Stepping Motors
ZSS 19 – 56

Diameter: 19 to 56 mm (0.75” to 2.2”)
Torque: 3.8 to 700 mNm (0.54 to 99 oz-in)

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About ZSS Stepping Motors

- Two-phase hybrid stepping motors for unipolar or bipolar control
- Holding torque from 0.54 to 99 oz-in
- Diameters from 19 to 56.4 mm
- Up to 3 motor types and 3 different standard windings per size
- Standard number of steps: 200 Optional: 8, 24, 56, 72, 500
- Minimum protection: IP 40
- Optional: IP 50, IP 65 depending on the size (see Mechanical table)
- Insulation class: F
- Permissible surface temperature: -20°C to +120°C
- CE mark

Options *(see Options Table, pg. 3)*

- 8, 24, 56, 72 or 500 full steps per revolution
- Double shaft
- Heat sink with radial (K1) or axial (K2) fins
- GPL Low backlash planetary gearing for motor sizes ZSS 19 - 56
- HD Harmonic Drive gearing for motor sizes ZSS 25 - 52
- Brake for motor sizes ZSS 52 and 56
- Incremental encoder for motor sizes 25 - 56

Extreme Environment

ZSS series of stepping motors can be adapted to operate in

- Vacuum up to 10^{-11} Torr
- Temperature range -454°F to 600°F
- Radiation-resistant up to 10^{8} Rad
- Clean rooms
- Combination of all the above
- Space

Ordering Information

ZSS 42 . 200 . 1.2 - E - K1 - HD 11 / 50 - FD

Stepping motor series

Size
(represents diameter in mm)

Steps per revolution
8 / 24 / 56 / 72 / 200 / 500 *(depends on motor size)*

Winding
0.3 / 0.6 / 1.2 / 2.5 / 5 Amp *(depends on motor size)*

Options
Double shaft: E
Incremental Encoder: HEDL 5540 *(not available for size 19))*
Brake: KEB 02 *(available for size 52 and 56 only)*

Heat sink
K1 radial / K2 axial

Gearing / Reduction ratio
GPL / HD

Flying leads: FD
for size 42 to 56 without brake

Stepping Motors
ZSS 19 – 56

Diameter: 19 to 56 mm (0.75” to 2.2”)
Torque: 3.8 to 700 mNm (0.54 to 99 oz-in)

		Electrical									***Mechanical***					
		Parallel (4-leads)			Series (4-leads)			Unipolar (5 or 6 leads)			Torque[4]			Loads		Mass
Size[5]	Standard part number (200 steps/rev.)	I/ph[1]	R/ph[2]	L/ph[3]	I/ph[1]	R/ph[2]	L/ph[3]	I/ph[1]	R/ph[2]	L/ph[3]	holding	detent	inertia	axial	radial	
		A	Ω	mH	A	Ω	mH	A	Ω	mH	mNm (oz-in)	mNm (oz-in)	kg-cm² (oz-in²)	N (lb_f)	N (lb_f)	kg (lb_m)
19	ZSS 19.200.0.3	0.3	6	2.2	0.15	24	8.8	0.21	12	2.2	3.8 (0.54)	0.9 (0.13)	0.0009 (0.005)	3 (0.67)	3 (0.67)	0.04 (0.08)
	ZSS 19.200.0.6	0.6	2.1	0.55	0.3	8.4	2.2	0.42	4.2	0.55						
	ZSS 19.200.1.2	1.2	0.625	0.15	0.6	2.5	0.6	0.84	1.25	0.15						
	ZSS 20.200.0.6	0.6	3.45	1.1	0.3	13.8	4.4	0.42	6.9	1.1	5 (0.71)	1 (0.14)	0.0016 (0.009)	3 (0.67)	3 (0.67)	0.065 (0.14)
25	ZSS 25.200.0.3	0.3	12	6	0.15	48	24	0.21	24	6	13 (1.86)	2 (0.29)	0.0025 (0.014)	5 (1.13)	5 (1.13)	0.07 (0.15)
	ZSS 25.200.0.6	0.6	3.25	1.5	0.3	13	6	0.42	6.5	1.5						
	ZSS 25.200.1.2	1.2	0.95	0.4	0.6	3.8	1.6	0.84	1.9	0.4						
	ZSS 26.200.0.3	0.3	21.5	12	0.15	86	48	0.21	43	12	25 (3.57)	2.2 (0.31)	0.006 (0.03)	5 (1.13)	5 (1.13)	0.11 (0.24)
	ZSS 26.200.0.6	0.6	5.85	3.2	0.3	23.4	12.8	0.42	11.7	3.2						
	ZSS 26.200.1.2	1.2	1.7	1	0.6	6.8	4	0.84	3.4	1						
32	ZSS 32.200.0.6	0.6	4.65	5.3	0.3	18.6	21.2	0.42	9.3	5.3	50 (7.14)	3 (0.43)	0.01 (0.05)	5 (1.13)	15 (3.38)	0.15 (0.33)
	ZSS 32.200.1.2	1.2	1.3	1.2	0.6	5.2	4.8	0.84	2.6	1.2						
	ZSS 32.200.2.5	2.5	0.3	0.3	1.25	1.2	1.2	1.75	0.6	0.3						
	ZSS 33.200.0.6	0.6	7.5	9.3	0.3	30	37.2	0.42	15	9.3	75 (10.71)	3.3 (0.47)	0.018 (0.09)	5 (1.13)	15 (3.38)	0.35 (0.77)
	ZSS 33.200.1.2	1.2	1.75	2.2	0.6	7	8.8	0.84	3.5	2.2						
	ZSS 33.200.2.5	2.5	0.47	0.6	1.25	1.88	2.4	1.75	0.94	0.6						
42	ZSS 41.200.0.6	0.6	5.1	7.6	0.3	20.4	30.4	0.42	10.2	7.6	100 (14.29)	4 (0.57)	0.025 (0.14)	20 (4.5)	40 (9.01)	0.26 (0.57)
	ZSS 41.200.1.2	1.2	1.35	2	0.6	5.4	8	0.84	2.7	2						
	ZSS 41.200.2.5	2.5	0.275	0.4	1.25	1.1	1.6	1.75	0.55	0.4						
	ZSS 42.200.0.6	0.6	7.25	11	0.3	29	44	0.42	14.5	11	140 (20)	5 (0.71)	0.045 (0.25)	20 (4.5)	40 (9.01)	0.32 (0.70)
	ZSS 42.200.1.2	1.2	1.6	3	0.6	6.4	12	0.84	3.2	3						
	ZSS 42.200.2.5	2.5	0.35	0.7	1.25	1.4	2.8	1.75	0.7	0.7						
	ZSS 43.200.0.6	0.6	9.5	22.9	0.3	38	91.6	0.42	19	22.9	260 (37.14)	7 (1.0)	0.077 (0.42)	20 (4.5)	40 (9.01)	0.47 (1.04)
	ZSS 43.200.1.2	1.2	2.6	5.2	0.6	10.4	20.8	0.84	5.2	5.2						
	ZSS 43.200.2.5	2.5	0.5	1.2	1.25	2	4.8	1.75	1	1.2						
52	ZSS 52.200.1.2	1.2	2.65	7	0.6	10.6	28	0.84	5.3	7	450 (64.29)	13 (1.86)	0.15 (0.82)	25 (5.63)	70 (15.77)	0.65 (1.43)
	ZSS 52.200.2.5	2.5	0.6	1.6	1.25	2.4	6.4	1.75	1.2	1.6						
	ZSS 52.200.5	5	0.165	0.4	2.5	0.66	1.6	3.5	0.33	0.4						
56	ZSS 56.200.1.2	1.2	2.85	6.7	0.6	11.4	26.8	0.84	5.7	6.7	400 (57.14)	30 (4.29)	0.17 (0.93)	40 (9.01)	80 (18.02)	0.7 (1.54)
	ZSS 56.200.2.5	2.5	0.65	1.7	1.25	2.6	6.8	1.75	1.3	1.7						
	ZSS 56.200.5	5	0.185	0.5	2.5	0.74	2	3.5	0.37	0.5						
	ZSS 57.200.1.2	1.2	3.9	9.5	0.6	15.6	38	0.84	7.8	9.5	700 (100)	50 (7.14)	0.24 (1.31)	40 (9.01)	80 (18.02)	0.9 (1.98)
	ZSS 57.200.2.5	2.5	0.8	2.4	1.25	3.2	9.6	1.75	1.6	2.4						
	ZSS 57.200.5	5	0.25	0.8	2.5	1	3.2	3.5	0.5	0.8						
	ZSS 59.200.1.2	1.2	3.9	9.5	0.6	15.6	38	0.84	7.8	9.5	700 (100)	50 (7.14)	0.24 (1.31)	40 (9.01)	80 (18.02)	1.05 (2.32)
	ZSS 59.200.2.5	2.5	0.8	2.4	1.25	3.2	9.6	1.75	1.6	2.4						
	ZSS 59.200.5	5	0.25	0.8	2.5	1	3.2	3.5	0.5	0.8						

1) I/ph: Phase current 2) R/ph: Phase resistance 3) L/ph: Phase inductance
4) Holding torque in bipolar mode with 2 phases ON at nominal current 5) Size represents diameter in mm (1in ≈ 25.4mm)

Stepping Motors
ZSS 19 – 56

Diameter: 19 to 56 mm (0.75” to 2.2”)
Torque: 3.8 to 700 mNm (0.54 to 99 oz-in)

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Options

Size	Type	Number of full steps/rev.						Design Voltage[1]		Double shaft	Brake[2]	Encoder[3]	Heat Sink		Gear heads[4] Planetary/ Harmonic			Protection class			Insulation	Test voltage
		8	24	56	72	200	500	<100V	<200V		KEB	HEDL	K1	K2	PLG	GPL	HD	IP40	IP50[5]	IP65	F	
19	ZSS 19	□			■	■		■		□			□	□		□		■[6]			■	700 V / 1 min
	ZSS 20					■		■		□			□	□		□		■[6]			■	
25	ZSS 25	□	□		■	■	■	■		□		□	□	□	□	□	□	■[6]			■	
	ZSS 26					■	■	■		□		□	□	□	□	□	□	■[6]			■	
32	ZSS 32				■	■		■		□		□	□	□	□	□	□	■[7]			■	
	ZSS 33				□	■		■		□		□	□	□	□	□	□	■[7]			■	
42	ZSS 41					■	■	■		□		□	□	□	□	□	□	□	■		■	
	ZSS 41/1					■	■		■	□		□	□	□	□	□	□	□	■		■	
	ZSS 42				□	■	■	■		□		□	□	□	□	□	□	□	■		■	
	ZSS 42/1				□	■	■		■	□		□	□	□	□	□	□	□	■		■	
	ZSS 43					■	■	■		□		□	□	□	□	□	□	□	■		■	
	ZSS 43/1					■	■		■	□		□	□	□	□	□	□	□	■		■	
52	ZSS 52			□	■	■	■		■	□	□	□	□	□	□	□	□	□	■[8]		■	
56	ZSS 56					■	□		■	□	□	□	□	□	□	□		□	■[8]		■	1500 V/1 min
	ZSS 57					■	□		■	□	□	□	□	□	□	□		□	■[8]		■	
	ZSS 59					■			■			□								■	■	

Motor Brake type KEB 02

For vertical positioning systems, stepping motors with built-in brakes are recommended.

- Supply voltage 24 V_{DC}
- Electrical connection of the brake by means of a connector
- Current consumption approx. 350 mA
- Dimensions on request.

Heat Sink

ZSS 19 – 57 are also available with an integrated heat sink.

Depending on the motor’s mounting position, a heat sink with radial fins (K1) or with axial fins (K2) can be selected.

The use of a K1 heat sink increases the stepping motor’s thermal dissipation surface by a factor of approx. 3.9. With K2 heat sink, it is increased by a factor of approx. 3.4.

A heat sink can be mounted subsequently, preferably by Phytron.

Incremental Encoder HEDL 5540

ZSS stepping motors can be equipped with an incremental encoder when each step needs to be monitored.

- Optical encoder
- Standard resolution: 500 lines
- Output signals:
  - Channel A and B
  - A and B shifted by 90°
  - 0 - reference pulse

These outputs are also available as inverted signals

- Supply voltage 5 V_{DC}
- Connection through flat cable with 10-point connector. Soldered for ZSS 59.
- Dimensions on request.

Remarks to Options

■ Standard - popular types
□ Options

1) <100 V: motor without earth-screw
<200 V: motor with earth-screw
2) Brake option (IP 00)
Motor connection via terminal box (soldered connection) and cable gland
Brake connection via a round connector
3) Incremental encoder option:
ZSS 25-57: motor with flying leads and encoder connection via flat cable with 10 point ICD-connector (IP 20)
ZSS 59: Motor and encoder connection via terminal box (soldered connection) and cable gland (IP 65)
4) Refer to pages 9-15
5) Cable outlet diameter:
max. 4.5 mm for size 42
max. 5 mm for size 52-56
6) AWG 28, flying leads 250 mm
7) AWG 26, flying leads 250 mm
8) ZSS 52-57 with 5-Amp winding:
Motor connection via terminal box (soldered connection) and cable gland (IP 50)

Stepping Motors
ZSS 19 – 56

Diameter: 19 to 56 mm (0.75” to 2.2”)
Torque: 3.8 to 700 mNm (0.54 to 99 oz-in)

Dimensions

Size	Type	Dimensions in mm															
		A	B1	B2	C	D	E	F1	F2	$G1_{g5}$	$G2_{g5}$	K	L	M	N	P	R
19	ZSS 19	19	26.5			1	2	7.5	6.5	2.5	2.5	19	10	16	M2.5	26	20.5
	ZSS 20	19	43			1	2	7.5	6.5	2.5	2.5	19	10	16	M2.5	26	37
25	ZSS 25	25	31			1	2.5	9.5	8.5	3	3	25	14	21.5	2.2	35	24
	ZSS 26	25	47			1	2.5	9.5	8.5	3	3	25	14	21.5	2.2	35	40
32	ZSS 32	32	38.5			1	3	11	10	4	4	32	18	27	2.8	42	30
	ZSS 33	32	57.5			1	3	11	10	4	4	32	18	27	2.8	42	49
42[3]	ZSS 41 ZSS 41/1	42		49	39	1	3	16	15	5	4	42	22	36	3.2	55	30
	ZSS 42 ZSS 42/1	42		64	54	1	3	16	15	5	4	42	22	36	3.2	55	45
	ZSS 43 ZSS 43/1	42		79	69	1	3	16	15	5	4	42	22	36	3.2	55	60
52	ZSS 52[2]	52		77	65	1.5	3.5	17.5	16	6	4	52	28	44	4.3	65	58
56	ZSS 56[2]	56.4		69.1	57.1	1.5	4.5	22	20.5	6.35	6.35	60	38.1	47.15	5.2	78	44
	ZSS 57[2]	56.4		85.1	73.1	1.5	4.5	22	20.5	6.35	6.35	60	38.1	47.15	5.2	78	60
	ZSS 59[1]	59		93		1.5	4.5	21		6.35		60	38.1	49.2	5.2		

ZSS 19 – 32 stepping motor with flying leads

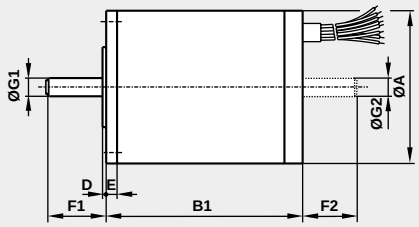

Fig. 1

ZSS 19 – 56 stepping motor flange

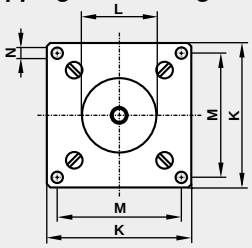

Fig. 4

ZSS 42 – 56 with terminal block and protective cover

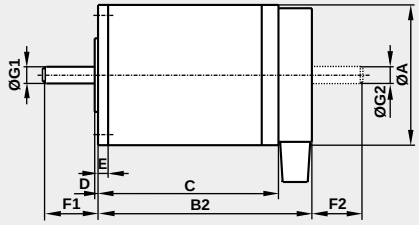

Fig. 2

K1 heat sink for ZSS 19-57

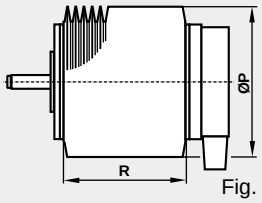

Fig. 5

K2 heat sink for ZSS 19-57

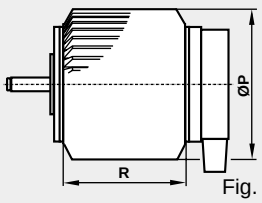

Fig. 6

ZSS 59 stepping motor (IP65) with cable gland

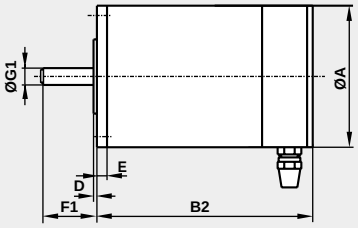

Fig. 3

Notes

1) ZSS 59 dimensions with IP 65 protection are shown in fig. 3.
2) ZSS 52, 56 and 57 with 5 Amp winding are supplied with terminal box and cable gland. Therefore the dimension B2 is increased by 11 mm.
3) Size 42 motors have same dimension for both the 100 V (ZSS 41, 42, 43) and 200 V (ZSS 41/1, 42/1, 43/1).

Other motor dimensions on request.

- Round mounting flange
- With brake
- With encoder
- With gear heads
- Vacuum motors

Stepping Motors
ZSS 19 – 56

Diameter: 19 to 56 mm (0.75” to 2.2”)
Torque: 3.8 to 700 mNm (0.54 to 99 oz-in)

Electrical Characteristics

Phytron ZSS stepping motors are 8-lead version (fig.7).

These motors can be used in the unipolar or bipolar mode as the windings can be connected in different configurations.

In the unipolar mode, the motors are controlled using a 5-lead or 6-lead connection.

In the bipolar mode, the motors are controlled using a 4-lead connection. Both windings of a phase can be connected in parallel or in series. We recommend connecting the windings in parallel (fig.8).

8-lead stepping motor ZSS

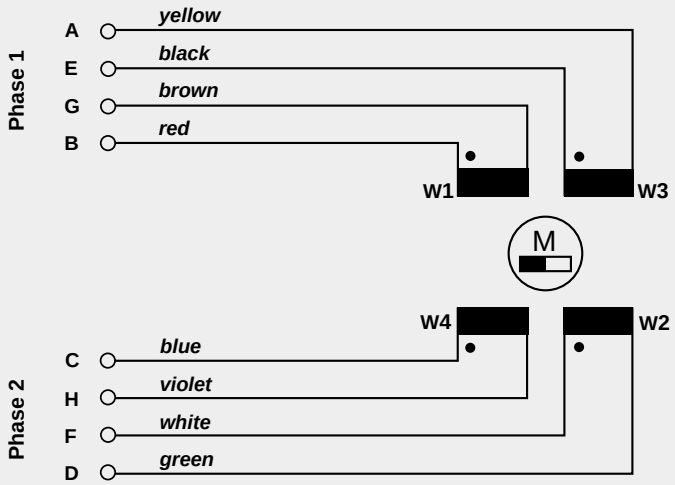

Fig. 7

When connecting the motor, follow the user’s manual! ZSS 41/1 - ZSS 59: With the earthing screw, the motor can be safely connected to the system’s ground.

EU and CE marks

Phytron ZSS stepping motors fulfill the requirements of the EMC and Low Voltage Directives, when installed appropriately. ZSS stepping motors are marked CE and comply with EN 60034-1 European standard.

When wired correctly, ZSS stepping motors fulfill the requirements of EMC Directive. Corresponding tests have been carried out with ZSS stepping motors with Phytron control units. Please, refer to the motor connection leaflet, the corresponding control unit and power stage manuals for further information on wiring according to EMC requirements.

According to Machine Directive, the stepping motor is only a part of a machine. The machine manufacturer must take appropriate measures to ensure that the entire system fulfills the requirements of the applicable EU-Directives.

Connection configurations for 8-lead stepping motors

For bipolar control signals:

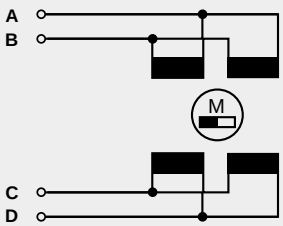

Fig. 8
4-lead/parallel winding connection

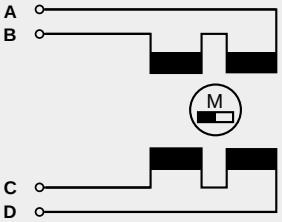

Fig. 10
4-leads/series winding connection

For unipolar control signals:

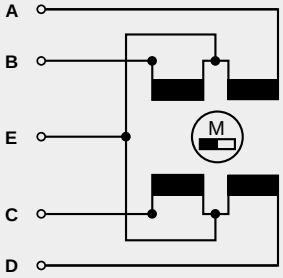

Fig. 9
5-lead connection

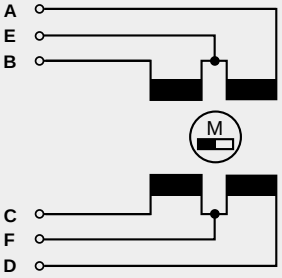

Fig. 11
6-lead connection

Stepping Motors
ZSS 19 – 56

Diameter: 19 to 56 mm (0.75” to 2.2”)
Torque: 3.8 to 700 mNm (0.54 to 99 oz-in)

Frequency characteristics

The curves correspond to the limit values of the operational torque (M) as a function of the control pulses (frequency), for two different supply voltages (+U_b) of the power stage.

The windings are connected in parallel (fig. 8), the motors are controlled by means of bipolar stepping motor power stages, in the half-step mode.

Power characteristics

For each frequency curve, the power characteristic indicates the power (P) delivered to the output shaft.

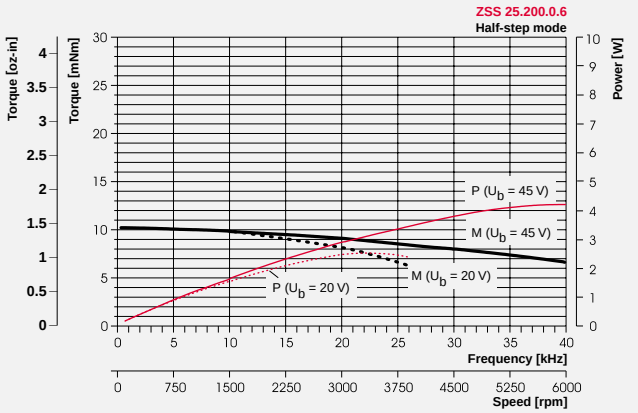

Fig. 14

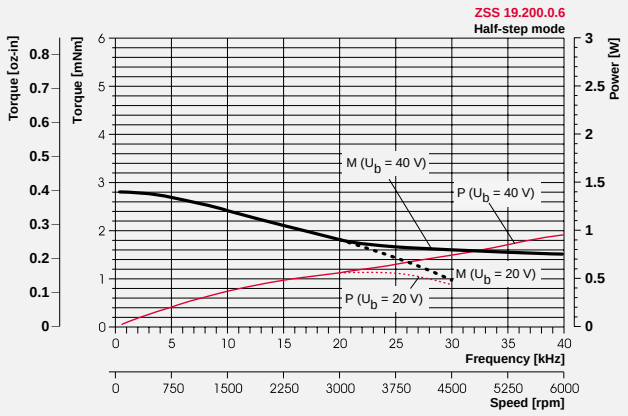

Fig. 12

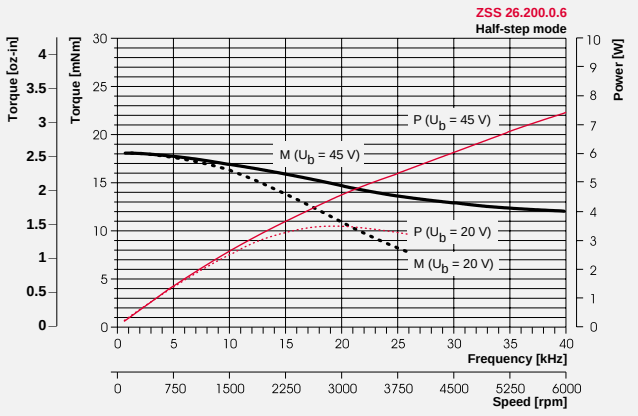

Fig. 15

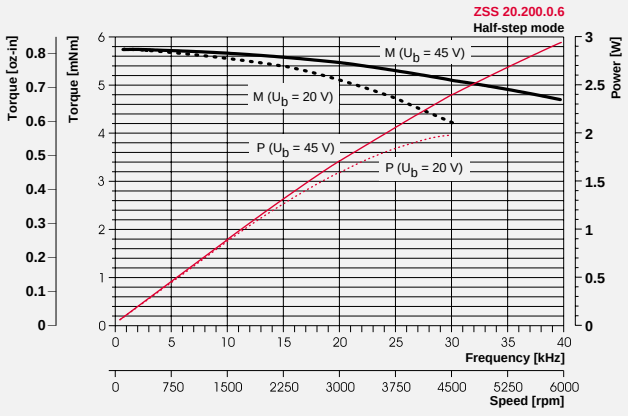

Fig. 13

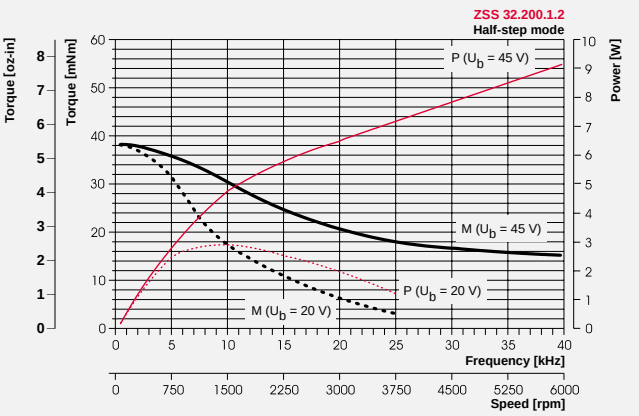

Fig. 16

Stepping Motors
ZSS 19 – 56
Diameter: 19 to 56 mm (0.75” to 2.2”)
Torque: 3.8 to 700 mNm (0.54 to 99 oz-in)

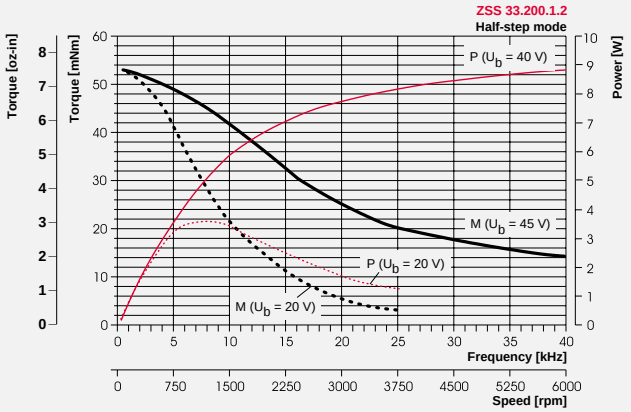

Fig. 17

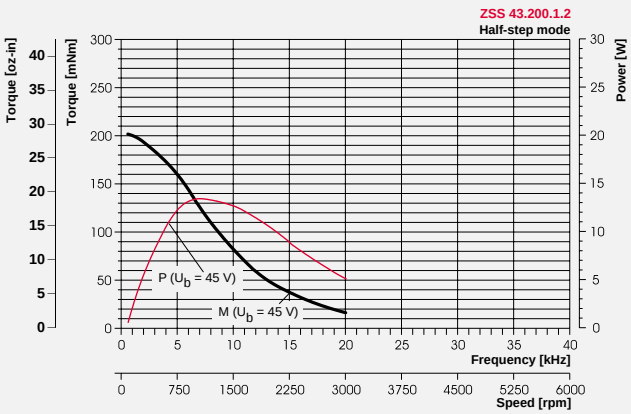

Fig. 20

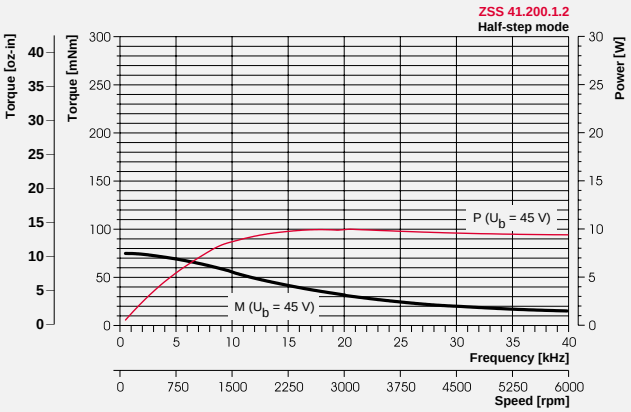

Fig. 18

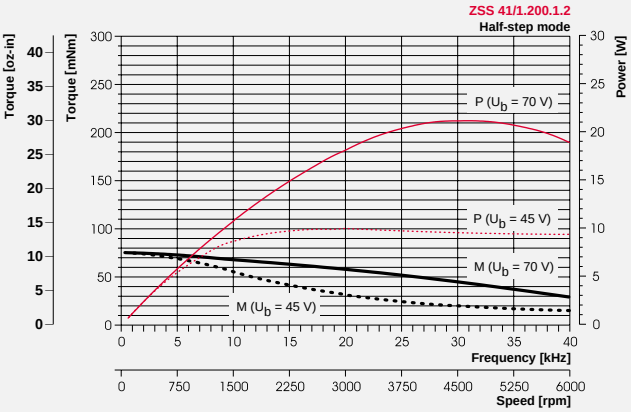

Fig. 21

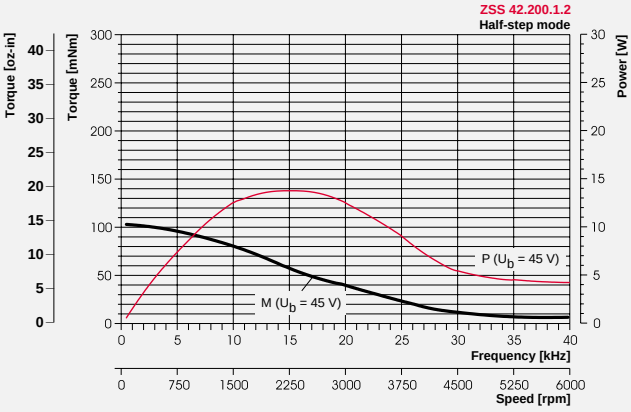

Fig. 19

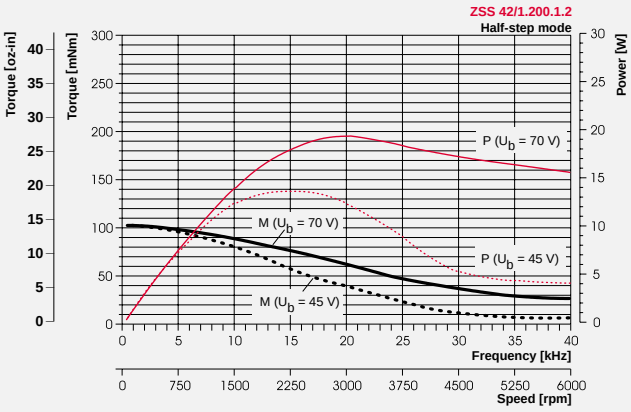

Fig. 22

Stepping Motors
ZSS 19 – 56

Diameter: 19 to 56 mm (0.75” to 2.2”)
Torque: 3.8 to 700 mNm (0.54 to 99 oz-in)

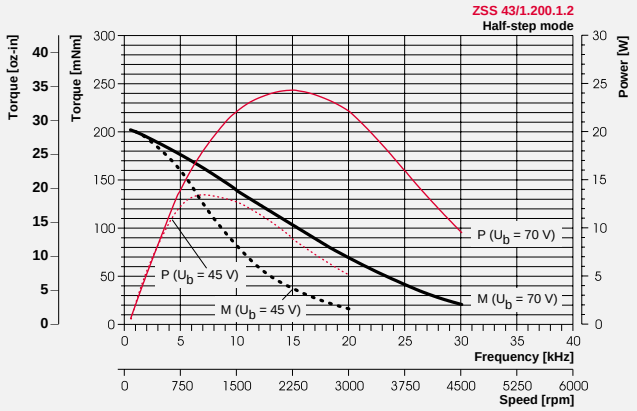

Fig. 23

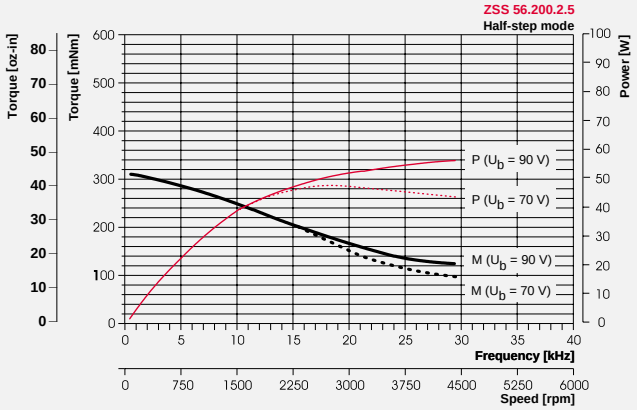

Fig. 25

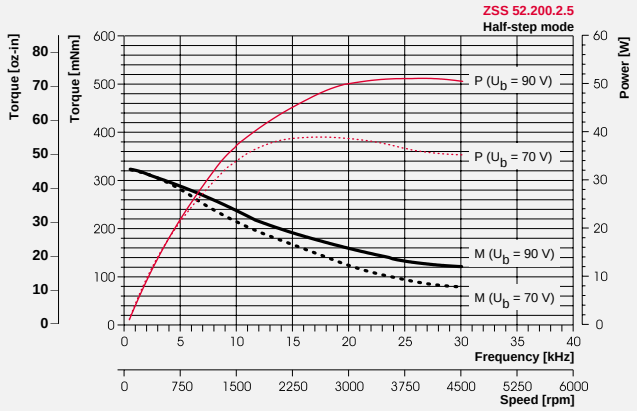

Fig. 24

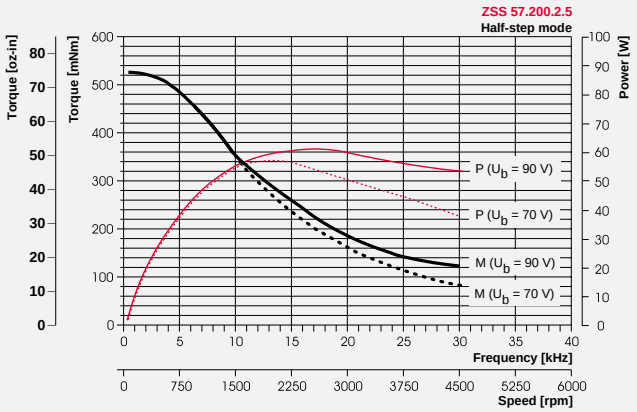

Fig. 26