	0,9°	0,9°	0,9°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%	±5%
3	Rated Voltage	V	7,4	3,6	2,3	2,5
4	Current/Phase	A	1	2	3	2,8
5	Resistance/Phase	Ω	7,4	1,8	0,75	0,9
6	Inductance/Phase	mH	10	2,5	1,1	2,5
7	Detent Torque	mNm	40	40	40	40
8	Holding Torque	Ncm	90	90	90	126
9	Rotor Inertia	g-cm²	300	300	300	300
10	Weight	Kg	0,7	0,7	0,7	0,7
11	Number of leads	n°.	6	6	6	4

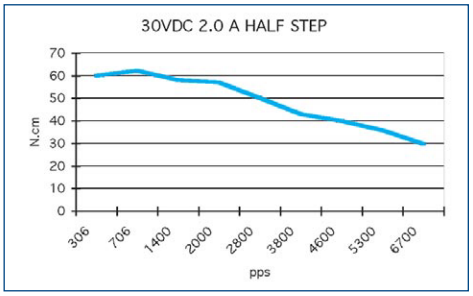
57SH..-.A single shaft • **57SH..-.B** double shaft

Speed vs. Torque Characteristics

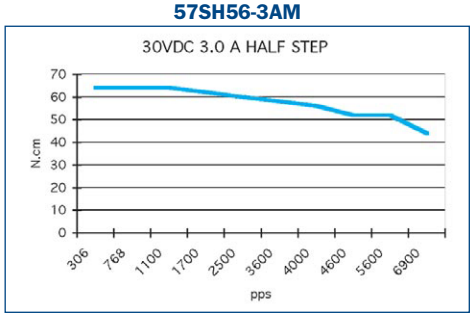
57SH56-1AM



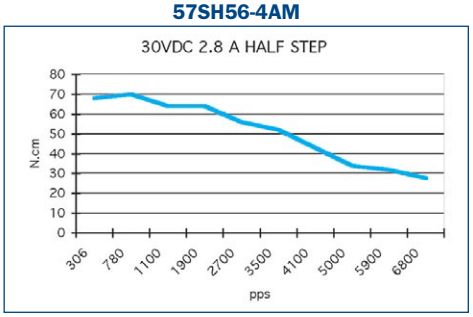
57SH56-2AM



57SH56-3AM



57SH56-4AM



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

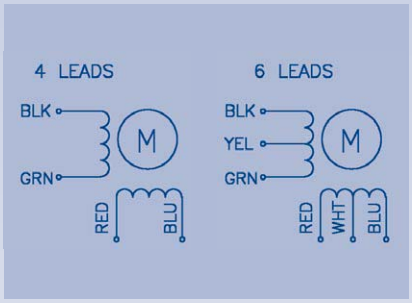
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

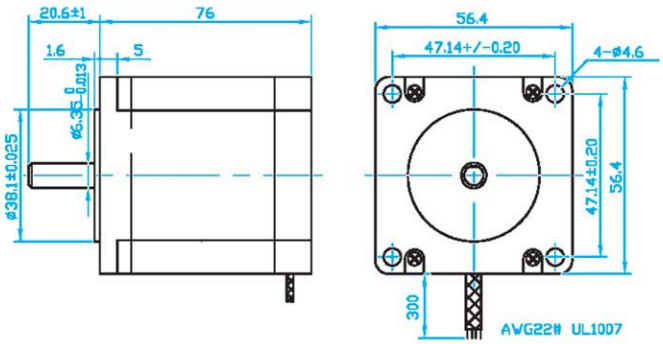
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

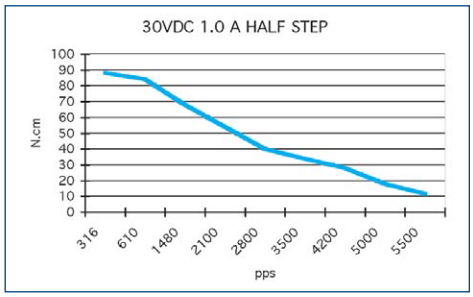
Specifications

	MODEL		57SH76-1AM	57SH76-2AM	57SH76-3AM	57SH76-4AM
1	STEP ANGLE		0,9°	0,9°	0,9°	0,9°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%	± 5%	± 5%	± 5%
3	RATED VOLTAGE	V	8,6	4,5	3	3,2
4	CURRENT/PHASE	A	1	2	3	2,8
5	RESISTANCE/PHASE	Ω	8,6	2,25	1	1,13
6	INDUCTANCE/PHASE	mH	14	3,6	1,6	3,6
7	DETENT TORQUE	mNm	68	68	68	68
8	HOLDING TORQUE	Ncm	135	135	135	189
9	ROTOR INERTIA	g-cm²	480	480	480	480
10	WEIGHT	Kg	1	1	1	1
11	NUMBER OF LEADS	n°.	6	6	6	4

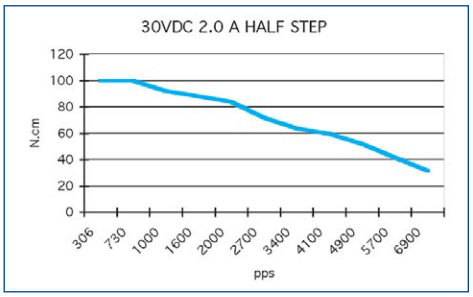
57SH..-.A single shaft • **57SH..-.B** double shaft

Speed vs. Torque Characteristics

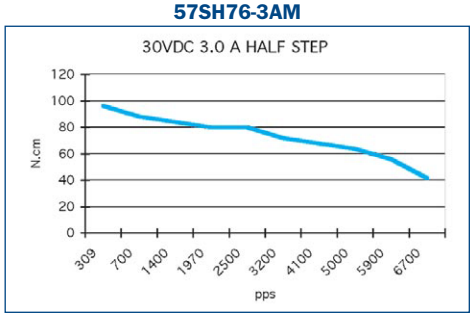
57SH76-1AM



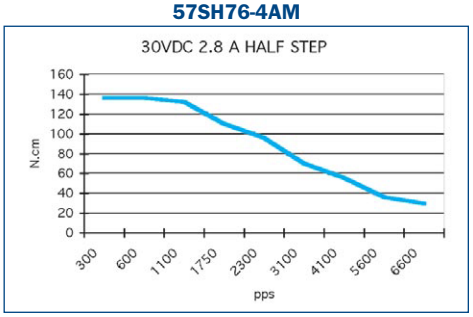
57SH76-2AM



57SH76-3AM



57SH76-4AM



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

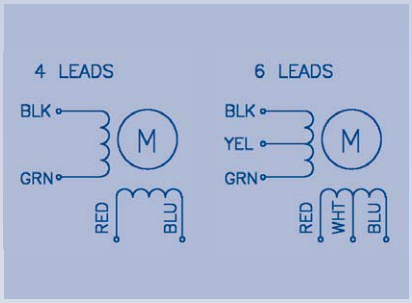
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



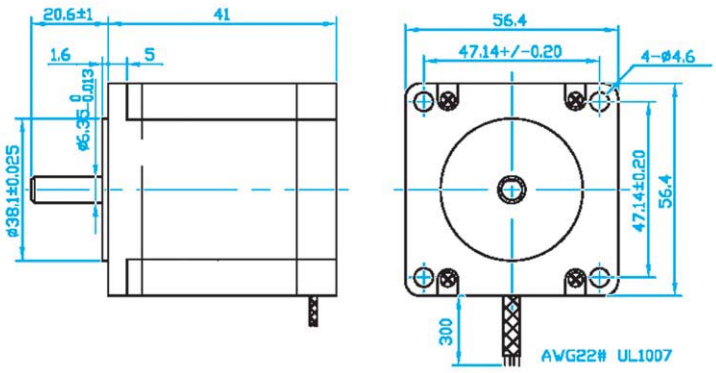
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

57SH41

High Torque Hybrid - 200 step

Step Motor



Dimensions in mm.

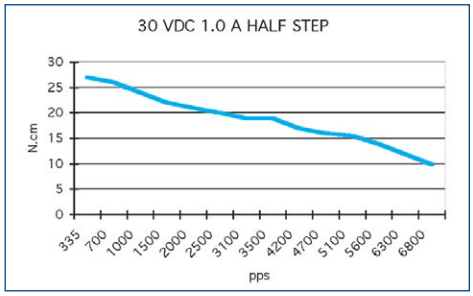
Specifications

	MODEL		57SH41-1A	57SH41-2A	57SH41-3A	57SH41-4A
1	Step angle		1,8°	1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%	± 5%
3	Rated Voltage	V	5,7	2,8	1,9	2
4	Current/Phase	A	1	2	3	2,8
5	Resistance/Phase	Ω	5,7	1,4	0,63	0,7
6	Inductance/Phase	mH	5,4	1,4	0,6	1,4
7	Detent Torque	mNm	18	18	18	18
8	Holding Torque	Ncm	39	39	39	55
9	Rotor Inertia	g-cm²	120	120	120	120
10	Weight	Kg	0,45	0,45	0,45	0,45
11	Number of leads	n°.	6	6	6	4

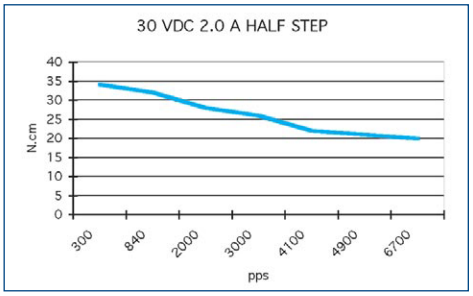
57SH..-.A single shaft • **57SH..-.B** double shaft

Speed vs. Torque Characteristics

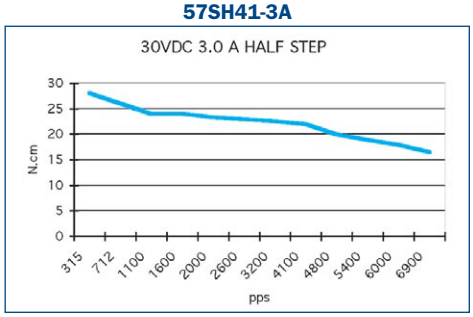
57SH41-1A



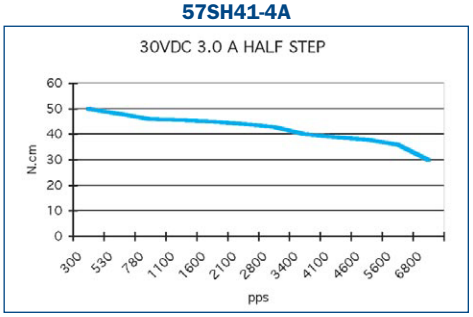
57SH41-2A



57SH41-3A



57SH41-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

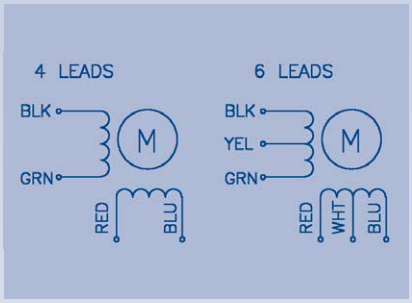
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

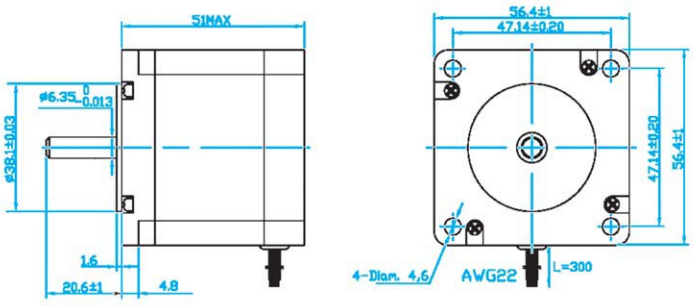
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

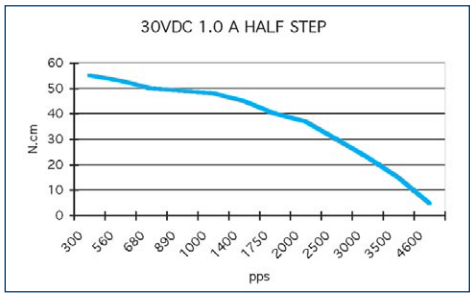
Specifications

	MODEL		57SH51-1A	57SH51-2A	57SH51-3A	57SH51-4A
1	Step angle		1,8°	1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%	±5%
3	Rated Voltage	V	6,6	3,3	2,2	2,3
4	Current/Phase	A	1	2	3	2,8
5	Resistance/Phase	Ω	6,6	1,65	0,74	0,83
6	Inductance/Phase	mH	8,2	2,2	0,9	2,2
7	Detent Torque	mNm	35	35	35	35
8	Holding Torque	Ncm	72	72	72	101
9	Rotor Inertia	g-cm²	275	275	275	275
10	Weight	Kg	0,65	0,65	0,65	0,65
11	Number of leads	n°.	6	6	6	4

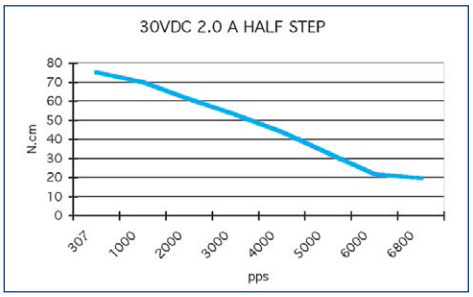
57SH..-.A single shaft • **57SH..-.B** double shaft

Speed vs. Torque Characteristics

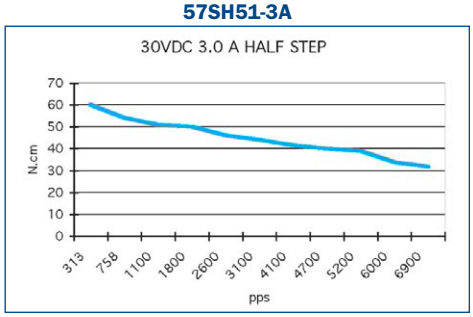
57SH51-1A



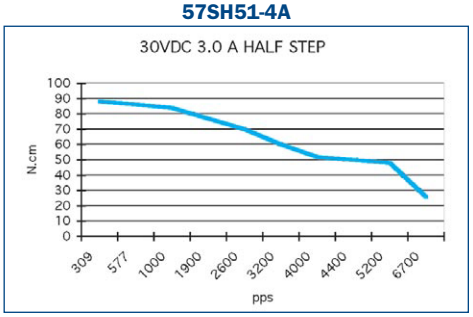
57SH51-2A



57SH51-3A



57SH51-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

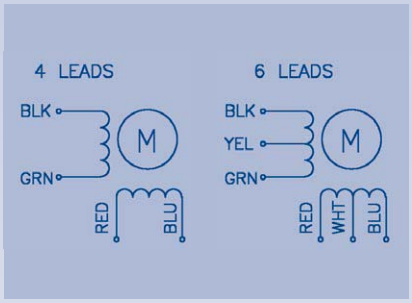
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



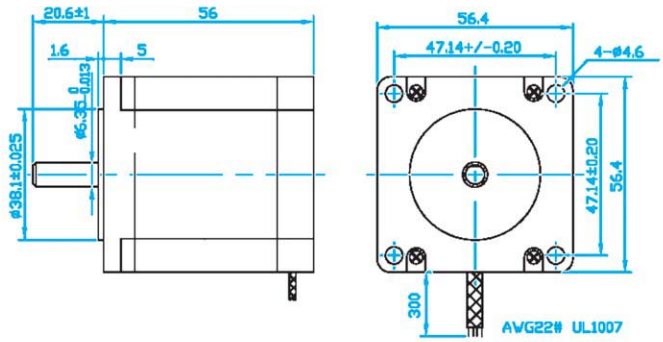
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

57SH56

High Torque Hybrid - 200 step

Step Motor



CE approved

Dimensions in mm.

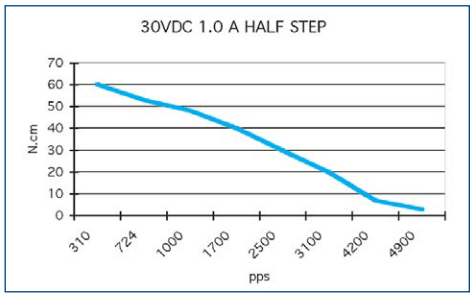
Specifications

	MODEL		57SH56-1A	57SH56-2A	57SH56-3A	57SH56-4A
1	Step angle		1,8°	1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%	± 5%
3	Rated Voltage	V	7,4	3,6	2,3	2,5
4	Current/Phase	A	1	2	3	2,8
5	Resistance/Phase	Ω	7,4	1,8	0,75	0,9
6	Inductance/Phase	mH	10	2,5	1,1	2,5
7	Detent Torque	mNm	42	42	42	42
8	Holding Torque	Ncm	90	90	90	126
9	Rotor Inertia	g-cm²	300	300	300	300
10	Weight	Kg	0,7	0,7	0,7	0,7
11	Number of leads	n°.	6	6	6	4

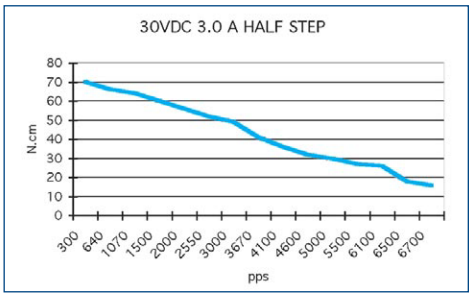
57SH..-.A single shaft • **57SH..-.B** double shaft

Speed vs. Torque Characteristics

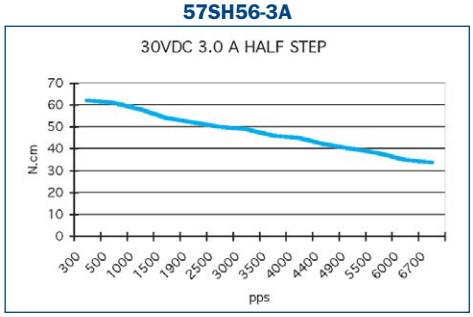
57SH56-1A



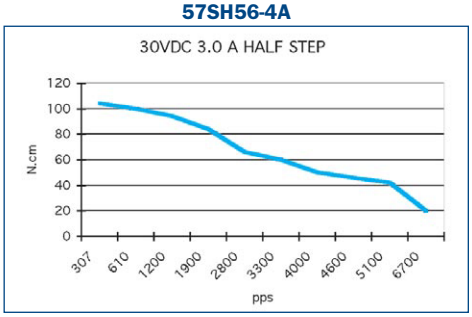
57SH56-2A



57SH56-3A



57SH56-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

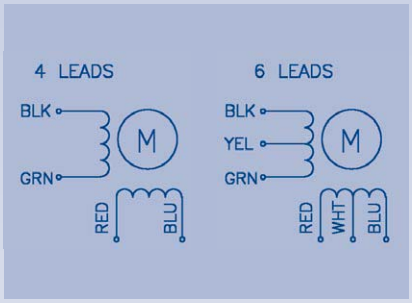
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

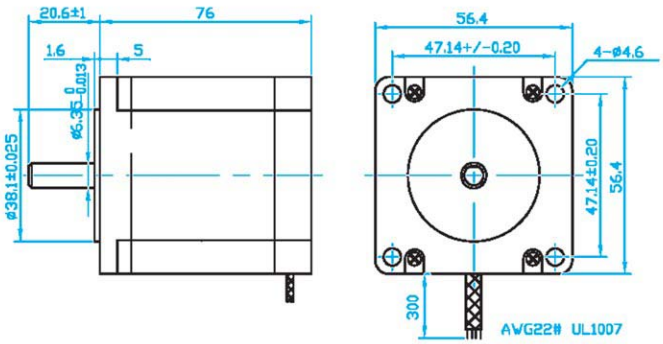
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

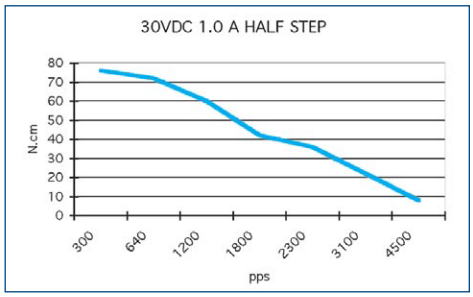
Specifications

	MODEL		57SH76-1A	57SH76-2A	57SH76-3A	57SH76-4A
1	STEP ANGLE		1,8°	1,8°	1,8°	1,8°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%	± 5%	± 5%	± 5%
3	RATED VOLTAGE	V	8,6	4,5	3	3,2
4	CURRENT/PHASE	A	1	2	3	2,8
5	RESISTANCE/PHASE	Ω	8,6	2,25	1	1,13
6	INDUCTANCE/PHASE	mH	14	3,6	1,6	3,6
7	DETENT TORQUE	mNm	72	72	72	72
8	HOLDING TORQUE	Ncm	135	135	135	189
9	ROTOR INERTIA	g-cm²	480	480	480	480
10	WEIGHT	Kg	1	1	1	1
11	NUMBER OF LEADS	n°.	6	6	6	4

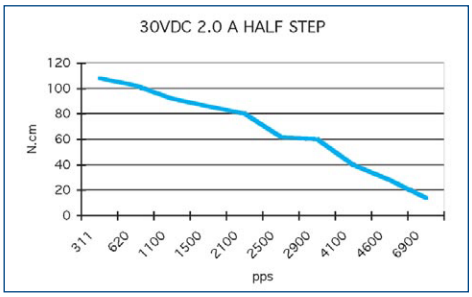
57SH..-.A single shaft • **57SH..-.B** double shaft

Speed vs. Torque Characteristics

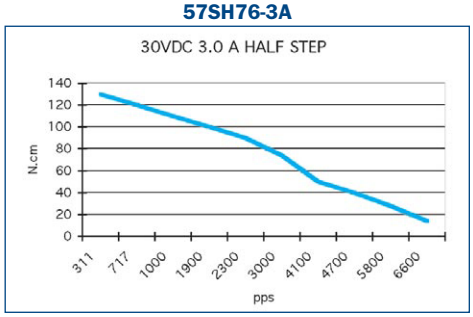
57SH76-1A



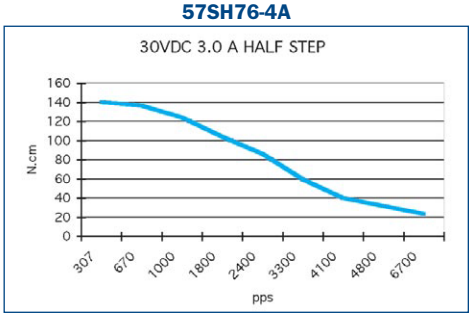
57SH76-2A



57SH76-3A



57SH76-4A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

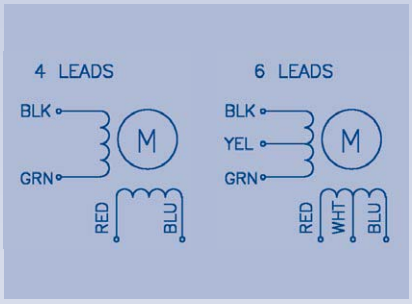
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



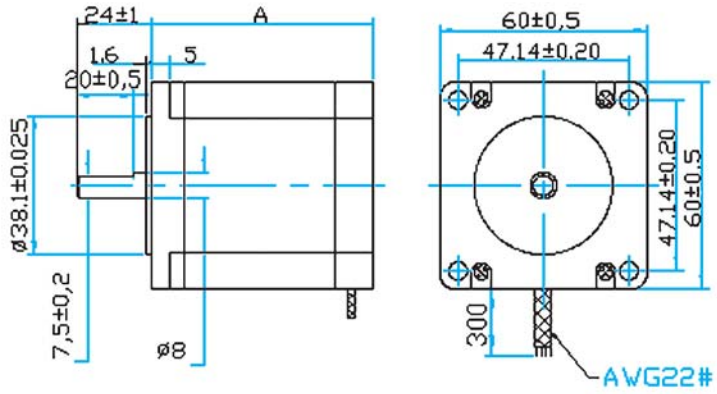
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

60SH

High Torque Hybrid - 200 step

Step Motor



Dimensions in mm.

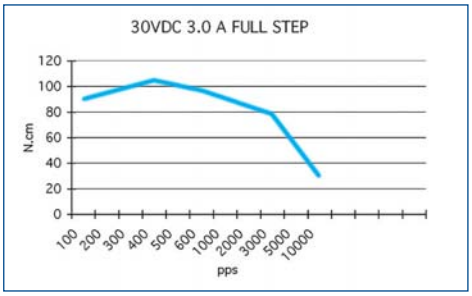
Specifications

	MODEL		60SH45-2008AF	60SH56-2008AF	60SH65-2008AF	60SH86-2008AF
1	Step angle		1,8°	1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%	± 5%
3	Rated Voltage	V	3	3,6	4,8	6
4	Current/Phase	A	2	2	2	2
5	Resistance/Phase	Ω	1,5	1,8	2,4	3
6	Inductance/Phase	mH	2	3,6	4,6	6,8
7	Holding Torque Bipolar	Ncm	110	160	210	310
8	Rotor Inertia	g-cm²	275	400	570	840
9	Weight	Kg	0,6	0,77	1,2	1,4
10	Number of leads	n°.	8	8	8	8

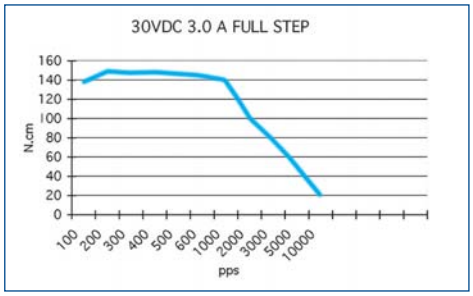
Specification for Bipolar connection

Speed vs. Torque Characteristics

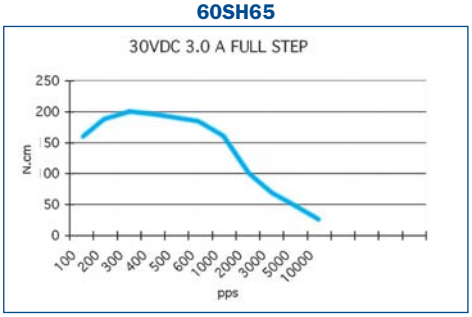
60SH45



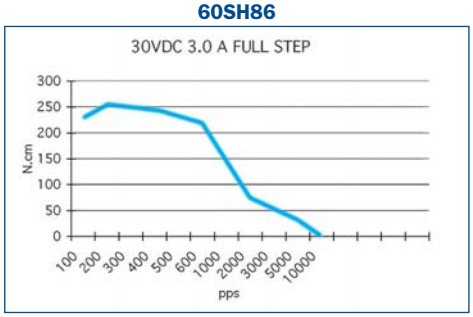
60SH56



60SH65



60SH86



Characteristics

Resistance accuracy
± 10%

Inductance accuracy
± 20%

Temperature rise
80° C max. (rated current, 2 phase on)

Ambient temperature
-20° C - + 50° C

Insulation resistance
100 M Ω min., 500 VDC

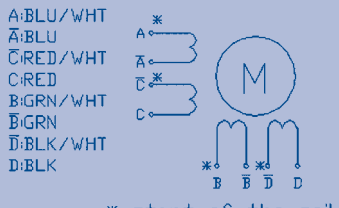
Dielectric strength
500 VAC for one minute

Shaft radial play
0,02 max. (450 g-load)

Shaft axial play
0,08 max. (450 g-load)

Max radial force
75 N (20mm from flange)

Max axial force
15 N



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.

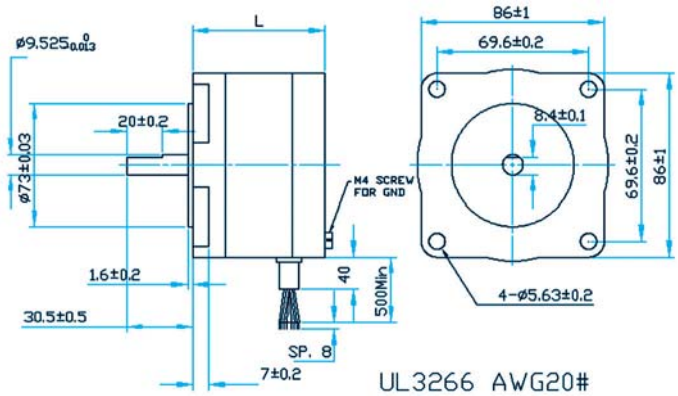
Shaft modifications:
flat, pinion, keyway, length.

Leadwire modifications:
wire type, wire color, wire length, connector installation.

86S

High Torque low inertia Hybrid - 200 step

Step Motor



Dimensions in mm.

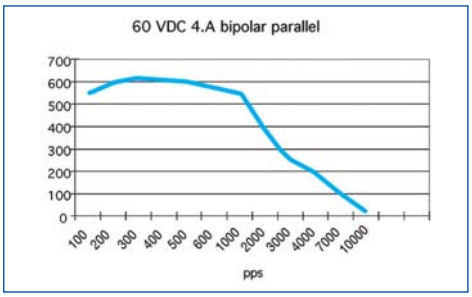
Specifications

	MODEL		86S67-2808A	86S94-2808A	86S125-3508A
1	Step angle		1,8°	1,8°	1,8°
2	Step angle accuracy (full step, no load)	%	± 5%	± 5%	± 5%
3	Rated Voltage	V	3,64	4,76	4,97
4	Current/Phase	A	2,8	2,8	3,5
5	Resistance/Phase	Ω	1,3	1,7	1,42
6	Inductance/Phase	mH	5,1	7,7	7,9
7	Holding Torque	Nm	2,8	4,8	7,6
8	Rotor Inertia	g-cm²	660	1200	1800
9	Weight	Kg	1,6	2,4	3,6
10	Number of leads	n°.	8	8	8

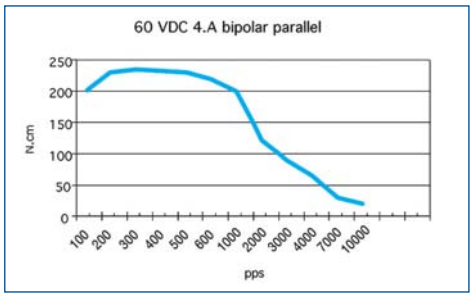
86S..-.A single shaft

Speed vs. Torque Characteristics

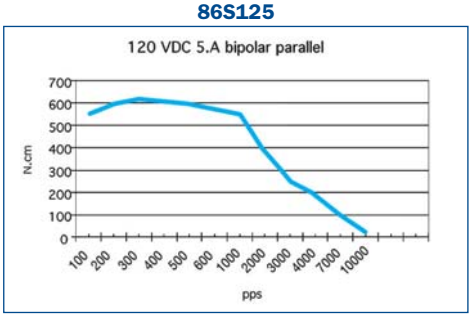
86S67



86S94



86S125



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

AMBIENT TEMPERATURE
-20° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

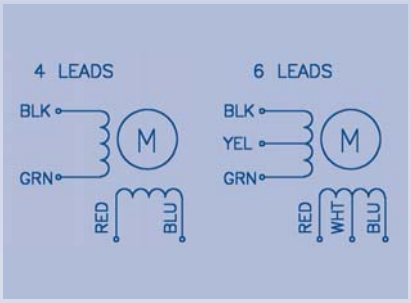
DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,02 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)

MAX RADIAL FORCE
220N

MAX RADIAL FORCE
60N



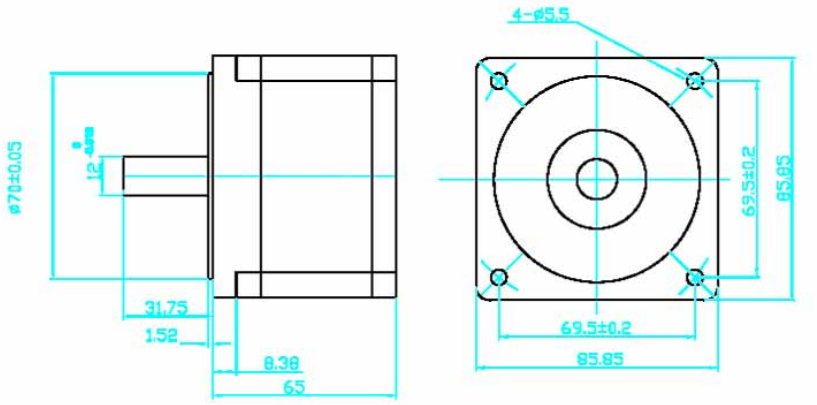
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

86SH65

High Torque Hybrid - 200 step

Step Motor



Dimensions in mm.

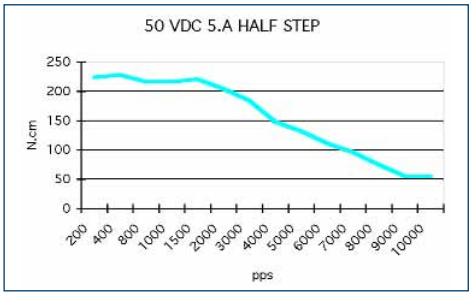
Specifications

	MODEL		86SH65-3008A
1	Step angle		1,8°
2	Step angle accuracy (full step, no load)	%	± 5%
3	Phase		4
4	Rated Voltage	V	4,2
5	Current/Phase	A	3
6	Resistance/Phase	Ω	1,14
7	Inductance/Phase	mH	6,8
8	Detent Torque	mNm	80
9	Holding Torque	Ncm	340
10	Rotor Inertia	g-cm²	1000
11	Weight	Kg	1,7
12	Number of leads	n°.	8

86SH..-.A single shaft • **86SH..-.B** double shaft

Speed vs. Torque Characteristics

86SH65-3008A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

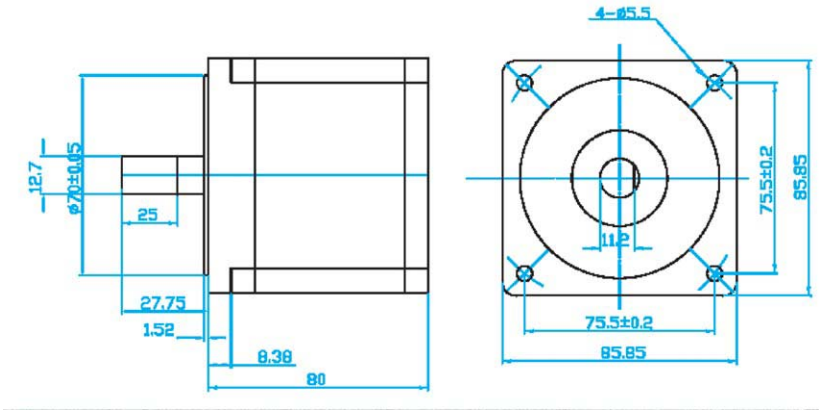
DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)

AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

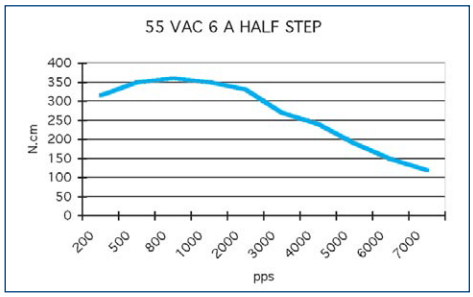
Specifications

	MODEL		86SH80-5504A
1	STEP ANGLE		1,8°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%
3	PHASE		2
4	RATED VOLTAGE	V	2,3
5	CURRENT/PHASE	A	5,5
6	RESISTANCE/PHASE	Ω	0,42
7	INDUCTANCE/PHASE	mH	3,5
8	DETENT TORQUE	mNm	120
9	HOLDING TORQUE	Ncm	460
10	ROTOR INERTIA	g-cm²	1400
11	WEIGHT	Kg	2,3
12	NUMBER OF LEADS	n°.	4

86SH..-.A single shaft • **86SH..-.B** double shaft

Speed vs. Torque Characteristics

86SH80-5504A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

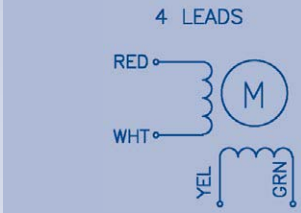
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



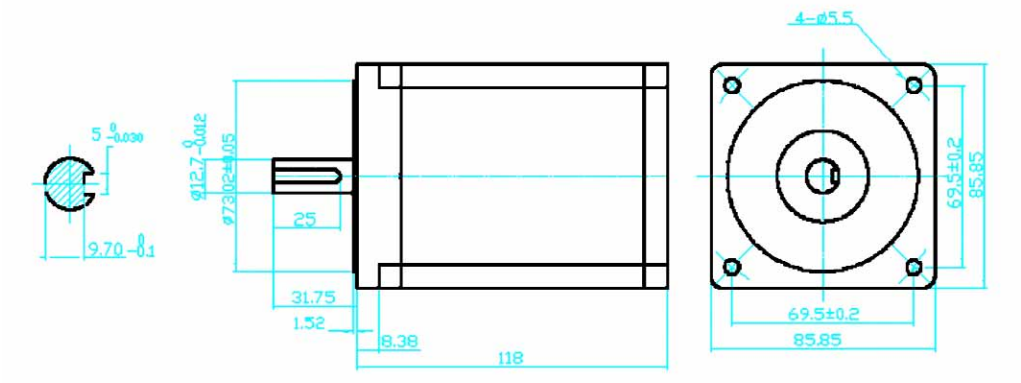
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

86SH118

High Torque Hybrid - 200 step

Step Motor



Dimensions in mm.

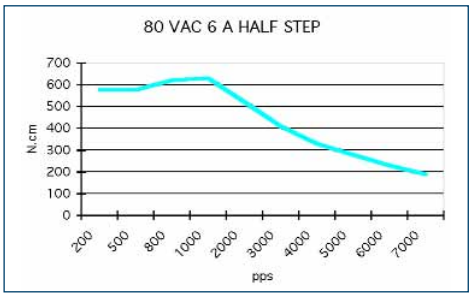
Specifications

	MODEL		86SH118-6004A
1	Step angle		1,8°
2	Step angle accuracy (full step, no load)	%	± 5%
3	Phase		2
4	Rated Voltage	V	2,7
5	Current/Phase	A	6
6	Resistance/Phase	Ω	0,45
7	Inductance/Phase	mH	5,1
8	Detent Torque	mNm	240
9	Holding Torque	Ncm	870
10	Rotor Inertia	g-cm²	2700
11	Weight	Kg	3,8
12	Number of leads	n°.	4

86SH..-.A single shaft • **86SH..-.B** double shaft

Speed vs. Torque Characteristics

86SH118-6004A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

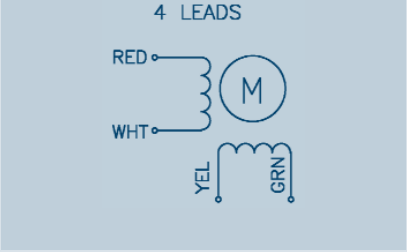
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

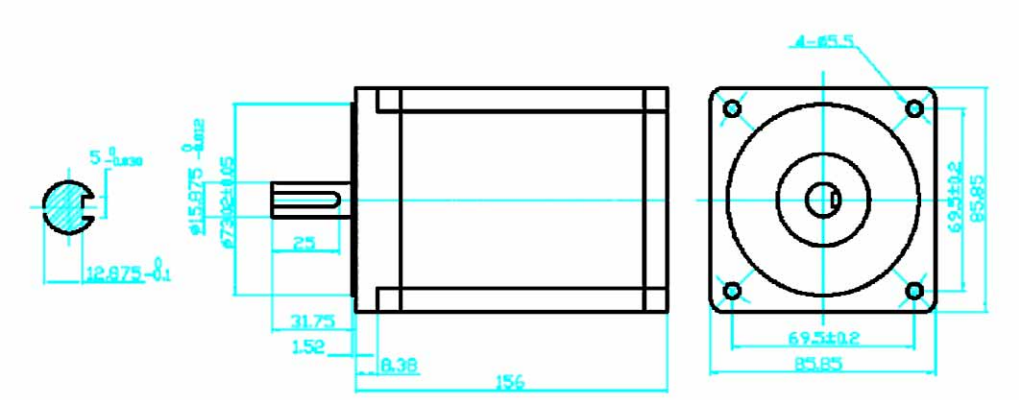
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

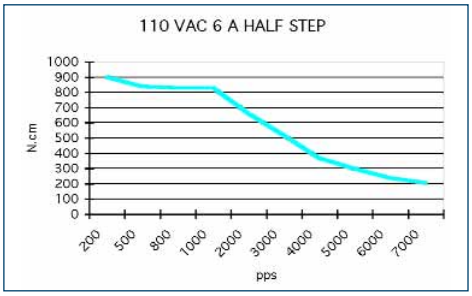
Specifications

	MODEL		86SH156-6204A
1	STEP ANGLE		1,8°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%
3	PHASE		2
4	RATED VOLTAGE	V	3,5
5	CURRENT/PHASE	A	6,2
6	RESISTANCE/PHASE	Ω	0,56
7	INDUCTANCE/PHASE	mH	6,4
8	DETENT TORQUE	mNm	360
9	HOLDING TORQUE	Ncm	1280
10	ROTOR INERTIA	g-cm²	4000
11	WEIGHT	Kg	5,4
12	NUMBER OF LEADS	n°.	4

86SH..-.A single shaft • **86SH..-.B** double shaft

Speed vs. Torque Characteristics

86SH156-6204A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

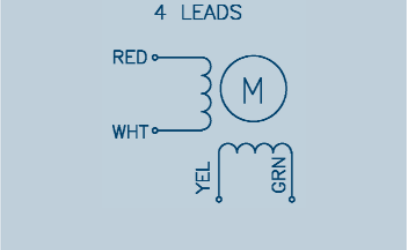
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



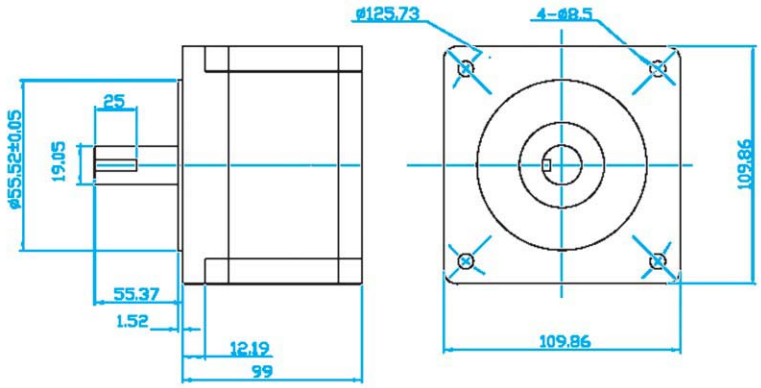
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

110SH99

High Torque Hybrid - 200 step

Step Motor



Dimensions in mm.

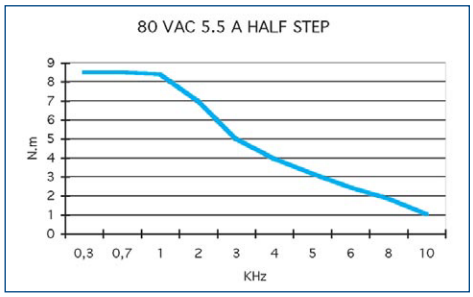
Specifications

	MODEL		110SH99-5504A
1	Step angle		1,8°
2	Step angle accuracy (full step, no load)	%	± 5%
3	Phase		2
4	Rated Voltage	V	3,2
5	Current/Phase	A	5,5
6	Resistance/Phase	Ω	0,58
7	Inductance/Phase	mH	10,1
8	Holding Torque	Nm	11,5
9	Rotor Inertia	g-cm²	5500
10	Weight	Kg	5
11	Number of leads	n°.	4

110SH..-.A single shaft • **110SH..-.B** double shaft

Speed vs. Torque Characteristics

110SH99-5504A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

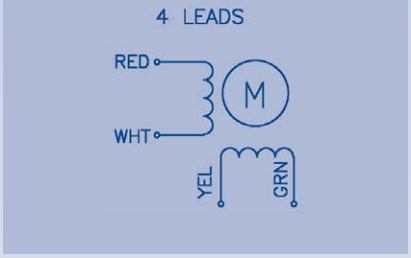
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

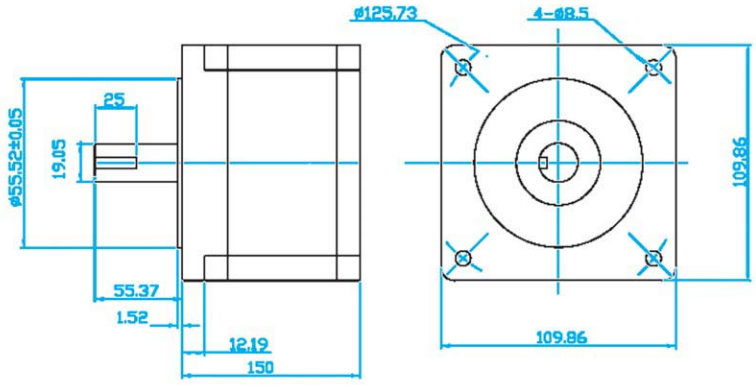
SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.



Dimensions in mm.

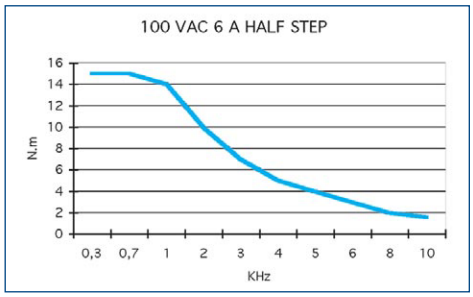
Specifications

	MODEL		110SH150-6504A
1	STEP ANGLE		1,8°
2	STEP ANGLE ACCURACY (FULL STEP, NO LOAD)	%	± 5%
3	PHASE		2
4	RATED VOLTAGE	V	3,9
5	CURRENT/PHASE	A	6,5
6	RESISTANCE/PHASE	Ω	0,6
7	INDUCTANCE/PHASE	mH	12,8
8	HOLDING TORQUE	Nm	22
9	ROTOR INERTIA	g-cm²	10900
10	WEIGHT	Kg	8,4
11	NUMBER OF LEADS	n°.	4

110SH..-.A single shaft • **110SH..-.B** double shaft

Speed vs. Torque Characteristics

110SH150-6504A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

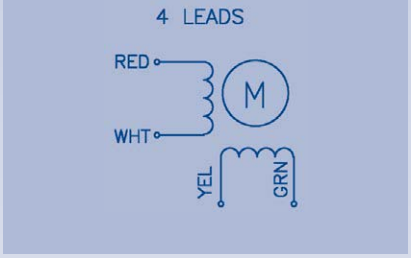
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



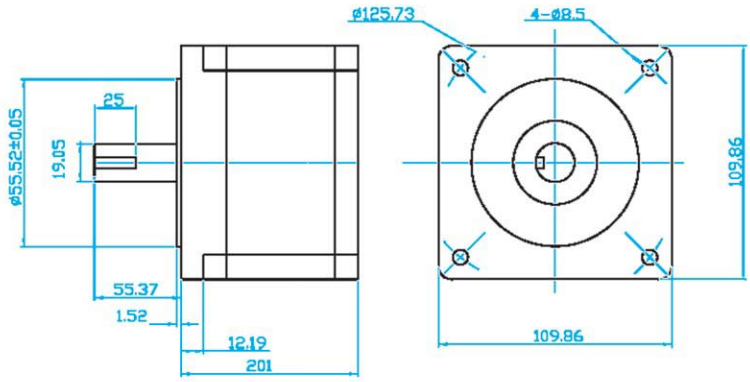
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

110SH201

High Torque Hybrid - 200 step

Step Motor



Dimensions in mm.

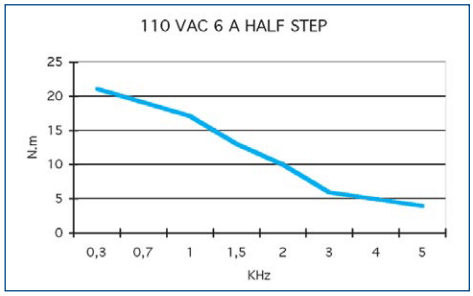
Specifications

	MODEL		110SH201-8004A
1	Step angle		1,8°
2	Step angle accuracy (full step, no load)	%	± 5%
3	Phase		2
4	Rated Voltage	V	4
5	Current/Phase	A	8
6	Resistance/Phase	Ω	0,5
7	Inductance/Phase	mH	11
8	Holding Torque	Nm	30
9	Rotor Inertia	g-cm²	16200
10	Weight	Kg	11,7
11	Number of leads	n°.	4 Step Motor

110SH..-.A single shaft • **110SH..-.B** double shaft

Speed vs. Torque Characteristics

110SH201-8004A



Characteristics

RESISTANCE ACCURACY
± 10%

INDUCTANCE ACCURACY
± 20%

TEMPERATURE RISE
80° C max. (rated current, 2 phase on)

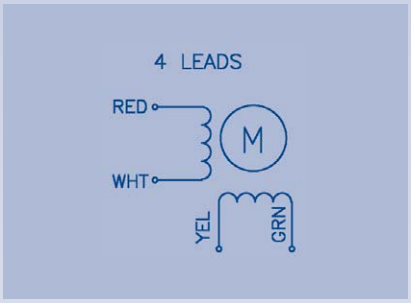
AMBIENT TEMPERATURE
-10° C - + 50° C

INSULATION RESISTANCE
100 M Ω min., 500 VDC

DIELECTRIC STRENGTH
500 VAC for one minute

SHAFT RADIAL PLAY
0,06 max. (450 g-load)

SHAFT AXIAL PLAY
0,08 max. (450 g-load)



AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements.
The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses.
The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied.

Stepper Motor Advantages and Disadvantages

Advantages

1 The rotation angle of the motor is proportional to the input pulse.
2 The motor has full torque at standstill (if the windings are energized)
3 Precise positioning and repeatability of movement since good stepper motors have an accuracy of 3 - 5% of a step and this error is non cumulative from one step to the next.
4 Excellent response to starting/stopping/reversing.
5 Very reliable since there are no contact brushes in the motor.
Therefore the life of the motor is simply dependant on the life of the bearing.
6 The motors response to digital input pulses provides open-loop control, making the motor simpler and less costly to control.
7 It is possible to achieve very low speed synchronous rotation with a load that is directly coupled to the shaft.
8 A wide range of rotational speeds can be realized as the speed is proportional to the frequency of the input pulses.

Disadvantages

1 Resonances can occur if not properly controlled.
2 Not easy to operate at extremely high speeds.

Open Loop Operation

One of the most significant advantages of a stepper motor is its ability to be accurately controlled in an open loop system. Open loop control means no feedback information about position is needed. This type of control eliminates the need for expensive sensing and feedback devices such as optical encoders. Your position is known simply by keeping track of the input step pulses.

Stepper motor type

There are three basic stepper motor types. They are:
• Variable - reluctance • Permanent-magnet • Hybrid

Variable-reluctance (VR)

This type of stepper motor has been around for a long time. It is probably the easiest to understand from a structural point of view.
Figure 1 shows a cross section of a typical V.R. stepper motor.
This type of motor consists of a soft iron multi-toothed rotor and a wound stator.
When the stator windings are energized with DC current the poles become magnetized.
Rotation occurs when the rotor teeth are attracted to the energized stator poles.

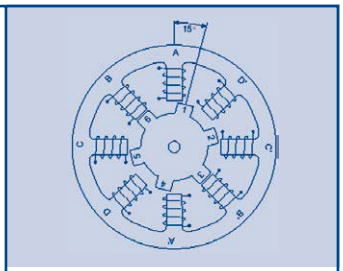


Figure. 1 - Cross-section of a *variable-reclutance (VR)* motor.

Permanent Magnet (PM)

Often referred to as a “tin can” or “canstock” motor the permanent magnet step motor is a low cost and low resolution type motor with typical step angles of 7.5∞ to 15∞.
(48 - 24 steps/revolution) PM motors as the name implies have permanent magnets added to the motor structure. The rotor no longer has teeth as with the VR motor.Instead the rotor is magnetized with alternating north and south poles situated in a straight line parallel to the rotor shaft. These magnetized rotor poles provide an increased magnetic flux intensity and because of this the PM motor exhibits improved torque characteristics when compared with the VR type.

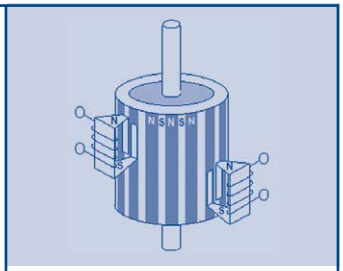


Figure. 2 - Principle of a *PM or Tin-Can* stepper motor.

Hybrid (HB)

The hybrid stepper motor is more expensive than the PM stepper motor but provides better performance with respect to step resolution, torque and speed.
Typical step angles for the HB stepper motor range from 3.6∞ to 0.9∞ (100 - 400 steps per revolution).
The hybrid stepper motor combines the best features of both the PM and VR type stepper motors. The rotor is multi-toothed like the VR motor and contains an axially magnetized concentric magnet around its shaft.
The teeth on the rotor provide an even better path which helps guide the magnetic flux to preferred locations in the airgap. This further increases the detent, holding and dynamic torque characteristics of the motor when compared with both the VR and PM types.
The two most commonly used types of stepper motors are the permanent magnet and the hybrid types. If a designer is not sure which type will best fit his applications requirements he should first evaluate the PM type as it is normally several times less expensive. If not then the hybrid motor may be the right choice.

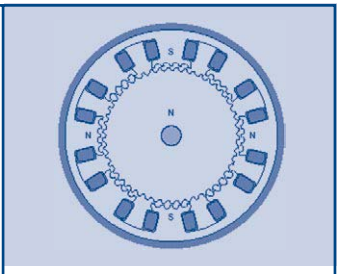


Figure. 3 - Cross-section of a *hybrid* stepper motor.

There also exist some special stepper motor designs. One is the disc magnet motor.
Here the rotor is designed as a disc with rare earth magnets, See fig. 4.
This motor type has some advantages such as very low inertia and a optimized magnetic flow path with no coupling between the two stator windings. These qualities are essential in some applications.

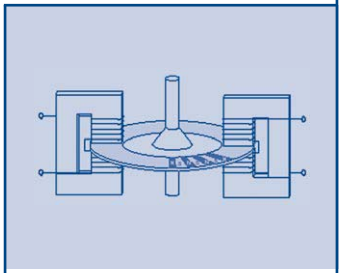


Figure. 4 - Principle of a *Disc Magnet* motor developed by Portescap

Size and Power

In addition to being classified by their step angle stepper motors are also classified according to frame sizes which correspond to the diameter of the body of the motor. For instance a size 11 stepper motor has a body diameter of approximately 1.1 inches.
Likewise a size 23 stepper motor has a body diameter of 2.3 inches (58 mm), etc. The body length may however, vary from motor to motor within the same frame size classification. As a general rule the available torque output from a motor of a particular frame size will increase with increased body length. Power levels for IC-driven stepper motors typically range from below a watt for very small motors up to 10 - 20 watts for larger motors. The maximum power dissipation level or thermal limits of the motor are seldom clearly stated in the motor manufacturers data. To determine this we must apply the relationship P =V · I. For example, a size 23 step motor may be rated at 6V and 1A per phase. Therefore, with two phases energized the motor has a rated power dissipation of 12 watts. It is normal practice to rate a stepper motor at the power dissipation level where the motor case rises65∞C above the ambient in still air. Therefore, if the motor can be mounted to a heat-sink it is often possible to increase the allowable power dissipation level. This is important as the motor is designed to be and should be used at its maximum power dissipation,to be efficient from a size/output power/cost point of view.

When to Use a Stepper Motor

A stepper motor can be a good choice whenever controlled movement is required. They can be used to advantage in applications where you need to control rotation angle, speed, position and synchronism. Because of the inherent advantages listed previously, stepper motors have found their place in many different applications.Some of these include printers, plotters, scanners, high-end office equipment, hard disk drives, fax machines and many more.

The Rotating Magnetic Field

When a phase winding of a stepper motor is energized with current a magnetic flux is developed in the stator. The direction of this flux is determined by the “Right Hand Rule” which states:“If the coil is grasped in the right hand with the fingers pointing in the direction of the current in the winding (the thumb is extended at a 90∞ angle to the fingers), then the thumb will point in the direction of the magnetic field.” Figure 5 shows the magnetic flux path developed when phase B is energized with winding current in the direction shown. The rotor then aligns itself so that the flux opposition is minimized. In this case the motor would rotate clockwise so that its south pole aligns with the north pole of the stator B at position 2 and its north pole aligns with the south pole of stator B at position 6. To get the motor to rotate we can now see that we must provide a sequence of energizing the stator windings in such a fashion that provides a rotating magnetic flux field which the rotor follows due to magnetic attraction.

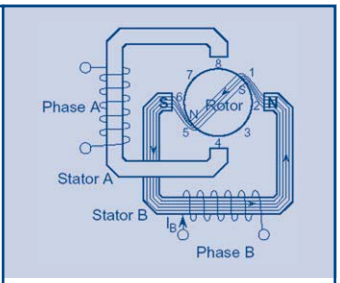


Figure. 5 - *Magnetic flux* path through a two-pole stepper motor with a lag between the rotor and stator.

Torque Generation

The torque produced by a stepper motor depends on several factors.
- The step rate
- The drive current in the windings
- The drive design or type

In a stepper motor a torque is developed when the magnetic fluxes of the rotor and stator are displaced from each other.
The stator is made up of a high permeability magnetic material.
The presence of this high permeability material causes the magnetic flux to be confined for the most part to the paths defined by the stator structure in the same fashion that currents are confined to the conductors of an electronic circuit.
This serves to concentrate the flux at the stator poles.
The torque output produced by the motor is proportional to the intensity of the magnetic flux generated when the winding is energized.
The basic relationship which defines the intensity of the magnetic flux is defined by:

$H = (N \cdot i) / l$ where:
H = Magnetic field intensity
N = The number of winding turns
i = current
l = Magnetic flux path length

This relationship shows that the magnetic flux intensity and consequently the torque is proportional to the number of winding turns and the current and inversely proportional to the length of the magnetic flux path.
From this basic relationship one can see that the same frame size stepper motor could have very different torque output capabilities simply by changing the winding parameters.

Phases, Poles and Stepping Angles

Usually stepper motors have two phases, but three- and five-phase motors also exist. A bipolar motor with two phases has one winding/phase and a unipolar motor has one winding, with a center tap per phase. Sometimes the unipolar stepper motor is referred to as a “four-phase motor”, even though it only has two phases. Motors that have two separate windings per phase also exist, these can be driven in either bipolar or unipolar mode.
A pole can be defined as one of the regions in a magnetized body where the magnetic flux density is concentrated. Both the rotor and the stator of a step motor have poles.
Figure 5 contains a simplified picture of a two-phase stepper motor having 2 poles (or 1 pole pairs) for each phase on the stator, and 2 poles (one pole pair) on the rotor. In reality several more poles are added to both the rotor and stator structure in order to increase the number of steps per revolution of the motor, or in other words to provide a smaller basic (full step) stepping angle.
The permanent magnet stepper motor contains an equal number of rotor and stator pole pairs.
Typically the PM motor has 12 pole pairs. The stator has 12 pole pairs per phase. The hybrid type stepper motor has a rotor with teeth.
The rotor is split into two parts, separated by a permanent magnet, making half of the teeth south poles and half north poles.
The number of pole pairs is equal to the number of teeth on one of the rotor halves.
The stator of a hybrid motor also has teeth to build up a higher number of equivalent poles (smaller pole pitch, number of equivalent poles = 360/teeth pitch) compared to the main poles, on which the winding coils are wound.
Usually 4 main poles are used for 3.6 hybrids and 8 for 1.8- and 0.9-degree types. It is the relationship between the number of rotor poles and the equivalent stator poles, and the number the number of phases that determines the full-step angle of a stepper motor.

Step angle $= 360 / (NPh \cdot Ph) = 360/N$
NPh = Number of equivalent poles per phase = number of rotor poles
Ph = Number of phases
N = Total number of poles for all phases together

If the rotor and stator tooth pitch is unequal, a more-complicated relation-ship exists.

Stepping Modes

The following are the most common drive modes.

- Wave Drive (1 phase on)
- Full Step Drive (2 phases on)
- Half Step Drive (1 & 2 phases on)
- Microstepping (Continuously varying motor currents)

For the following discussions please refer to the figure 6.

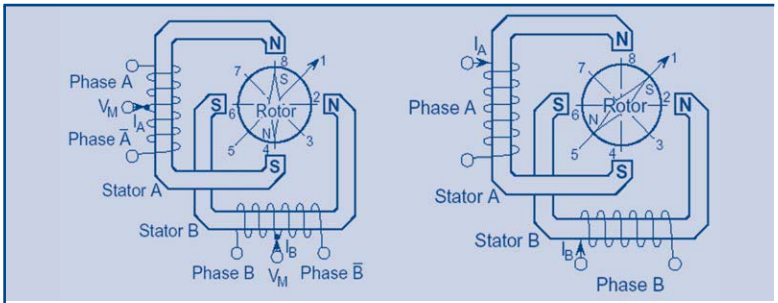


Figure. 6 - *Unipolar and bipolar* wound stepper motors

In Wave Drive only one winding is energized at any given time. The stator is energized according to the sequence **A - B - A - B** and the rotor steps from position **8 - 2 - 4 - 6**.
For unipolar and bipolar wound motors with the same winding parameters this excitation mode would result in the same mechanical position. The disadvantage of this drive mode is that in the unipolar wound motor you are only using 25% and in the bipolar motor only 50% of the total motor winding at any given time. This means that you are not getting the maximum torque output from the motor. In Full Step Drive you are energizing two phases at any given time.

The stator is energized according to the sequence **AB - AB - AB - AB** and the rotor steps from position **1 - 3 - 5 - 7**.
Full step mode results in the same angular movement as 1 phase on drive but the mechanical position is offset by one half of a full step. The torque output of the unipolar wound motor is lower than the bipolar motor (for motors with the same winding parameters) since the unipolar motor uses only 50% of the available winding while the bipolar motor uses the entire winding.
Half Step Drive combines both wave and full step (1&2 phases on) drive modes.

Every second step only one phase is energized and during the other steps one phase on each stator. The stator is energized according to the sequence **AB - B - AB - A - AB - B - AB - A** and the rotor steps from position **1 - 2 - 3 - 4 - 5 - 6 - 7 - 8**.
This results in angular movements that are half of those in 1 or 2 -*phases*- on drive modes. Half stepping can reduce a phenomena referred to as resonance which can be experienced in 1 or 2 -*phases*- on drive modes.
The excitation sequences for the above drive modes are summarized in Table 1.
In Microstepping Drive the currents in the windings are continuously varying to be able to break up one full step into many smaller discrete steps.

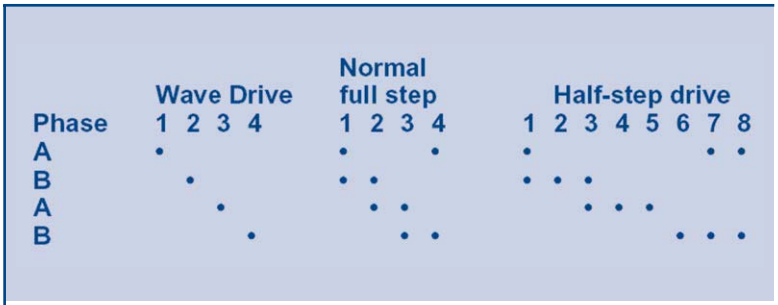


Table. 1 - Excitation sequences for different drives modes

Torque vs, Angle Characteristics

The torque vs angle characteristics of a stepper motor are the relationship between the displacement of the rotor and the torque which applied to the rotor shaft when the stepper motor is energized at its rated voltage. An ideal stepper motor has a sinusoidal torque vs displacement characteristic as shown in figure 7. Positions A and C represent stable equilibrium points when no external force or load is applied to the rotor shaft. When you apply an external force Ta to the motor shaft you in essence create an angular displacement, Qa.
This angular displacement, Qa, is referred to as a lead or lag angle depending on wether the motor is actively accelerating or decelerating. When the rotor stops with an applied load it will come to rest at the position defined by this displacement angle. The motor develops a torque, Ta, in opposition to the applied external force in order to balance the load. As the load is increased the displacement angle also increases until it reaches the maximum holding torque, Th, of the motor. Once Th is exceeded the motor enters an unstable region. In this region a torque is the opposite direction is created and the rotor jumps over the unstable point to the next stable point. The displacement angle is determined by the following relationship:

X = (Z / 2p) · sin(Ta / Th) where:
Z = Rotor tooth pitch
Ta = Load torque
Th = Motors rated holding torque
X = Displacement angle.

Therefore if you have a problem with the step angle error of the loaded motor at rest you can improve this by changing the “stiffness” of the motor. This is done by increasing the holding torque of the motor. We can see this effect shown in the figure 8. Increasing the holding torque for a constant load causes a shift in the lag angle from Q2 to Q1.

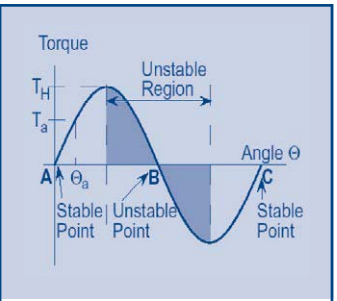


Figure. 7 - Torque vs. rotor angular position.

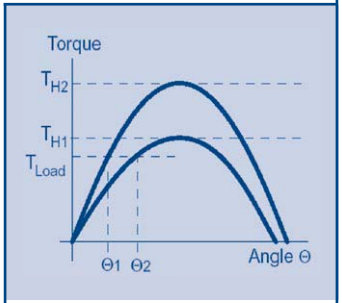


Figure. 8 - Torque vs. rotor angle position at different holding torque.

Step Angle Accuracy

One reason why the stepper motor has achieved such popularity as a positioning device is its accuracy and repeatability.
Typically stepper motors will have a step angle accuracy of 3-5% of one step. This error is also noncumulative from step to step.
The accuracy of the stepper motor is mainly a function of the mechanical precision of its parts and assembly. Figure 9 shows a typical plot of the positional accuracy of a stepper motor.

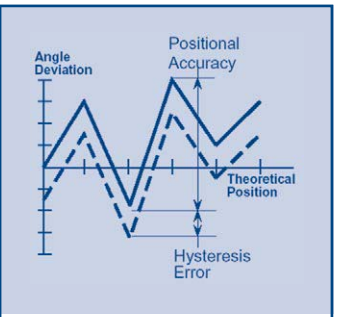


Figure. 9 - Positional accuracy of a stepper motor.

Step Position Error

The maximum positive or negative position error caused when the motor has rotated one step from the previous holding position.
Step position error = measured step angle - theoretical angle

Positional Error

The motor is stepped N times from an initial position (N = 360∞/step angle) and the angle from the initial position is measured at each step position. If the angle from the initial position to the N-step position is QN and the error is DQN where: DQN = DQN - (step angle) · N.

The positional error is the difference of the maximum and minimum but is usually expressed with a ± sign.
That is: positional error = ±1.2 (DQMax - DQMin)

Hysteresis Positional Error

The values obtained from the measurement of positional errors in both directions.

Mechanical Parameters, Load, Friction, Inertia

The performance of a stepper motor system (driver and motor) is also highly dependent on the mechanical parameters of the load. The load is defined as what the motor drives. It is typically frictional, inertial or a combination of the two.
Friction is the resistance to motion due to the unevenness of surfaces which rub together. Friction is constant with velocity. A minimum torque level is required throughout the step in over to overcome this friction (at least equal to the friction). Increasing a frictional load lowers the top speed, lowers the acceleration and increases the positional error. The converse is true if the frictional load is lowered.Inertia is the resistance to changes in speed. A high inertial load requires a high inertial starting torque and the same would apply for braking. Increasing an inertial load will increase speed stability, increase the amount of time it takes to reach a desired speed and decrease the maximum self start pulse rate.
The converse is again true if the inertia is decreased. The rotor oscillations of a stepper motor will vary with the amount of friction and inertia load. Because of this relationship unwanted rotor oscillations can be reduced by mechanical damping means however it is more often simpler to reduce these unwanted oscillations by electrical damping methods such as switch from full step drive to half step drive.

Torque vs, Speed Characteristics

The torque vs speed characteristics are the key to selecting the right motor and drive method for a specific application. These characteristics are dependent upon (change with) the motor, excitation mode and type of driver or drive method. A typical “speed – torque curve” is shown in figure 10.
To get a better understanding of this curve it is useful to define the different aspect of this curve.

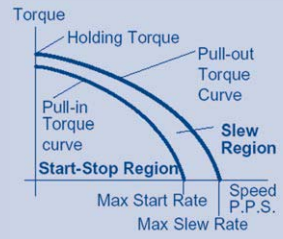


Figure. 10 - Torque vs. speed characteristics of a stepper motor.

Holding torque

The maximum torque produced by the motor at standstill.

Pull-In Curve

The pull-in curve defines a area refered to as the start stop region.
This is the maximum frequency at which the motor can start/stop instantaneously, with a load applied, without loss of synchronism.

Maximum Start Rate

The maximum starting step frequency with no load applied.

Pull-Out Curve

The pull-out curve defines an area refered to as the slew region. It defines the maximum frequency at which the motor can operate without losing synchronism.
Since this region is outside the pull-in area the motor must ramped (accelerated or decelerated) into this region.

Maximum Slew Rate

The maximum operating frequency of the motor with no load applied.
The pull-in characteristics vary also depending on the load. The larger the load inertia the smaller the pull-in area. We can see from the shape of the curve that the step rate affects the torque output capability of stepper motor.
The decreasing torque output as the speed increases is caused by the fact that at high speeds the inductance of the motor is the dominant circuit element. The shape of the speed - torque curve can change quite dramatically depending on the type of driver used.
The bipolar chopper type drivers which New JRC produces will maximum the speed - torque performance from a given motor. Most motor manufacturers provide these speed - torque curves for their motors.
It is important to understand what driver type or drive method the motor manufacturer used in developing their curves as the torque vs. speed characteristics of an given motor can vary significantly depending on the drive method used.

Single Step Response and Resonances

The single-step response character- istics of a stepper motor is shown in figure 11.
When one step pulse is applied to a stepper motor the rotor behaves in a manner as defined by the above curve. The step time t is the time it takes the motor shaft to rotate one step angle once the first step pulse is applied. This step time is highly dependent on the ratio of torque to inertia (load) as well as the type of driver used.
Since the torque is a function of the displacement it follows that the acceleration will also be. Therefore, when moving in large step increments a high torque is developed and consequently a high acceleration. This can cause over shots and ringing as shown. The settling time T is the time it takes these oscillations or ringing to cease. In certain applications this phenomena can be undesirable. It is possible to reduce or eliminate this behaviour by microstepping the stepper motor.
Stepper motors can often exhibit a phenomena refered to as resonance at certain step rates. This can be seen as a sudden loss or drop in torque at certain speeds which can result in missed steps or loss of synchronism. It occurs when the input step pulse rate coincides with the natural oscillation frequency of the rotor. Often there is a resonance area around the 100 – 200 pps region and also one in the high step pulse rate region. The resonance phenomena of a stepper motor comes from its basic construction and therefore it is not possible to eliminate it completely. It is also dependent upon the load conditions. It can be reduced by driving the motor in half or microstepping modes.

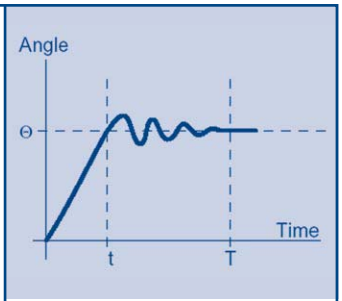
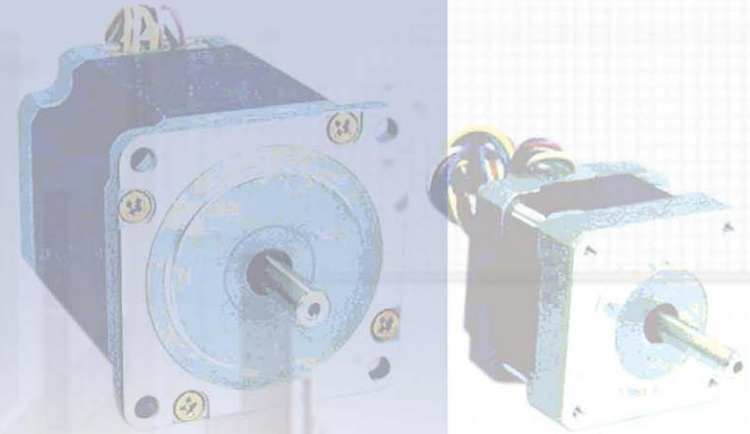


Figure. 7 - Torque vs. rotor angular position.

NOTE

DPM

BRUSHLESS MOTOR



BRUSHLESS MOTOR

Codification Number

57	Size in mm.
BL	Motor type: BL= brushless round and-bell BLS = brushless square and-bell
54	Motor lenght in mm.
A	Shaft configuration: A= 1 shaft B= 2 shaft
XXXX	Exec. Number Special configuration

SHAFT CONFIGURATION
All motors can be supplied with single or double ended shaft (standard or customized design).

BEARING
Brushless motors fitted with ball bearings.

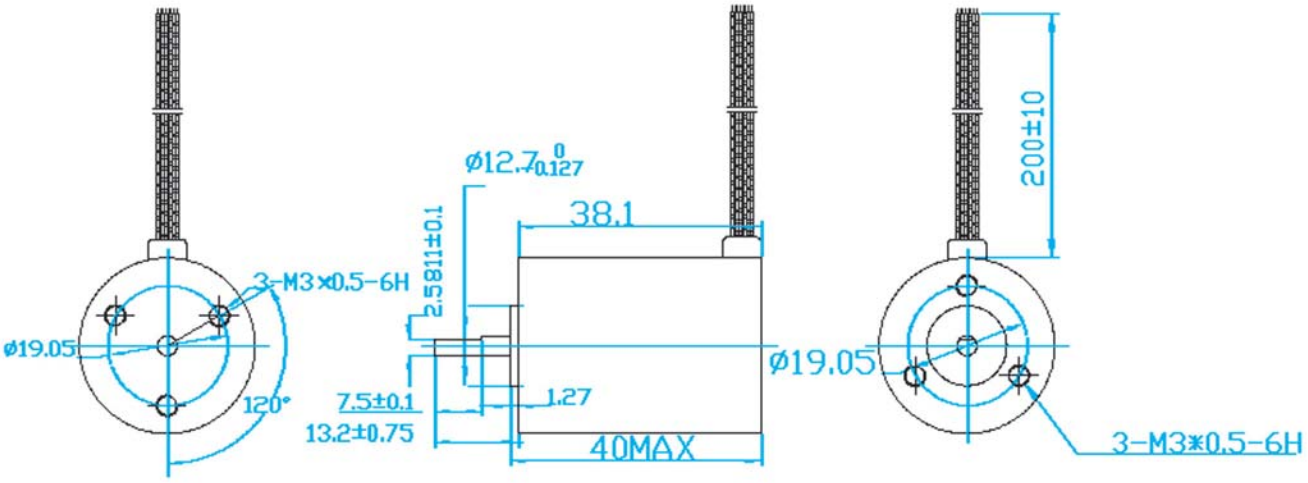
RECOM AMBIENT TEMPERATURE RANGE
-20° C to +40° C.

NOTE

The technical specifications mentioned are typical

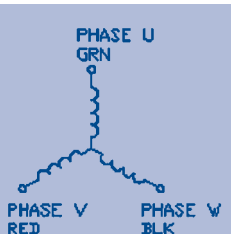
28/BL

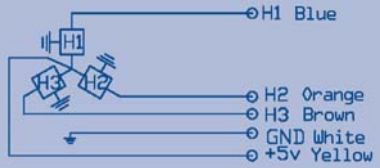
38mm Brushless Motor



Specifications

	MODEL		28BL38
1	N° of pole		4
2	N° of phase		3
3	Rated Voltage	V	24
4	Rated Speed	rpm	10000
5	Rated Torque	mNm	14
6	Max Peak Torque	mNm	42
7	Torque Constant	Nm/A	0,016
8	Terminal Resistance	ohm	4,63
9	Line to line inductance	mH	1,69
11	Max peak current	A	2,62
12	Lenght A	mm	38,1
13	Rotor Inertia	Kgm² x 10-6	2,12





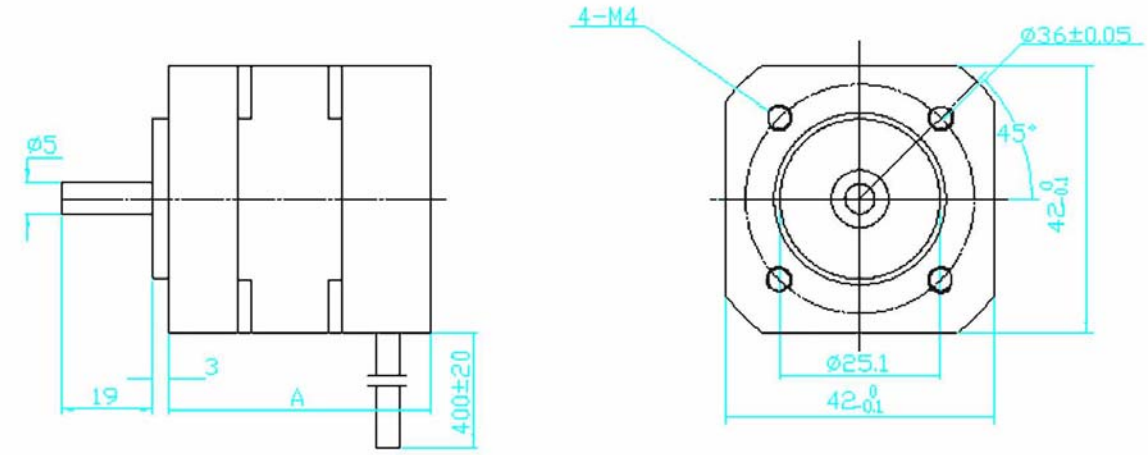
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

42/BL

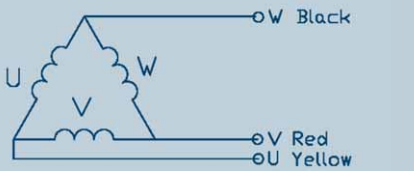
41mm - 61mm - 100mm

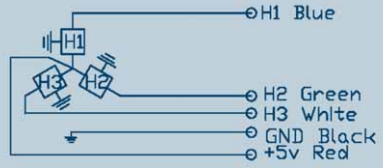
Brushless Motor



Specifications

	MODEL SQUARE AND-BELL		42BL41	42BL61	42BL100
1	N° OF POLE		8	8	8
2	N° OF PHASE		3	3	3
3	RATED VOLTAGE	V	24	24	24
4	RATED SPEED	RPM	4000	4000	4000
5	RATED TORQUE	NM	0,0625	0,125	0,25
6	MAX PEAK TORQUE	NM	0,19	0,38	0,75
7	TORQUE CONSTANT	NM/A	0,035	0,036	0,036
8	TERMINAL RESISTANCE	OHM	1,8	0,72	0,28
9	LINE TO LINE INDUCTANCE	MH	2,23	1,04	0,54
10	B.E.M.F AT NOMINAL SPEED	VRMS	14,8	15,2	15,2
11	MAX PEAK CURRENT	A	5,4	10,6	20
12	LENGHT A	MM	41	61	100
13	ROTOR INERTIA	KGM² X 10-6	24	48	96
14	MASS	KG	0,3	0,45	0,8



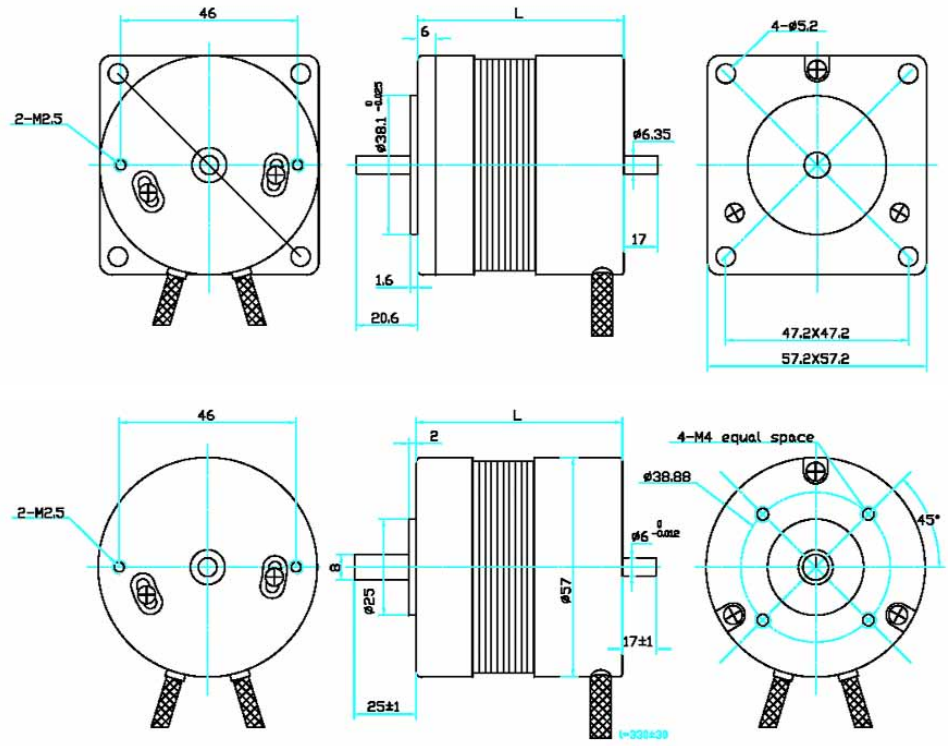


AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

57BLS/BL

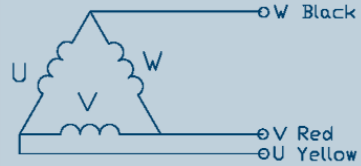
54mm - 74mm - 94mm - 116mm Brushless Motor

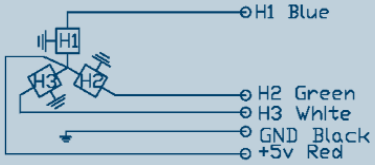


Dimensions in mm.

Specifications

MODEL SQUARE AND-BELL			57BLS54	57BLS74	57BLS94	57BLS116
MODEL ROUND AND-BELL			**57BL54**	**57BL74**	**57BL94**	**57BL116**
1	N° of pole		4	4	4	4
2	N° of phase		3	3	3	3
3	Rated Voltage	V	36	36	36	36
4	Rated Speed	rpm	4000	4000	4000	4000
5	Rated Torque	Nm	0,11	0,22	0,32	0,42
6	Max Peak Torque	Nm	0,35	0,68	0,98	1,3
7	Torque Constant	Nm/A	0,063	0,063	0,061	0,082
8	Terminal Resistance	ohm	1,5	0,58	0,5	0,38
9	Line to line inductance	mH	4,5	2,1	1,65	1
10	B.E.M.F at nominal speed	Vrms	21	21	20,3	30
11	Max peak current	A	5,5	9,8	15	15,9
12	Lenght A	mm	54	74	94	116
13	Rotor Inertia	Kgm² x 10-6	7,5	11,9	17,3	23
14	Mass	Kg	0,5	0,75	1	1,25





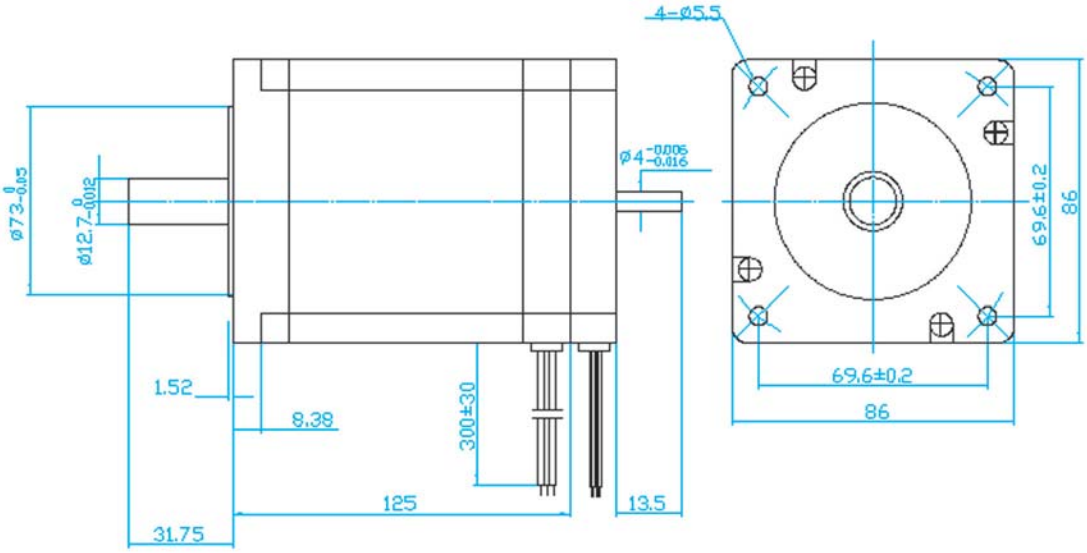
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

86/BLS

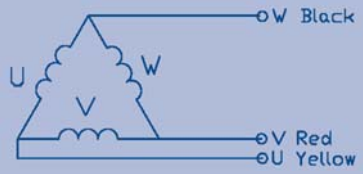
58mm - 71mm - 98mm - 125mm

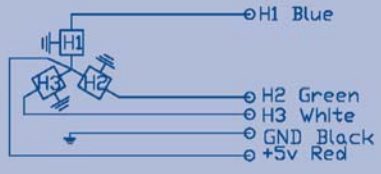
Brushless Motor



Specifications

MODEL SQUARE AND-BELL			B6BLS58		86BLS71		86BLS98		86BLS125	
1	N° OF POLE		8		8		8		8	
2	N° OF PHASE		3		3		3		3	
3	RATED VOLTAGE	V	48		48		48		48	
4	TERMINAL RESISTANCE	OHM	0,4		0,2		0,007		0,008	
5	LINE TO LINE INDUCTANCE	MH	0,7		0,7		1,4		2,1	
6	LENGTH	MM	58		2,1		4,2		6,3	
7	ROTOR INERTIA	KG CM2	0,4		0,122		0,13		0,13	
8	CONNECTION		STAR	DELTA	STAR	DELTA	STAR	DELTA	STAR	DELTA
9	RATED SPEED	RPM	3000	6000	3000	6000	3000	6000	3000	6000
10	RATED TORQUE	NM	0,35	0,175	0,7	0,35	1,4	0,7	2,1	1,05
11	MAX PEAK TORQUE	NM	1,05	0,52	2,1	1,05	4,2	2,1	6,3	3,2
12	TORQUE CONSTANT	NM/A	0,104	0,06	0,122	0,07	0,13	0,077	0,13	0,075
13	MAX PEAK CURRENT	A	11	10	18	17	33	30	50	46





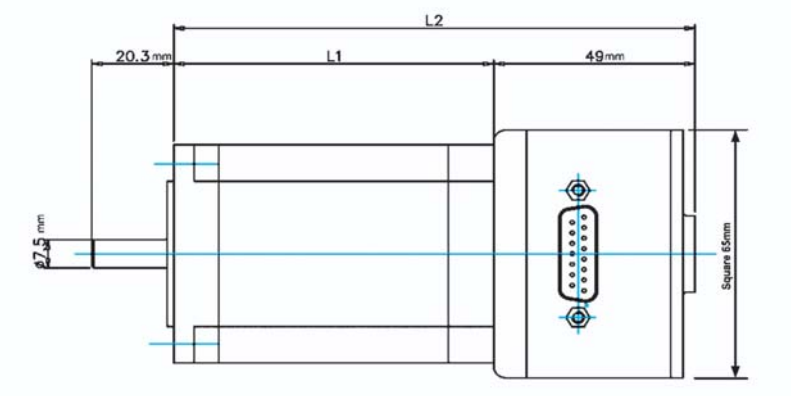
AVAILABLE OPTIONS

Motor modifications:
custom winding, special bearing, special tap.
Shaft modifications:
flat, pinion, keyway, length.
Leadwire modifications:
wire type, wire color, wire length, connector installation.

ST57

3A - 24VDC TO 60VDC

Step Drive



Dimensions in mm.

Specifications

	MODEL		ST57-01C-41	ST57-01C-51	ST57-01C-56	ST57-01C-76
	DPM MOTOR		57SH41-4A	57SH51-4A	57SH56-4A	57SH76-4A
1	SUPPLY VOLTAGE	VDC	24-60	24-60	24-60	24-60
2	CURRENT/PHASE	A	2,8	2,8	2,8	2,8
3	STEP RESOLUTION UP TO	Ω	1/128	1/128	1/128	1/128
4	DIGITAL INPUT		5	5	5	5
5	DIGITAL OUTPUT		2	2	2	2
6	DETENT TORQUE	MNM	18	35	42	72
7	HOLDING TORQUE	NCM	55	101	126	189
8	ROTOR INERTIA	G-CM²	120	275	300	480
9	L1	MM	41	51	56	76
10	L2	MM	90	100	105	125

Specification for Bipolar connection

Step Drive

- The stepper motors with integrated driver are the best tool for our customers, as they combine both the motor and the driver functions.
- This compact device is easy to install and it is the best solution in terms of price and performances.

Characteristics

CLOCK AND DIRECTION

MOD BUS PROTOCOL WITH INTERNAL CLOCK THROUGH SERIAL INTERFACE RS485

40 CYCLES WRITING IN INTERNAL FLASH MEMORY

POSITION CONTROL AND PROGRAMMING PROFILE

STEPS RESOLUTION UNTIL 25600 MICROSTEPPING.

SUPPLY VOLTAGE 24-60VDC

Setting

PROGRAMMABLE CURRENT REDUCTION (VALUE AND DELAY).

ACC/DEC AND POSITIONING.

Digital Inputs

5 INPUT OPTOCOUPLED PROGRAMMABLE FUNCTIONS (EX: CLOCK, DIRECTION, LIMIT SWITC....)

Digital Output

2 OUTPUT OPTOCOUPLED PROGRAMMABLE OPEN COLLECTOR NPN (EX: DRIVE OK, ...)

Protection

MAX CURRENT, VOLTAGE AND TEMP.

Support softwares

CUSTOMER INTERFACE ON PC, WIN 98 OR HIGHER

Connection

CONNECTOR SUB-DIN 41652 15 POLES

Available Options

HEATSINK KIT FOR SPECIAL APPLICATIONS

CABLE WITH CONNECTOR

SHAFT MODIFICATIONS

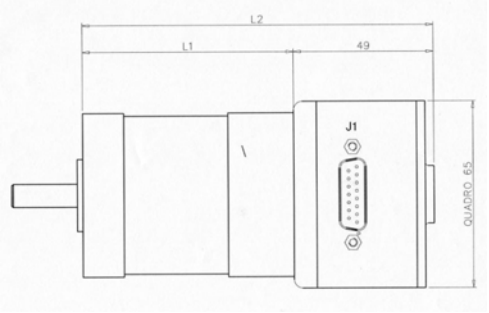
BL57

22Vdc to 60Vdc Brushless DRIVE

The BRUSHLESS motors with integrated driver are the best tool for our customers, as they combine both the motor and the driver functions.
This compact device, easy to install, is it the best solution in terms of price and performances.

DRIVE DESCRIPTION

Characteristics	Supply voltage 22-60Vdc.
	Hall effect (standard) A good speed regulation on starts from 300 RPm on.
	64ppr encoder (option) A good speed regulation on starts from 100 RPm on.
	Serial interface RS485
	Programming through serial interface RS485 MOD BUS.
	Can be interfaced with microprocessor, PC, PLC.
	Analog input 0-10Vdc
	Nominal current 3,5 Arms
Setting	current %.
	Acc. / Dec.
	Speed, torque control
	IEC 1131-3 I.L. (Instruction List) with 512 instruction step (PLC compatible)
Digital Inputs	3 Optocoupled input
	2 Optocoupled fast input
Digital Output	2 Optocoupled open collector NPN
Support softwares	Customer interface on PC
Potection	Max current, voltage and temperature
Option	64ppr encoder for low speed use (100 Rpm min)
	Heatsink kit for special applications.
	Cable with connector
Connection	Connector SUB-D DIN 41652 15 poles male
Funtionality mode	Standard execution with analog input.
	RS485 with MOD BUS protocol
Brushless motor	DPM 57BL54 DPM 57BL74 DPM57BL94 DPM57BL116



Tipo motore	L1	L2
57BL01	54	103
57BL02	74	123
57BL03	94	143
57BL04	116	165

Quote in mm

Our Sales Organization

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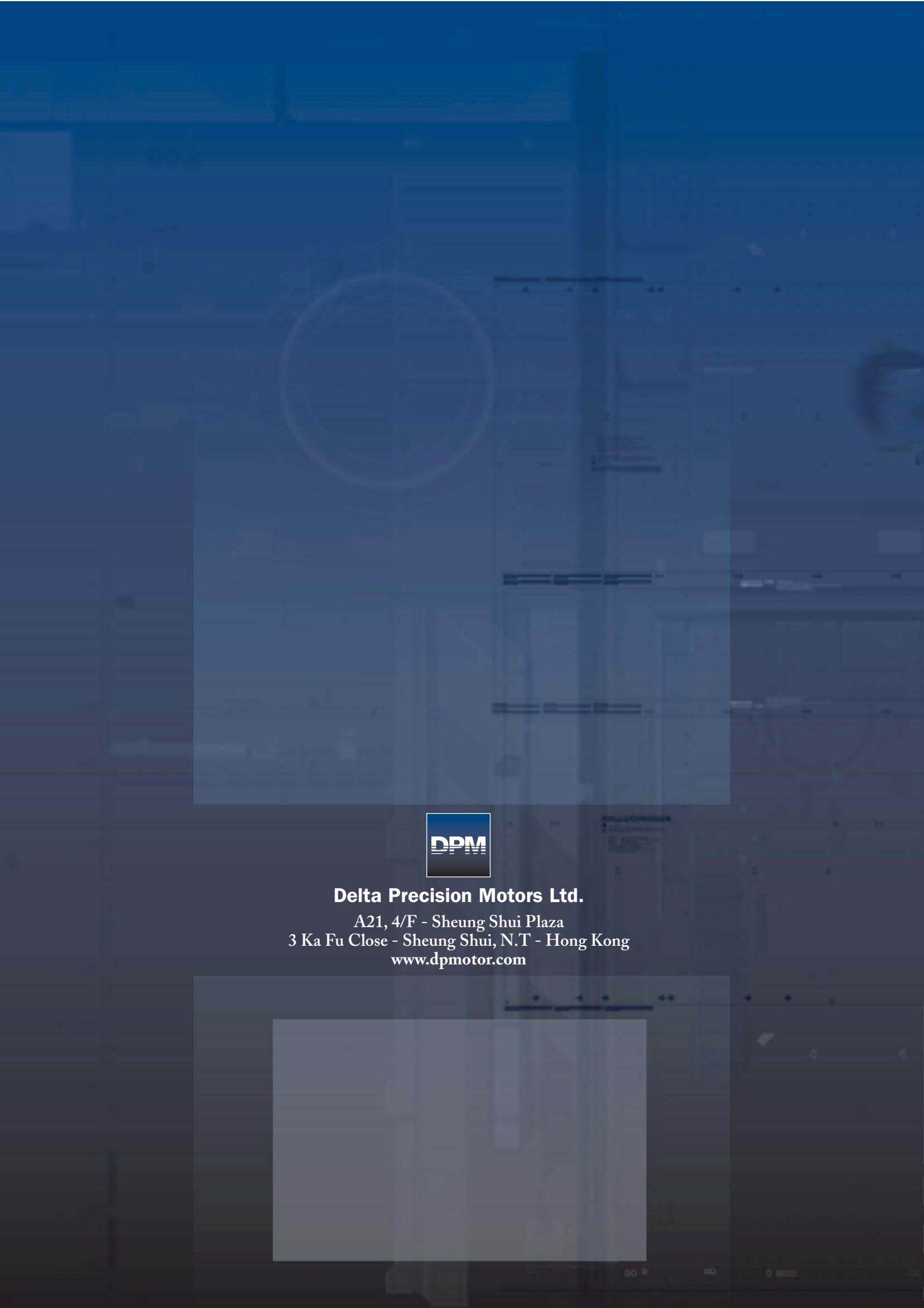

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