Selecting Your Linipower Jack • Technical Notes

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Technical Notes

LINIPOWER JACK

Selecting Your Linipower Jack

Selecting Process

1) **Equipment** ....Table or theatre lifter, conveyer line selector etc.
2) **Layout**...................................Patterns of multiple jack systems (4, 6 or more units), driving, coupling etc.
3) **Maximum Load (W)** ....Load or work weight N {kgf}.
4) **Screw Shaft Speed (V)**........Required speed for jack, m/min.
5) **Stroke** ....Actual stroke used, mm.
6) **Screw Types**........................Machine Screw Type (JWM), Ball Screw Type (JWB), High Lead Ball Screw Type (JWH).
7) **Installation Configuration**...Basic specifications (lift or suspend, with or without rotation prevention). Travel nut type (lift or suspend).
8) **Installation Conditions**........Fixed base, shaft end, clevis etc. For compression loads, consider buckling.
9) **Life Expectancy** ....Years jack will withstand wear (for JWB, JWH only).

Selecting Process 1　Selecting Your Linipower Jack

1. Adjusted Load Ws

Calculate the "Adjusted Load" Ws, by determining the correct safety coefficient rate (Table 1) for specific load conditions.

$$\underset{N\ \{kgf\}}{\text{Adjusted Load Ws}} = \underset{N\ \{kgf\}}{\text{Maximum Load W}} \times \text{Coefficient Sf}$$

2. Load per jack

Calculate load W per jack, by using the adjusted load Ws obtained above.

For a synchronous drive, use a synchronous drive coefficient (Table 2).

$$\underset{N\ \{kgf\}}{\text{Load / jack W}} = \frac{\text{Adjusted Load Ws}\quad N\ \{kgf\}}{\text{No. of jacks} \times \text{synchro. drive coefficient fd}}$$

Table 1. Coefficient Sf

Load Conditions	Example Purposes	Coefficient Range
Smooth movement with no shock Light load	Opening and closing a valve Adjusting a conveyor	1.0～1.3
Light shock Medium load	Use with various kinds of trans-porting equipment and lifters	1.3～1.5
Severe shock and/or vibration Heavy load	Use with large transporting carriages Holding the position of a press roller	1.5～3.0

Note) The above table is for general reference only. Consider particular operating conditions under which you operate before selecting a coefficient.

Table 2. Synchronous Drive Coefficient fd

No. of units	2	3	4	5～8
Coefficient	0.95	0.9	0.85	0.8

3. Jack Selection

Follow these steps to make a preliminary jack selection.

①Select (temporary) worm speed ratio by adjusting the screw shaft rpm. If difficult to select, inspect by H speed.
②Consider traveling space when selecting stroke.
③Select options based on your needs.

4. Verifying Buckling and Screw Shaft rpm

①Allowable Buckling Load

For a compressive load, verify that it does not exceed the allowable buckling load (See pgs. 18～20). If it does, increase jack size and recalculate.

②Allowable Screw Shaft rpm

If using a travel nut, verify that it does not exceed the allowable shaft rpm (See pg. 23). If it does, increase jack size and recalculate.

5. Confirming Required Input rpm

Determine the required input rpm, using the required screw shaft speed.

$$N = \frac{V}{\ell} \times R$$

N ：Input rpm		r/min
V ：Screw Shaft Speed		m/min
ℓ ：Screw Lead		m
R ：Gear Ratio		

6. Verifying Required Input Torque

Calculate required input torque.

$$T = \frac{W \times \ell}{2 \times \pi \times R \times \eta} + To$$

T ：Required Input Torque　N・m {kgf･m}
W ：Lifting Load　N・{kgf}
ℓ ：Screw Lead　m
π ：Circular Constant　3.14
R ：Gear Ratio
η ：Overall Efficiency
To：Tare Drag Torque　N・m {kgf･m}

* For screw lead, gear ratio, overall efficiency and tare drag torque, see pgs. 29, 55 and 79. Take caution in selecting screw units.　(8mm→0.008m)

7. Verifying Input Capacity

SI Unit　$P = \dfrac{T \times N}{9550}$

Gravitational Unit　$P = \dfrac{T \times N}{974}$

T ：Required Input Torque		N・m {kgf･m}
P ：Required Input Load		kW
N ：Input rpm		r/min

8. Allowable Overhang Load

If attaching a sprocket, gear, or belt to the input shaft, verify that the total weight is within the allowable overhang load. (See pg. 23) If not, increase jack size and recalculate.

9. Verifying Wear Life (JWB/JWH only)

Check if wear life is sufficient. (See pg.22)

When increasing travel distance, increase jack size and recalculate.

* Life cannot be calculated for JWM (Machine Screw Type).

10. Selecting Your Options

Select options that best suit your needs.

1. Output Option 2. Installation Option
3. Sensor Option 4. Input Option
5. Accessory Option

(See pg.89~)

11. Jack Number

Determine the actual Linipower Jack number that meets the above conditions.

Selecting Process 2 Parts Options

Motor

Determine the required drive unit capacity for synchronous drive Pt.

1. Add the torque required for each jack $T_{1\sim4}$ on the drive unit side to determine the overall Torque Tt.

<Required Torque per Jack>

$$T_{1\sim4} = \frac{T}{(\text{Gearbox efficiency})^{\text{No. of gear box}}}$$

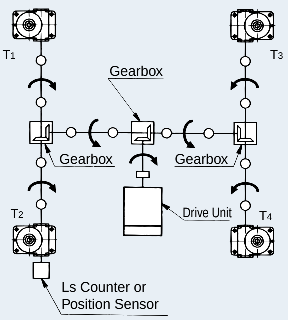
<Required Torque for the Drive Unit>

$$Tt = T_1 + T_2 + T_3 + T_4$$

$T_{1\sim4}$: Required torque for each jack on the drive unit side N • m {kgf·m}
T : Required input torque per jack N • m {kgf·m}
Gear box efficiency: Assume 0.9
Tt : Required torque for the drive-unit N • m {kgf·m}

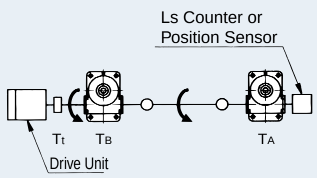
For a four unit system (Fig. 1), $T_{1\sim4} = \frac{T}{(0.9)^2}$

Fig. 1



2. Be certain that the required input torque calculated is within the allowable input shaft torque.
(e.g.) If jacks are arranged in a linear structure as shown in Fig. 2, the drive unit input shaft consumes the total input torque required for both jacks. This doubled torque should not exceed the allowable input torque.

Fig. 2



T_A : Required input torque for Jack A
T_B : Required input torque for Jack B
Required torque at the motor $Tt = T_A + T_B <$ Allowable input shaft torque

3. Next, determine the required drive unit capacity Pt with input rpm N and 1.

SI Unit $Pt = \frac{Tt \times N}{9550}$

Gravitational Unit $Pt = \frac{Tt \times N}{974}$

Pt: Required capacity at the drive unit kW
Tt: Total required torque at the drive unit N • m{kgf·m}
N: Input rpm for the jack r/min

Other Parts Options

1. Gear box....Select based on input rpm and required torque.
See Tsubaki Emerson Miter Gear Box Catalog. (Catalog No. 985-K515)

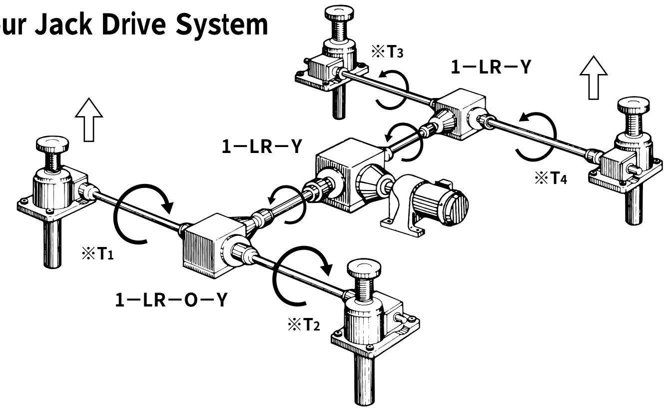
2. Coupling....Select based on allowable torque and maximum shaft diameter.
See Tsubaki Emerson Coupling Catalog. (Consult TEM)

Example

Jack Selection Example 1

Example: Four jack synchronous drive for lifting with 3-phase 220v/60Hz motor (see layout below), operating at room temperature under low dust conditions.
Guide installed on the equipment to prevent side load.
Fixed base-Guided shaft end/Fixed shaft end.
Operation cycle : (2 times/hour) X (8 hours/day) X (300 days/year) X (3 years usage)
1) Maximum load : 88.2 kN {9 tf} / 4 Units
2) Required speed : 10 mm/s (600 mm/min)
3) Operating stroke : 260 mm

Four Jack Drive System



Jacks lift as rotational input is applied in the direction of each arrow.

See pg.10 for T_1～T_4

SI Unit

1. Adjusted load Ws is (coefficient Sf=1.3)
   Ws＝88200×1.3＝114660 N

2. Load W per jack is
   $$W = \frac{114660}{4\times0.85} = 33724\ \text{N}$$

3. Considering speed, efficiency and drive unit, JWB050USH is preliminarily selected.

4. For 260mm operating stroke, use 300 mm stroke for the jack. Considering its possible dust generation and shaft end stability (see layout above), the appropriate jack would be JWB050USH3JM.

5. Since this load is compressive, calculate the operated buckling load based on the formula used on pgs. 19～20. (Assume safety level Sf=4.) See pg.20 for details on calculations.
   $$P_{CR} = 20\times10^4\times\left(\frac{31.3^2}{637}\right)^2$$
   *Refer to dimensions on page 63.
   $$= 473073\ \text{N}$$
   $$Sf = \frac{473073}{33724} > 4 \cdots \text{OK}$$

6. This is not a travel nut type so there is no need to confirm allowable screw shaft rpm. (Inspect the allowable screw shaft rpm if using a travel nut.)

{ Gravitational Unit }

1. Adjusted load Ws is (coefficient Sf=1.3)
   Ws＝9000×1.3＝11700 kgf

2. Load W per jack is
   $$W = \frac{11700}{4\times0.85} = 3442\ \text{kgf}$$

3. Considering speed, efficiency and drive unit, JWB050USH is preliminarily selected.

4. For 260mm operating stroke, use 300 mm stroke for the jack. Considering its possible dust generation and shaft end stability (see layout above), the appropriate jack would be JWB050USH3JM.

5. Since this load is compressive, calculate the operated buckling load based on the formula used on pgs. 19～20. (Assume safety level Sf=4.) See pg.20 for details on calculations.
   $$P_{CR} = 20\times10^3\times\left(\frac{31.3^2}{637}\right)^2$$
   *Refer to dimensions on page 63.
   $$= 47307\ \text{kgf}$$
   $$Sf = \frac{47307}{3442} > 4 \cdots \text{OK}$$

6. This is not a travel nut type so there is no need to confirm allowable screw shaft rpm. (Inspect the allowable screw shaft rpm if using a travel nut.)

SI Unit

7. Required Input Capacity

①$N=\frac{0.60}{0.010}\times6=360$ r/min

②$T=\frac{33724\times0.010}{2\times3.14\times6\times0.64}+1.37=15.4$ N・m

From ①② $P=\frac{15.4\times360}{9550}=0.58$ kW

Rated input capacity for JWB050USH3 is 0.58 kW < 2.2 kW. (If not suitable, increase the frame number or reduce the screw shaft rpm and recalculate.)

8. Overhang load dose not apply so inspection is not required. Inspect as appropriate.

9. Verifying Wear Life for JWB

Calculate the expected travel distance from usage frequency. (See pg. 22)

Expected driving distance = $0.26\times2\times8\times300\times10^{-3}\times3=$ 3.74 km

We then find that the suitable jack number is JWB050. ……OK

10. Jack Options

Possible dust ⟶ Use with bellow

Shaft end ⟶ Table shaft end

Finally, we conclude by selecting JWB050USH3JM.

{ Gravitational Unit }

7. Required Input Capacity

①$N=\frac{0.60}{0.010}\times6=360$ r/min

②$T=\frac{3442\times0.010}{2\times3.14\times6\times0.64}+0.14=1.57$ kgf・m

From ①② $P=\frac{1.57\times360}{974}=0.58$ kW

Rated input capacity for JWB050USH3 is 0.58 kW < 2.2 kW. (If not suitable, increase the frame number or reduce the screw shaft rpm and recalculate.)

8. Overhang load dose not apply so inspection is not required. Inspect as appropriate.

9. Verifying Wear Life for JWB

Calculate the expected travel distance from usage frequency. (See pg. 22)

Expected driving distance = $0.26\times2\times8\times300\times10^{-3}\times3=$ 3.74 km

We then find that the suitable jack number is JWB050. ……OK

10. Jack Options

Possible dust ⟶ Use with bellow

Shaft end ⟶ Table shaft end

Finally, we conclude by selecting JWB050USH3JM.

Selecting Parts (Parts Options)

A. Selecting a Drive Unit

1. Required Drive Unit Torque

Calculate the required torque T_1 (2.3.4) for each jack on the drive unit side.

SI Unit $T_1=\frac{15.4}{0.9^2}=19.0$ N・m

{ Gravitational Unit $T_1=\frac{1.57}{0.9^2}=1.94$ kgf・m }

Since 4 jacks follow the same route

SI Unit $Tt=T_1\times4=76.0$ N・m

{ Gravitational Unit $Tt=T_1\times4=7.76$ kgf・m }

2. Inspecting the Rated Input Torque

In this case, inspection is not necessary because 2 or more jacks are not arranged in a linear structure.

3. Required Capacity for the Drive Unit Pt

SI Unit $Pt=\frac{76.0\times360}{9550}=2.87$ kW

{ Gravitational Unit $Pt=\frac{7.76\times360}{974}=2.87$ kW }

from the input rpm 360r/min we find

$\frac{1800}{360}=5$

Based on this data we select GMTA370-50L5B, Tsubaki Emerson 3.7kW gearmotor with a brake unit.

For details, see Tsubaki Emerson Compact Gearmotor Catalog (Catalog No.985K315).

B.1. B.1.Select a gear box based on the required input torque of 15.4N・m{kgf・m}, and input rpm of 360r/min.

1.1. Gear box on each side of the jack must tolerate the combined torque of 2 jacks. Thus we selected gear box ED4M.

$\frac{15.4\times2}{0.9}=34.3$ N・m $\left\{\frac{1.57\times2}{0.9}=3.49 \text{ kgf・m}\right\}$

(Caution: Make sure the direction of the gear box shaft rotation is correct.)

1-2. Gear box by the gearmotor requires torque for 4 jacks

$\frac{15.4\times4}{0.9^2}=76.1$ N・m $\left\{\frac{1.57\times4}{0.9^2}=7.76 \text{ kgf・m}\right\}$

From this, we find that the gear box ED6M is most suitable.

Gear box by the jack Left ⟶ ED4M 1-LR-O-Y

Right ⟶ ED4M 1-LR-Y

Gear box by the gearmotor ⟶ ED6M 1-LR-Y

(For details see Tsubaki Emerson Miter Gear Box Catalog).

B.2. Select couplings based on your requirements. (See Tsubaki Emerson Coupling Catalog for details.)

The following is an example process for selecting the right couplings. (Refer to the layout on page 11.)

2-1. Select couplings used between each jack and their adjacent gear box based on the required input torque per jack, 15.4N・m {1.57kgf・m}, input shaft diameter (φ20 for JWB050USH), and the gear box shaft diameter (φ19 for ED4M).

Required number is 2×2×2×=8.

2-2. Select couplings used between the gear boxes based on the required torque for the nearest pair of jacks,

$\frac{15.4\times2}{0.9}=34.3$ N・m $\left\{\frac{1.57\times2}{0.9}=3.49 \text{ kgf・m}\right\}$

and the diameter of each gear box shaft: one by the jack (φ19 for ED4M), and the other by the gearmotor (φ25 ED6M). Required number is 2×2=4.

2-3. Select couplings used between each gear box and the gearmotor based on the total required torque for the four jacks,

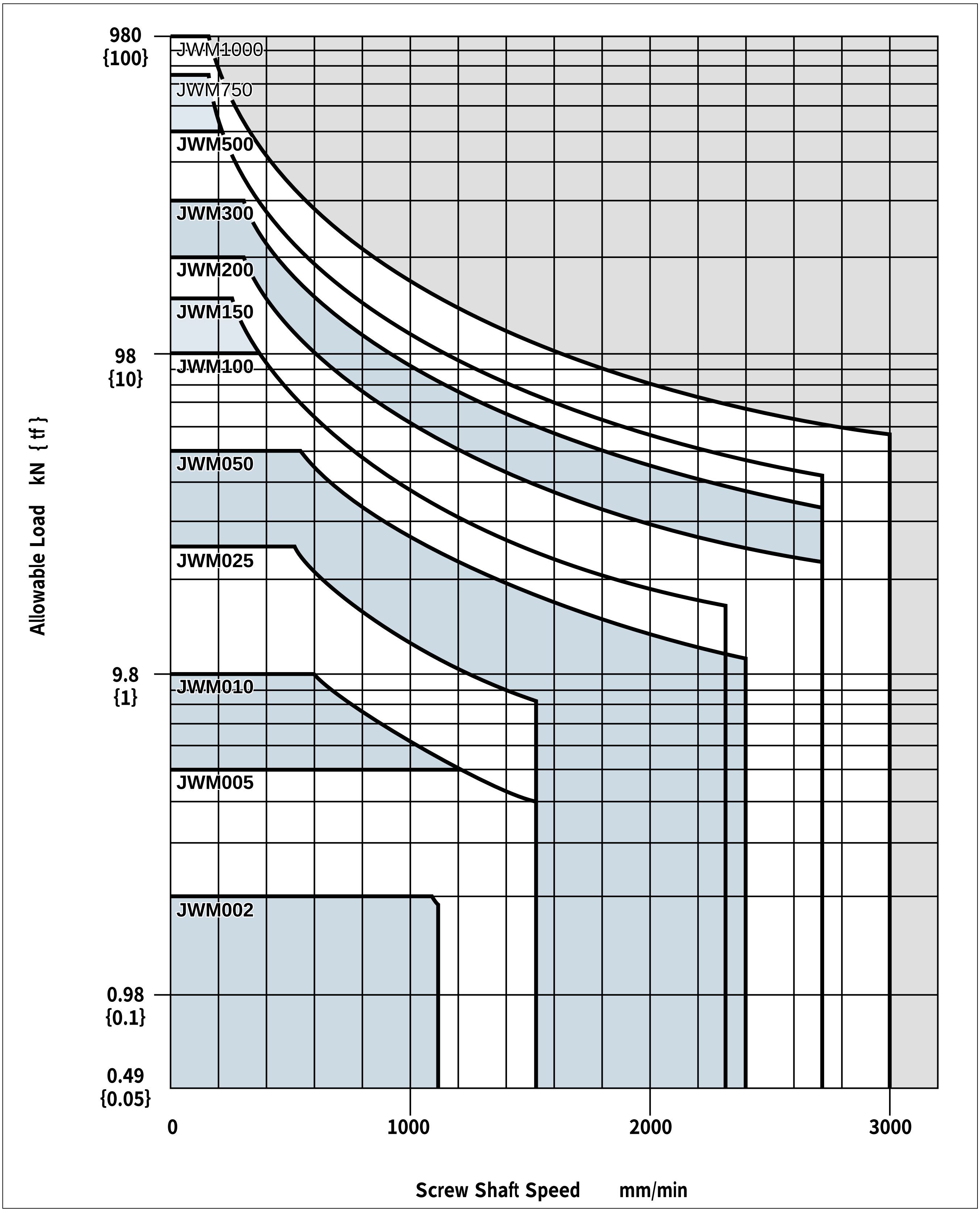
$\frac{15.4\times4}{0.9^2}=76.1$ N・m $\left\{\frac{1.57\times4}{0.9^2}=7.76 \text{ kgf・m}\right\}$

and the diameters of the gear box (φ25 for ED6M) and the output shafts (φ50 for GMTA370-50L5B).

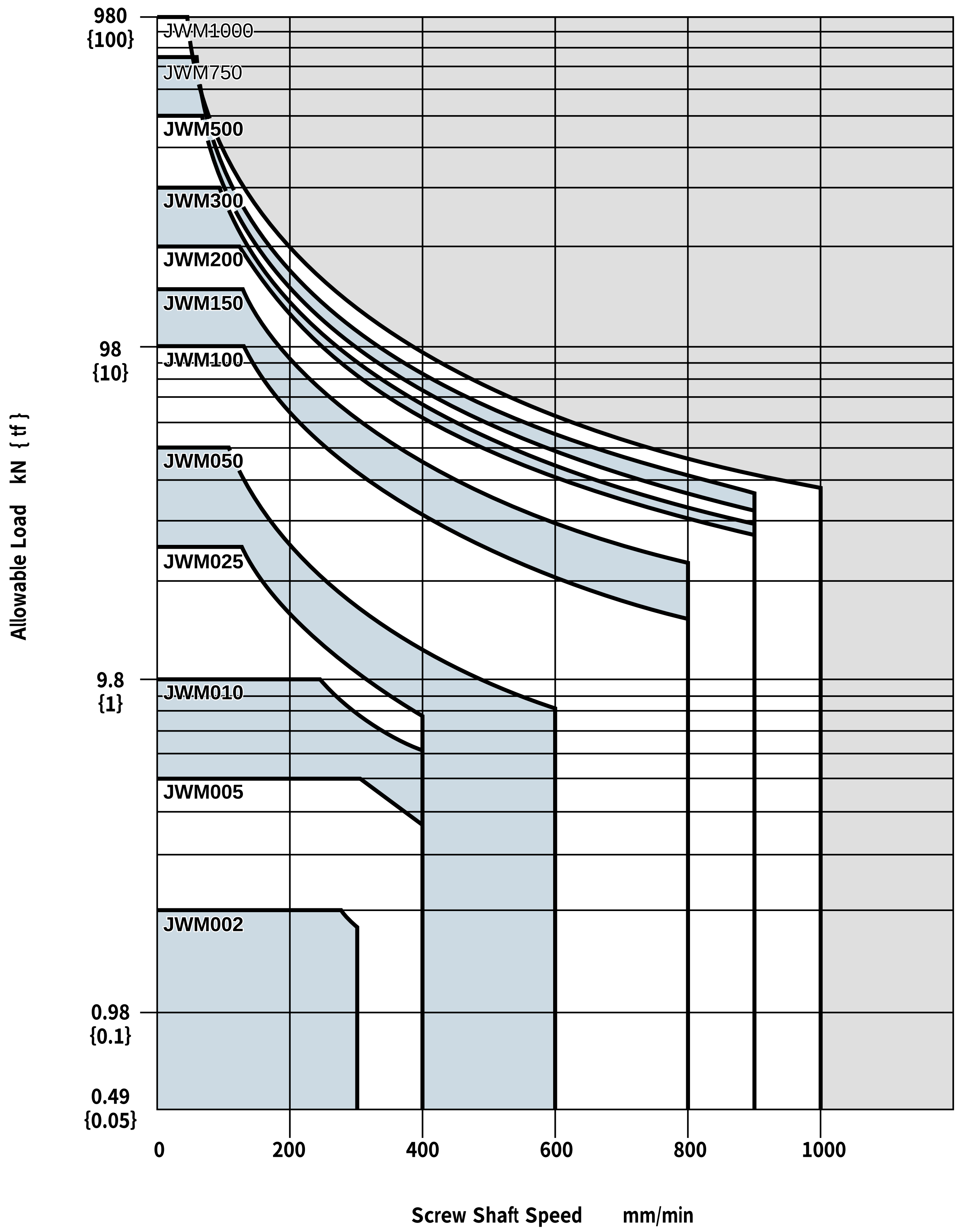
Screw Shaft Speed (Lifting) and Allowable Load for JWM (Machine Screw Type)

This graph illustrates the relationship between screw shaft speed and allowable load for each frame number. Use this graph to select the correct frame number for specific requirements.
If inspection is required, see pg. 9 for calculation details.

■H Speed



■L Speed

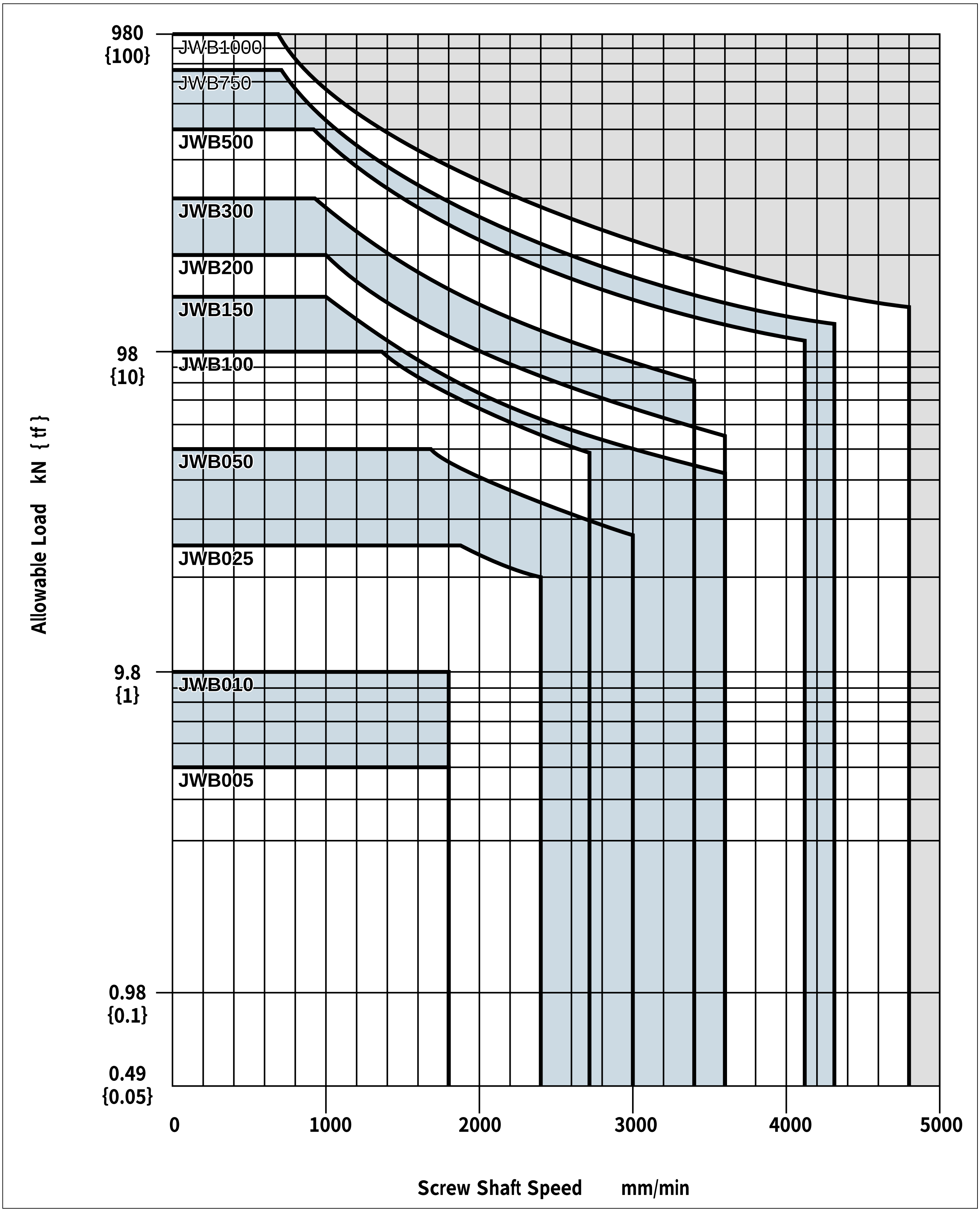


980
{100}
98
{10}
9.8
{1}
0.98
{0.1}
0.49
{0.05}
Allowable Load kN {tf}
JWM1000
JWM750
JWM500
JWM300
JWM200
JWM150
JWM100
JWM050
JWM025
JWM010
JWM005
JWM002
0
200
400
600
800
1000
Screw Shaft Speed mm/min

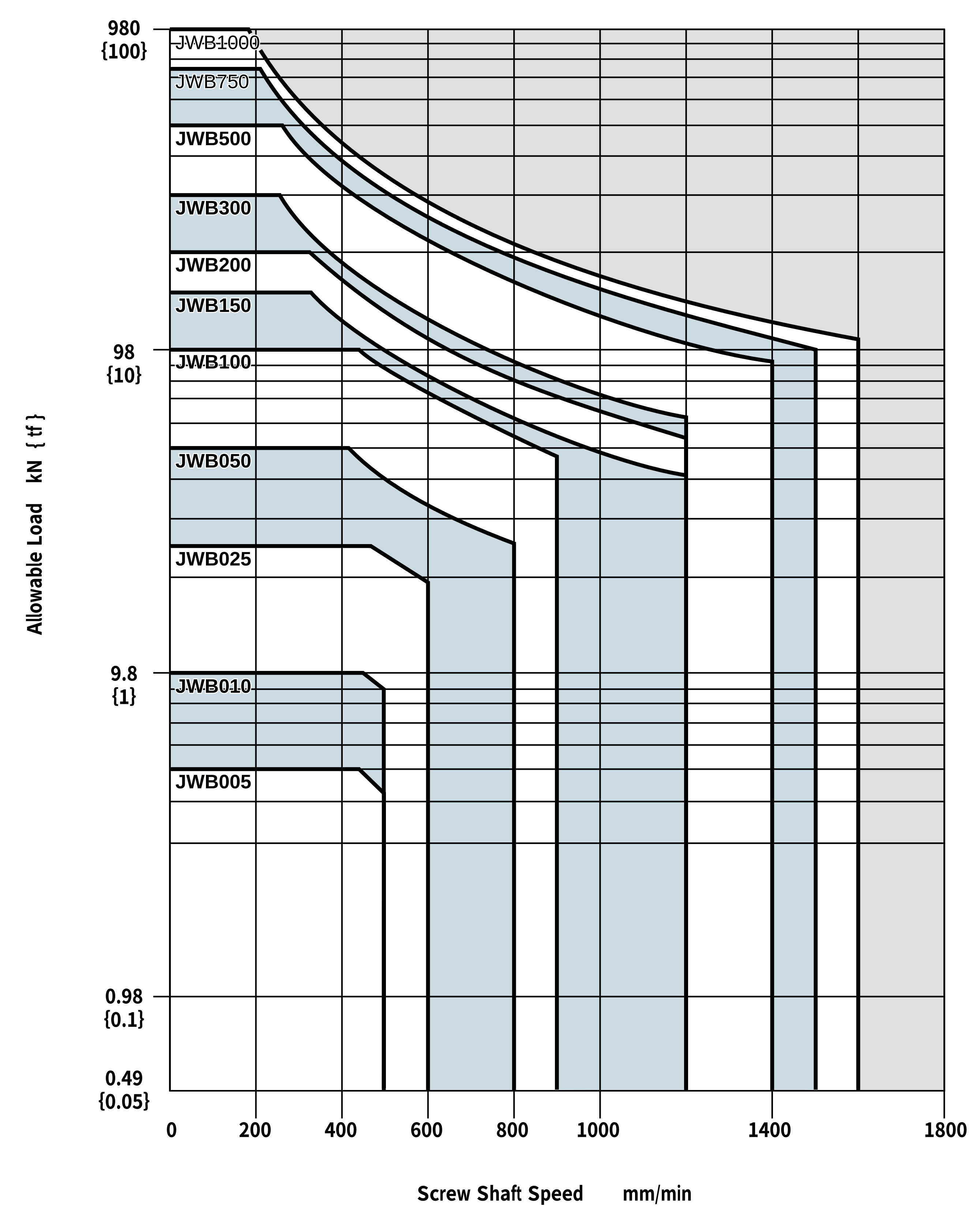
Screw Shaft Speed (Lifting) and Allowable Load for JWB (Ball Screw Type)

This graph illustrates the relationship between screw shaft speed and allowable load for each frame number. Use this graph to select the correct frame number for specific requirements.
If inspection is required, see pg. 9 for calculation details.

■H Speed



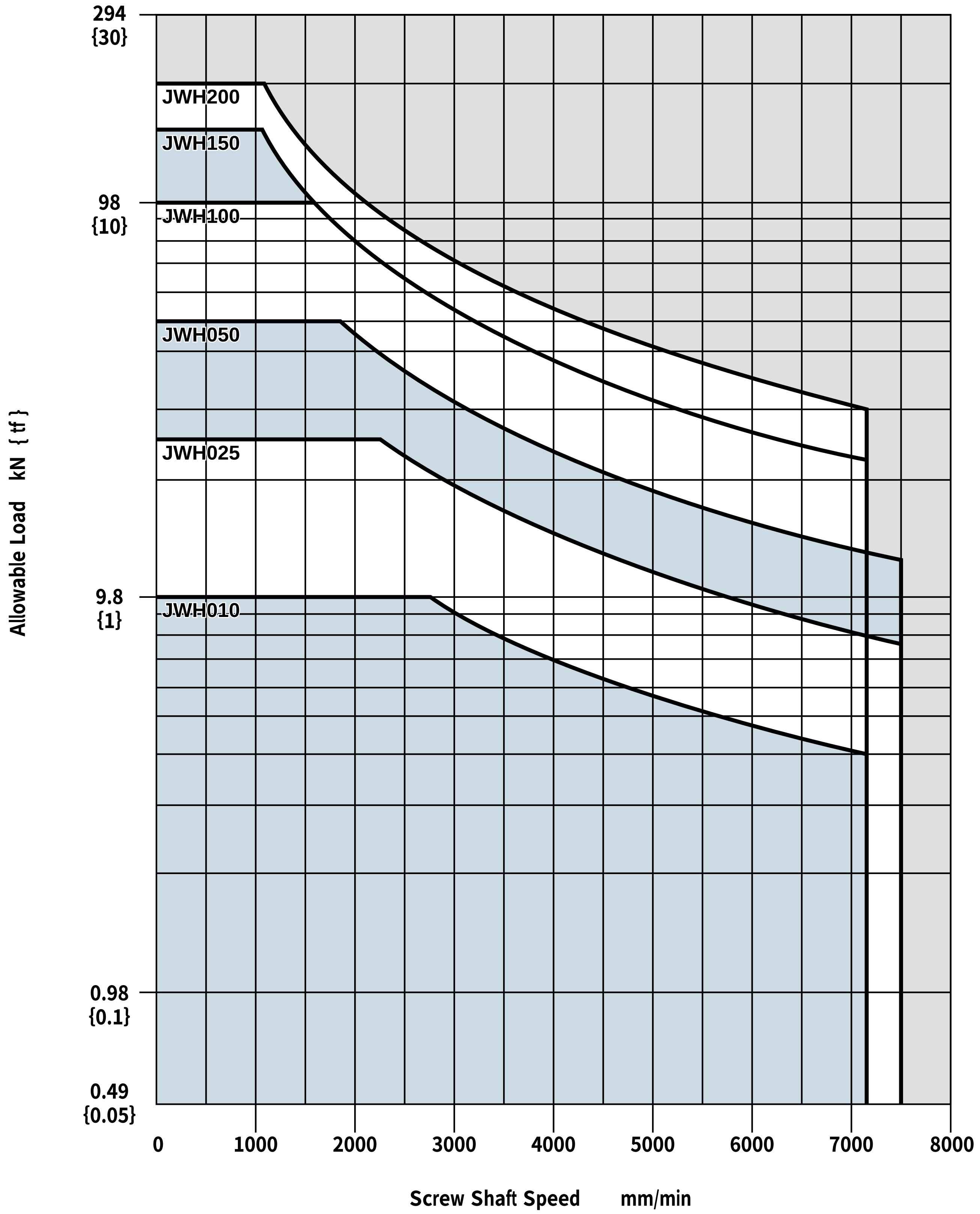
■L Speed


980
{100}
98
{10}
9.8
{1}
0.98
{0.1}
0.49
{0.05}
Allowable Load kN {tf}
JWB1000
JWB750
JWB500
JWB300
JWB200
JWB150
JWB100
JWB050
JWB025
JWB010
JWB005
0
200
400
600
800
1000
1400
1800
Screw Shaft Speed mm/min

Screw Shaft Speed (Lifting) and Allowable Load for JWH (High Lead Ball Screw Type)

This graph illustrates the relationship between screw shaft speed and allowable load for each frame number.
Use this graph to select the correct frame number for specific requirements.
If inspection is required, see pg. 9 for calculation details.

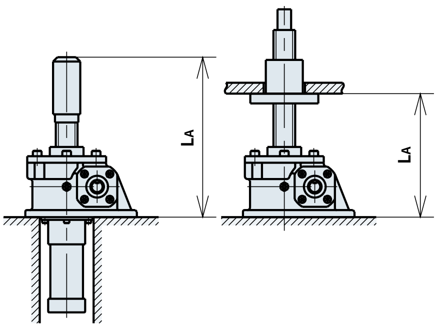
■H Speed



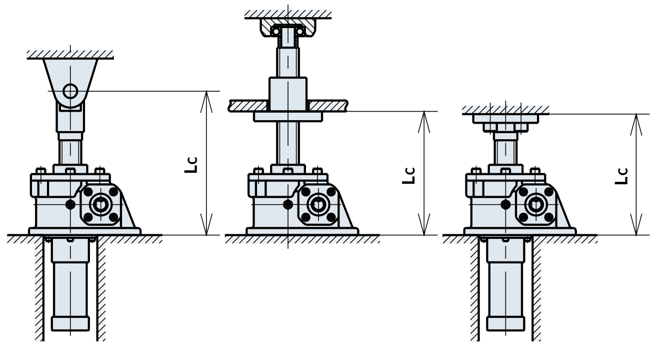
Allowable Buckling Load for JWM (Machine Screw Type)

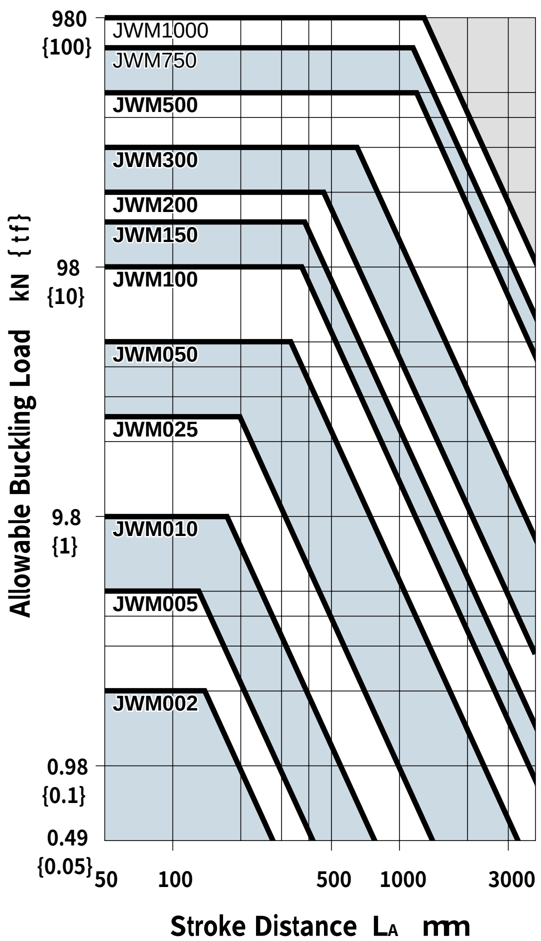
- Use this graph to select the correct frame number based on a specific buckling load, for compression loads. The graph for Allowable Buckling Load assumes a load safety rate of Sf = 4.
  ①From the installation conditions shown in A and C below, determine the correct distance for L_A and Lc. (For other installation conditions, see pg. 20)
  ②The graphs allow you to select the correct frame number based on a specific load W (vertical axis) and stroke distance L_A (horizontal axis).
- Make sure side load does not apply. The graph below assumes no side load.
- If the shaft is loaded in tension buckling can be avoided, and hence be highly economical.

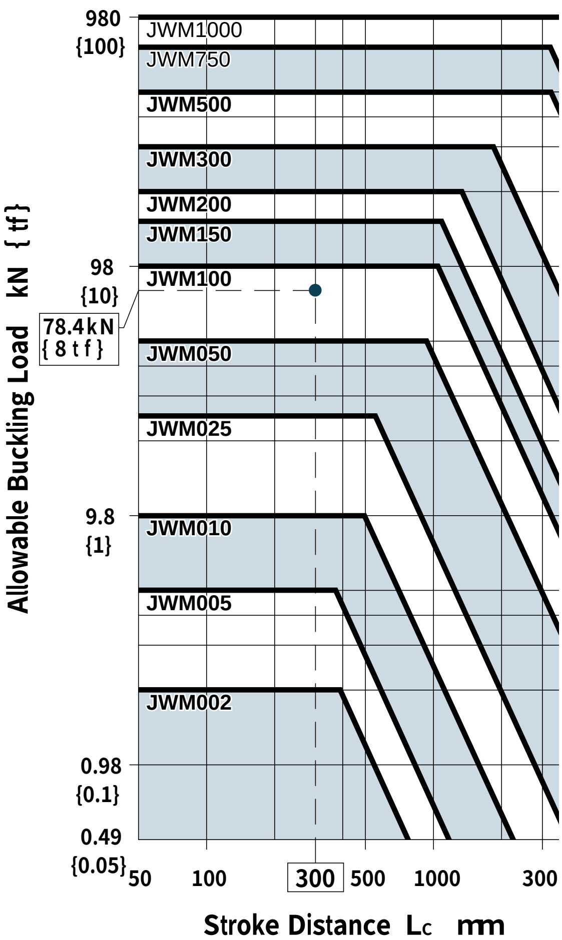
A Fixed base - Shaft end free



C Fixed base - Guided shaft end/ Fixed shaft end







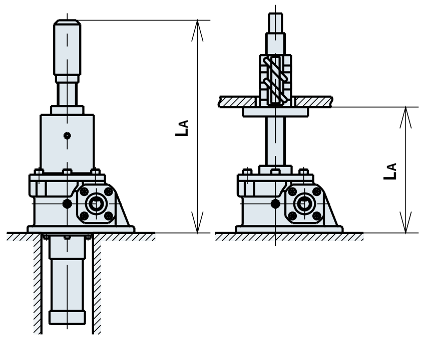
Notes)

1. The dotted line on the graph represents an example based on W78.4kN {8tf} load (buckling safety rate of Sf =4) and installation condition C with a distance of 300mm. From this graph, JWM100 is selected as the suitable frame number for these conditions.
2. If full inspection is required, see pg. 20 for calculation details.

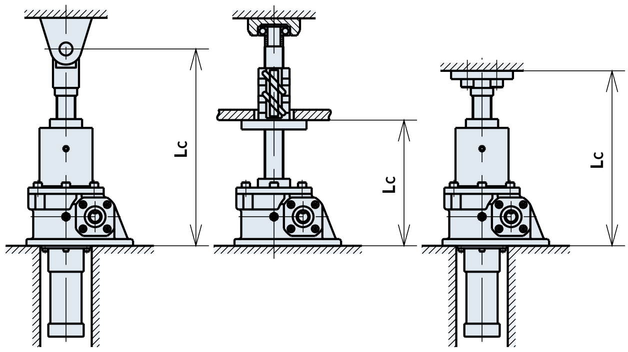
Allowable Buckling Load for JWB (Ball Screw Type)

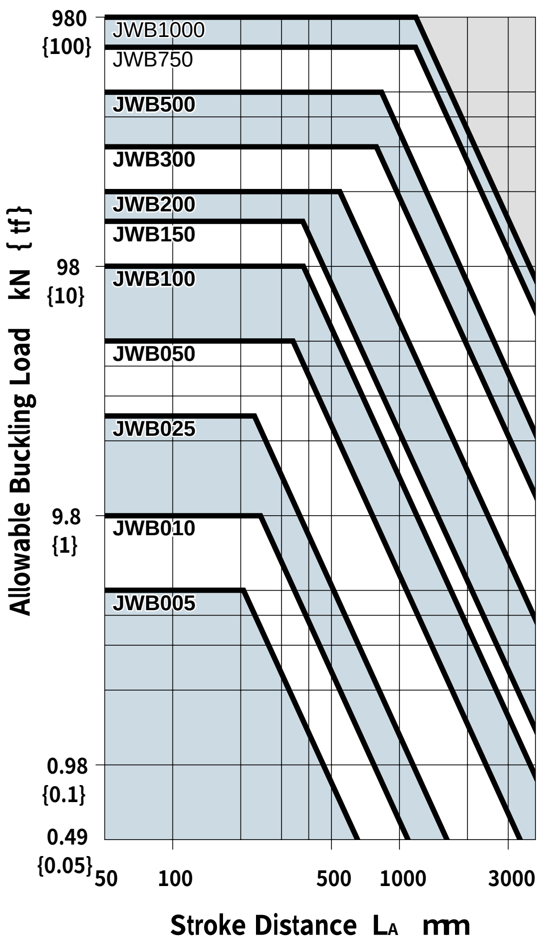
- Use this graph to select the correct frame number based on a specific buckling load, for compression loads.
  The graph for Allowable Buckling Load assumes a buckling load safety rate of Sf = 4.
  ①From the installation conditions shown in A and C below, determine the correct distance for L_A and Lc. (For other installation conditions, see pg. 20)
  ②The graphs allow you to select the correct frame number based on a specific load W (vertical axis) and stroke distance L_A (horizontal axis).
- Make sure side load does not apply. The graph below assumes no side load.
- If the shaft is loaded in tension buckling can be avoided, and hence be highly economical.

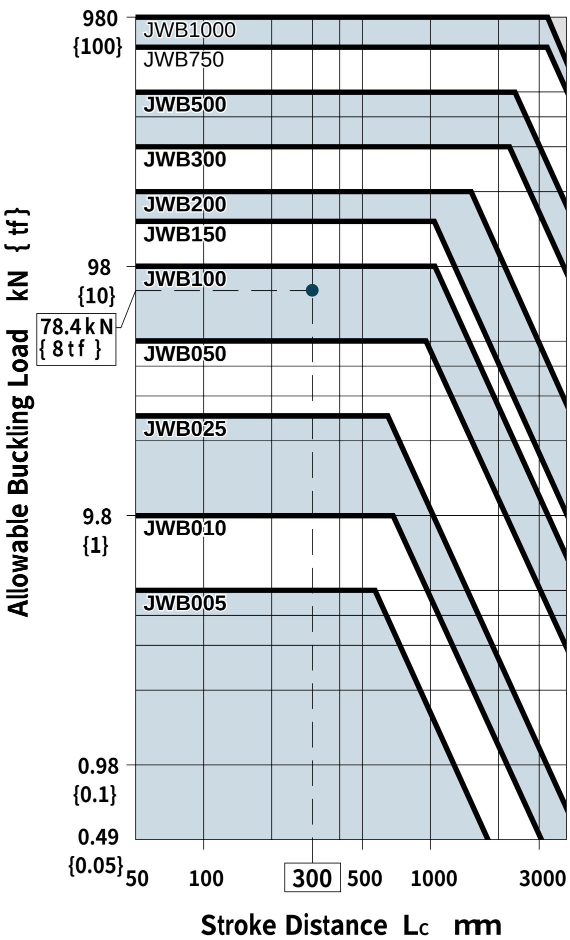
A Fixed base - Shaft end free



C Fixed base - Guided shaft end/ Fixed shaft end







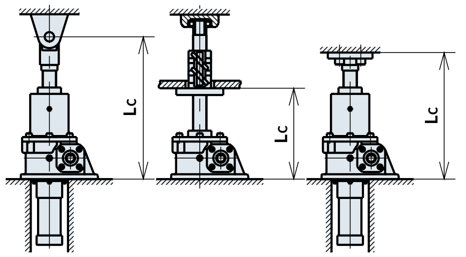
Notes)

1. The dotted line on the graph represents an example based on W78.4kN {8tf} load (buckling safety rate of Sf =4) and installation condition C with a distance of 300mm. From this graph, JWM100 is selected as the suitable frame number for these conditions.
2. If full inspection is required, see pg. 20 for calculation details.

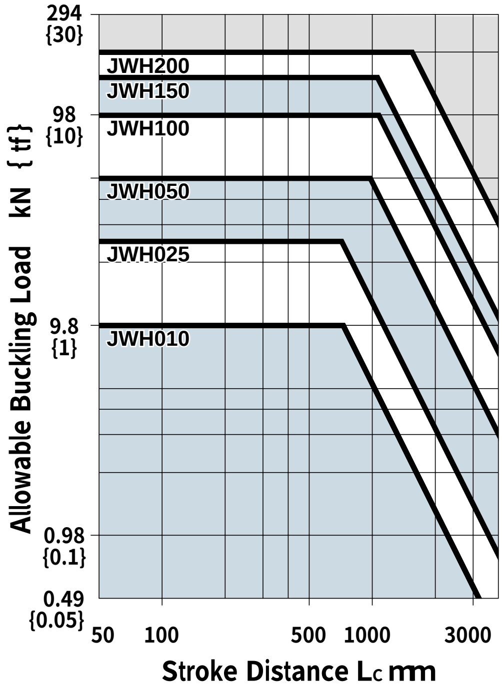
Allowable Buckling Load for JWH (High Lead Ball Screw Type)

- Use this graph to select the correct frame number based on a specific buckling load for compression loads. The graph for Allowable Buckling Load assumes a buckling load safety rate of Sf = 4.
  ①From the installation condition shown in C below, determine the correct distance for Lc. (For other installation conditions, see technical data).
  ②The graph allows you to select the correct frame number based on a specific load W (vertical axis) and stroke distance Lc (horizontal axis).
- Make sure side load does not apply. The graph below assumes no side load.
- If the shaft is loaded in tension buckling can be avoided, and hence be highly economical.

C Fixed base - Guided shaft end/ Fixed shaft end



Note) If detailed inspection is required, see Technical Data below.



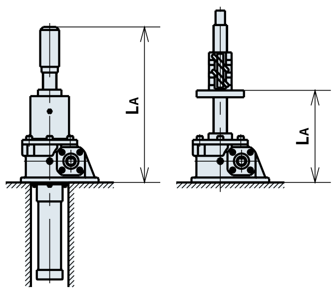
Technical Data

Formula used to calculate allowable buckling load.

$$P_{CR} = m \times \left(\frac{d^2}{L}\right)^2$$

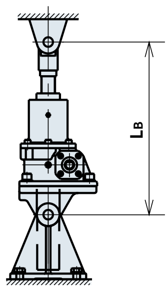
Make sure $P_{CR} > W \times Sf$

- P_{CR} : Allowable buckling load N {kgf}
- d : Screw shaft root diameter mm (Refer to pgs. 29～30 for JWM, pgs. 55～56 for JWB and pgs. 79～80 for JWH)
- m : Support coefficient (Select installation condition from the figures below)
- L : Screw shaft projection distance mm (See graph for each frame number)
- W : Load per jack N {kgf}
- Sf : Buckling safety rate (Assume 4)



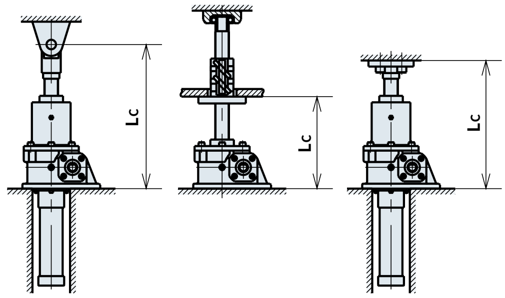
A Fixed base-Shaft end free

	m
SI Unit	2.5×10^4
Gravitational Unit	2.5×10^3



B Base and shaft end with clevis

	m
SI Unit	10×10^4
Gravitational Unit	10×10^3



C Fixed base-Guided shaft end / Fixed shaft end

	m
SI Unit	20×10^4
Gravitational Unit	20×10^3

SI Unit

We calculate the P_{CR} of JWM100USH5JI, based on 4900N load and installation condition C (Fixed base and guided shaft end/Fixed shaft end.)

(SF=4)

$$P_{CR} = 20 \times 10^4 \times \left(\frac{38.4^2}{791}\right)^2$$

* See dimensions on pg. 41

$= 695027$ N

$W \times SF = 49000 \times 4$

$= 196000$ N

$P_{CR} > W \times Sf$

695027>196000…OK

{ Gravitational Unit }

We calculate the P_{CR} of JWM100USH5JI, based on 4900N load and installation condition C (Fixed base and guided shaft end/Fixed shaft end.)

(SF=4)

$$P_{CR} = 20 \times 10^3 \times \left(\frac{38.4^2}{791}\right)^2$$

* See dimensions on pg. 41

$= 69502$ kgf

$W \times SF = 5000 \times 4$

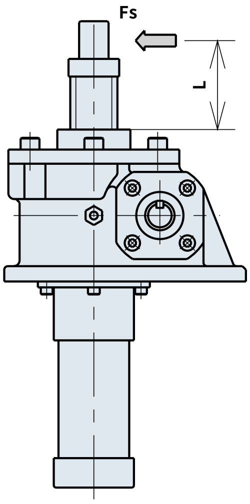
$= 20000$ kgf

$P_{CR} > W \times Sf$

69502>20000…OK

Allowable Side Load for JWM (Machine Screw Type)

Guides are typically used for Machine Screw Types as shown in the diagram below. However, if the shaft projection distance (L) beyond the housing surface is relatively short, a certain amount of side load is acceptable.
Note) L represents the distance of screw shaft projection that affects side load. It does not refer to stroke distance.

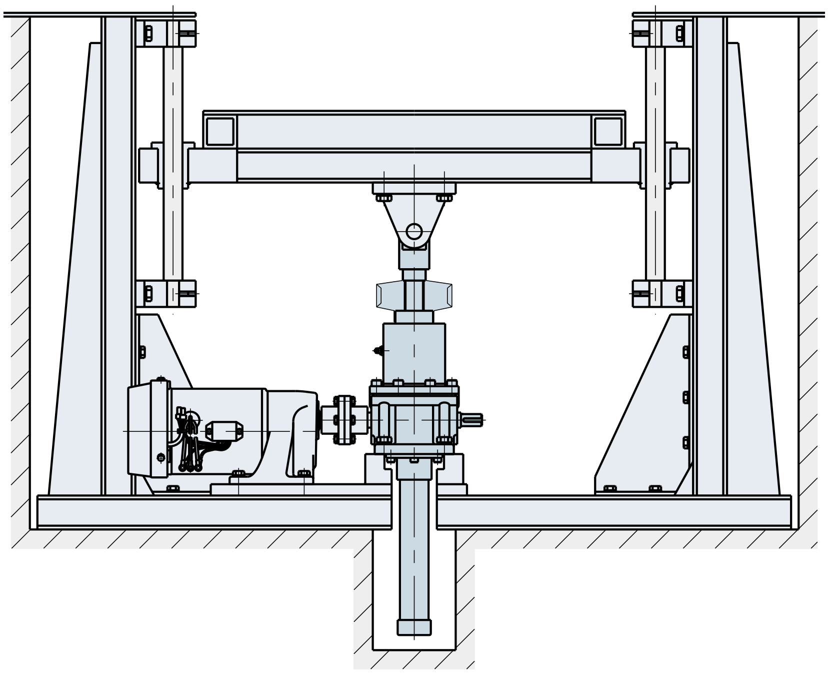


Allowable Side Load N {kgf}

Screw Shaft Projection Distance L mm \ Frame Number	002	005	010	025	050	100	150	200	300	500	750	1000
100	83	128	318	570	2,500	4,010	4,610	8,210	21,700	85,300	73,500	159,700
	{9}	{13}	{32}	{59}	{255}	{409}	{470}	{838}	{2,210}	{8,700}	{7,500}	{16,300}
200	42	64	159	290	1,250	2,010	2,300	4,110	10,800	50,400	56,700	79,900
	{4}	{7}	{16}	{29}	{128}	{205}	{235}	{419}	{1,110}	{5,150}	{5,780}	{8,150}
300	28	43	106	190	830	1,340	1,540	2,740	7,200	33,600	37,800	53,200
	{3}	{4}	{11}	{20}	{85}	{136}	{157}	{279}	{740}	{3,430}	{3,860}	{5,430}
400	21	32	79	140	620	1,000	1,150	2,050	5,400	25,200	28,300	39,900
	{2}	{3}	{8}	{15}	{64}	{102}	{118}	{210}	{550}	{2,570}	{2,890}	{4,080}
500	–	27	64	110	500	800	920	1,640	4,300	20,200	22,700	31,900
	–	{3}	{6}	{12}	{51}	{82}	{94}	{168}	{440}	{2,060}	{2,310}	{3,260}
600	–	25	53	100	420	670	770	1,370	3,600	16,800	18,900	26,600
	–	{3}	{5}	{10}	{43}	{68}	{78}	{140}	{370}	{1,720}	{1,930}	{2,720}
700	–	23	51	90	360	570	660	1,170	3,100	14,400	16,200	22,800
	–	{2}	{5}	{9}	{36}	{58}	{67}	{120}	{320}	{1,470}	{1,650}	{2,330}
800	–	21	48	90	310	500	580	1,030	2,700	12,600	14,200	20,000
	–	{2}	{5}	{9}	{32}	{51}	{59}	{105}	{280}	{1,290}	{1,450}	{2,040}
900	–	–	45	90	280	450	510	910	2,400	11,200	12,600	17,700
	–	–	{5}	{9}	{28}	{45}	{52}	{93}	{250}	{1,140}	{1,290}	{1,810}
1000	–	–	42	90	250	400	460	820	2,200	10,100	11,300	16,000
	–	–	{4}	{9}	{26}	{41}	{47}	{84}	{220}	{1,030}	{1,160}	{1,630}

Allowable Side Load for JWB and JWH (Ball Screw and High Lead Ball Screw Types)

Ball Screw and High Lead Ball Screw Types can only tolerate loads applied in the direction of their thrusts.
Be sure to adjust side load with guides so it does not apply directly onto the jack.



Expected Travel Distance for JWB and JWH (Ball Screw and High Lead Ball Screw Types)

Ball screw life is determined by the flaking of the rolling surface due to fatigue.
Verify ball screw life expectancy using the graphs shown. However, note that conditions such as severe shock and failure to conduct regular maintenance can largely affect the life of a ball screw.

Expected travel distance (km) = Actual load stroke (m) × Usage frequency (times/day) × No. of operating days/yr. × 10^{-3} × Expected no. of years

The graph on the right is based on life expectancy of L10. L10 represents distance traveled by 90% of the entire unit.
If selecting a jack based on life, use the following graph and determine the frame number first.
Each graph shows the equivalent P_M or 39.2kN {4tf} for the required expected travel distance, 5km. The coordinates of horizontal and vertical axes suggest suitable frame numbers. In this case, jacks JWB050, JWH050 or above are recommended.
If the load largely fluctuates in the middle of a stroke, use the following formula to calculate equivalent load.

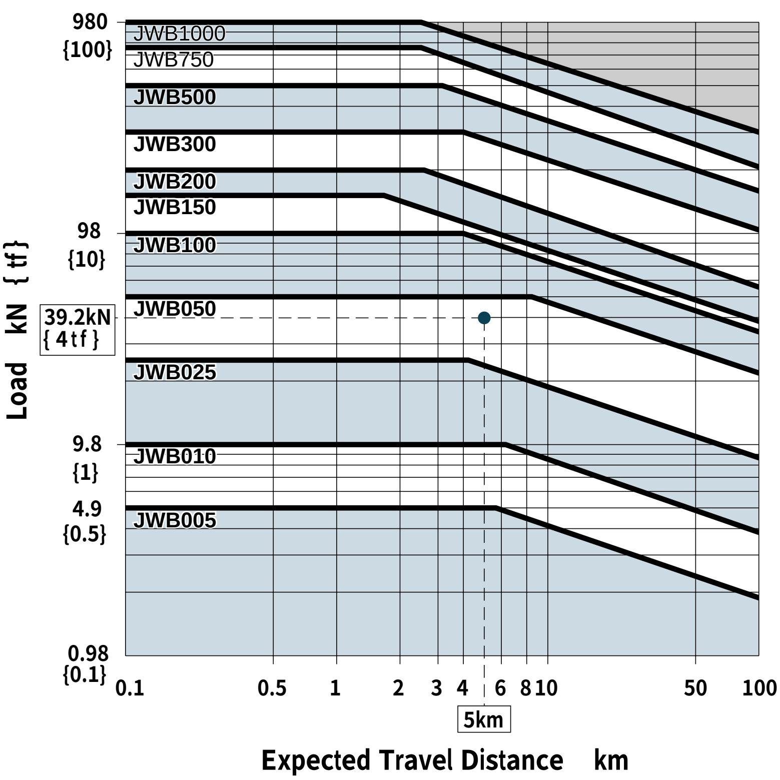
$$P_M = \frac{P_{MIN} + 2 \times P_{MAX}}{3}$$

P_M : Equivalent load kN {kgf}
P_{MIN} : Minimum load kN {kgf}
P_{MAX} : Maximum load kN {kgf}

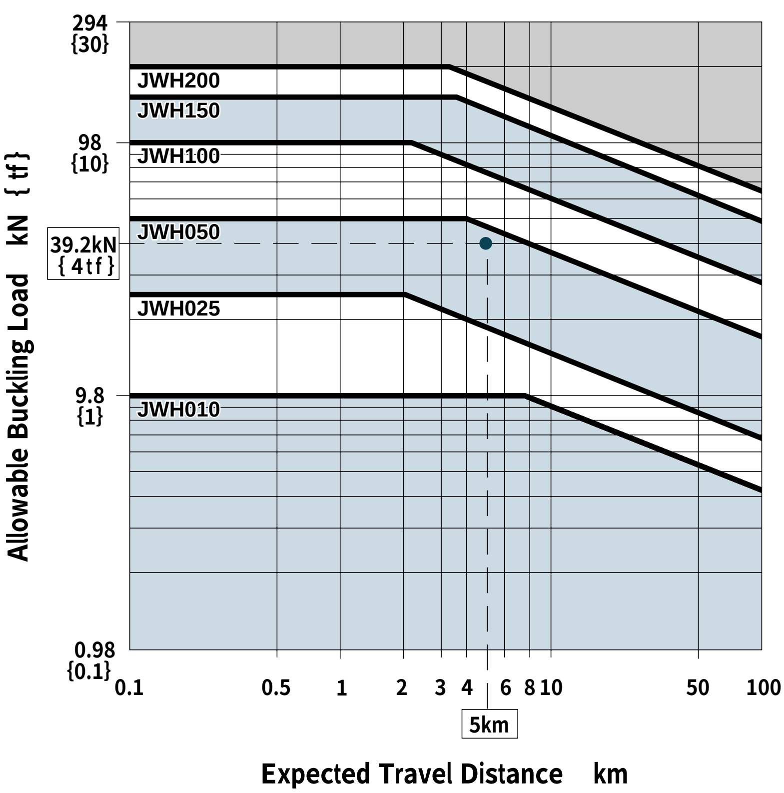
<JWM (Machine Screw Type) Expected Travel Distance>
Machine screw life cannot be determined by the formula used to calculate a ball screw wear life. Use the information below as a reference.

JWM050 and below
----5km (Average expected life)
JWM100 and above
----1km (Average expected life)

JWB



JWH



Technical Data

1. Allowable Overhang Load

When installing a sprocket, gear, or belt, use the following formula to verify that any overhang load applied to the shaft falls within the allowable OHL (Table 1).

$$\text{Allowable O.H.L.} \geqq \frac{T \times f \times Lf}{R}$$

O.H.L. : Overhang load N {kgf}
T : Input torque N・m {kgf・m}
f : Coefficient - power transmission element
Lf : Coefficient-Load position
R : Sprocket, Gear, V pulley or Pitch diameter m

Table 1. Allowable O.H.L.

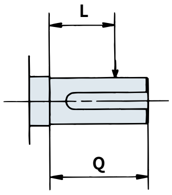
Frame No.		002	005	010	025	050	100	150	200	300	500	750	1000
JWM (Machine Screw Type) H Speed	N	99	200	380	710	1500	2270	3160	4320	6110	10100	13900	18000
	{ kgf }	{10}	{21}	{39}	{73}	{153}	{232}	{323}	{441}	{624}	{1030}	{1420}	{1840}
JWM (Machine Screw Type) L Speed	N	63	120	220	420	820	1430	1950	2800	4400	6650	9390	13200
	{ kgf }	{6}	{13}	{23}	{44}	{85}	{146}	{200}	{286}	{449}	{678}	{958}	{1350}
JWB (Ball Screw Type) H Speed	N	–	130	220	480	870	1290	2030	2490	3450	5240	7200	9790
	{ kgf }	–	{14}	{23}	{50}	{89}	{132}	{208}	{255}	{352}	{535}	{735}	{998}
JWB (Ball Screw Type) L Speed	N	–	82	140	290	500	840	1300	1610	2400	3560	4940	6970
	{ kgf }	–	{8}	{15}	{31}	{52}	{86}	{133}	{165}	{245}	{363}	{504}	{711}
JWH (High Lead Ball Screw Type) H Speed	N	–	–	530	980	1510	2390	3130	3840	–	–	–	–
	{ kgf }	–	–	{54}	{100}	{154}	{244}	{320}	{392}	–	–	–	–

Table 2. Coefficient- Power Transmission Element (f)

Chain	1.00
Gear	1.25
V Belt	1.50
Flat Belt	2.50

Table 3. Coefficient (Lf) - Load Position

L/Q	Below 0.5	0.75	1
Lf	1	1.5	2



Q : Shaft Length
L : Loaded Position

2. Screw Shaft rpm

When using a travel nut with screw shaft rotation, make sure the screw shaft rpm is within the rated value determined by the following formula. In cases where it exceeds the allowable rate, increase the frame number and recalculate.
(Verify the allowable screw shaft rpm if the input rpm is 900 r/min or over with H speed standard stroke, or if the stroke used exceeds the standard value.)

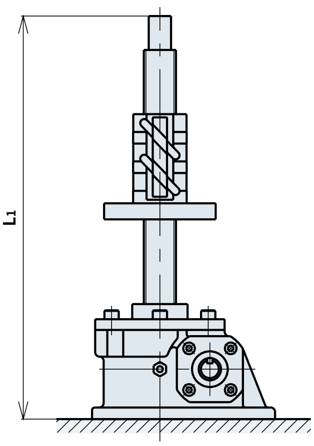
$$N_C = \frac{96 \times n \times d \times 10^6}{L^2}$$

N_C : Allowable screw shaft rpm r/min
d : Screw shaft root diameter mm
(See pgs. 29～30 for JWM, pgs. 55～56 for JWB and pgs. 79～80 for JWH.)
n : Shaft end support coefficient
①Shaft end free: n=0.36
②Fixed shaft end: n=1.56
L : Support space distance mm (See graph for each frame no.)

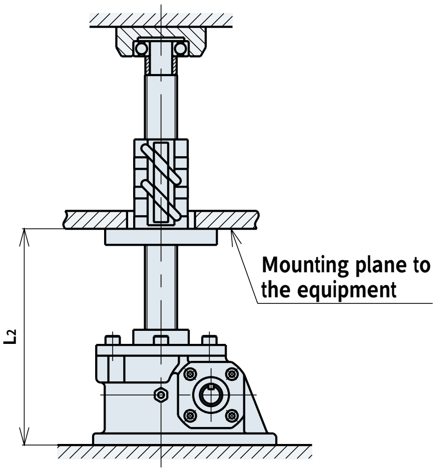
$$N_S = \frac{N}{R}$$

N_S : Screw shaft rpm r/min
N : Input rpm r/min
R : Worm speed ratio

MAKE SURE $N_C > N_S$



① Shaft end free



② Shaft end guided

Calculation Example

Assume JWM200URH20D with input rpm of 1200r/min with fixed shaft end.
Screw shaft rpm Ns is:

$$N_S = \frac{1200}{8} = 150\text{r/min}$$

* See dimensions on pg. 46

$$N_C = \frac{96 \times 1.56 \times 51.3 \times 10^6}{2237^2}$$

$$= 1535\text{r/min}$$

$N_C = 1535\text{r/min} > N_S = 150\text{r/min}$…OK