# Selection and ordering
# HT-direct motors 1FW4
# water-cooled

**■ Overview**



The motors are designed for the following rated voltages:

- 690 V丫/50 Hz
- 400 V丫/50 Hz
- 460 V丫/60 Hz

Ambient temperature: –20 °C to +40 °C; when operated below 0 °C, use anti-freeze in cooling water. Motors can optionally be ordered for higher ambient temperatures (see Page 2/6).

Cooling water inlet temperature: max. 25 °C; at higher coolant inlet temperatures up to 45 °C, a motor Order No. must be selected in accordance with the derating factors (see Page 2/10). The order code for the higher cooling water inlet temperature (see Page 2/6) must also be specified in the order.

Degree of protection: IP55

Cooling method: IC71W

Type of construction: IM B3

Overview of torques and outputs
in accordance with the rated speed

| Rated speed rpm | Max. rated torque Nm | Max. rated output kW |
|---|---|---|
| 200 | 42000 | 879 |
| 300 | 41000 | 1288 |
| 400 | 40000 | 1675 |
| 500 | 34235 | 1792 |
| 600 | 33000 | 2073 |
| 800 | 19000 | 1591 |

**■ Benefits**

When high torques and low speeds are required for electrical drives in combination with compact dimensions and a low-noise design, the HT-direct motor with water-jacket cooling provides the ideal customer solution. Depending on the ambient conditions, water-jacket cooling generally provides maximum cooling performance – with minimal heating of the immediate environment.

## Selection and ordering data

| Rated torque | Rated output [1] | Frame size | Efficiency at 690 V 4/4-load | Power factor at 690 V 4/4-load | Rated current at 690 V Y | Rated current at 400 V Y | Rated current at 460 V Y | Norm. max. torque at 690 V [2] $T_{max}/T_{rated}$ | Moment of inertia $J$ | Version with two galvanically isolated winding systems [3] 690 V Y | 400 V Y | 460 V Y | Order No. | Weight, approx. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nm | kW | | % | cos $\varphi$ | A | A | A | | kgm² | | | | | kg |
| **200 rpm, IP55 degree of protection, IMB3 type of construction** | | | | | | | | | | | | | | |
| 9375 | 196 | 401 | 94.4 | 0.89 | 205 | 335 | 305 | 1.5 | 19.4 | – | – | – | 1FW4401-1HA■0-1AA0 | 3040 |
| 11250 | 235 | 403 | 94.4 | 0.88 | 245 | 410 | 370 | 1.5 | 22.4 | – | – | – | 1FW4403-1HA■0-1AA0 | 3310 |
| 13125 | 274 | 405 | 94.7 | 0.89 | 280 | 485 | 425 | 1.5 | 26.1 | – | – | – | 1FW4405-1HA■0-1AA0 | 3650 |
| 15000 | 314 | 407 | 95.0 | 0.90 | 315 | 530 | 465 | 1.5 | 30.9 | – | – | – | 1FW4407-1HA■0-1AA0 | 4100 |
| 16215 | 339 | 451 | 93.1 | 0.79 | 400 | 740 | 650 | 1.5 | 37.9 | – | – | – | 1FW4451-1HA■0-1AA0 | 4010 |
| 18975 | 397 | 453 | 93.9 | 0.80 | 460 | 840 | 720 | 1.5 | 44.9 | – | – | – | 1FW4453-1HA■0-1AA0 | 4350 |
| 21850 | 457 | 455 | 94.3 | 0.81 | 550 | 900 | 830 | 1.5 | 51.5 | – | – | – | 1FW4455-1HA■0-1AA0 | 4680 |
| 27600 | 578 | 503 | 95.0 | 0.80 | 660 | 1190 | 990 | 1.5 | 89.3 | – | – | – | 1FW4503-1HA■0-1AA0 | 5610 |
| 32775 | 686 | 505 | 94.8 | 0.79 | 870 | 1350 | 1210 | 1.5 | 102.6 | – | ✓ | – | 1FW4505-1HA■0-1AA0 | 6110 |
| 37950 | 794 | 507 | 95.2 | 0.80 | 930 | 1720 | 1340 | 1.5 | 118.4 | – | ✓ | ✓ | 1FW4507-1HA■0-1AA0 | 6680 |
| 42000 | 879 | 508 | 95.6 | 0.82 | 930 | 1600 | 1400 | 1.5 | 139.3 | – | ✓ | ✓ | 1FW4508-1HA■0-1AA0 | 7440 |
| **300 rpm, IP55 degree of protection, IMB3 type of construction** | | | | | | | | | | | | | | |
| 9060 | 284 | 401 | 95.7 | 0.90 | 275 | 475 | 420 | 1.5 | 19.4 | – | – | – | 1FW4401-1HB■0-1AA0 | 3040 |
| 10875 | 341 | 403 | 95.8 | 0.89 | 340 | 550 | 510 | 1.5 | 22.4 | – | – | – | 1FW4403-1HB■0-1AA0 | 3310 |
| 12690 | 398 | 405 | 96.1 | 0.89 | 390 | 640 | 580 | 1.5 | 26.1 | – | – | – | 1FW4405-1HB■0-1AA0 | 3650 |
| 14500 | 455 | 407 | 96.3 | 0.90 | 450 | 750 | 670 | 1.5 | 30.9 | – | – | – | 1FW4407-1HB■0-1AA0 | 4100 |
| 15860 | 498 | 451 | 95.3 | 0.79 | 560 | 1010 | 840 | 1.5 | 37.9 | – | – | – | 1FW4451-1HB■0-1AA0 | 4010 |
| 18560 | 583 | 453 | 95.6 | 0.81 | 700 | 1100 | 990 | 1.5 | 44.9 | – | – | – | 1FW4453-1HB■0-1AA0 | 4350 |
| 21375 | 671 | 455 | 95.8 | 0.81 | 890 | 1390 | 1220 | 1.5 | 51.5 | – | ✓ | – | 1FW4455-1HB■0-1AA0 | 4680 |
| 26700 | 838 | 503 | 96.2 | 0.81 | 960 | 1640 | 1440 | 1.5 | 89.3 | – | ✓ | ✓ | 1FW4503-1HB■0-1AA0 | 5610 |
| 31705 | 996 | 505 | 96.3 | 0.80 | 1170 | 1960 | 1680 | 1.5 | 102.6 | – | ✓ | ✓ | 1FW4505-1HB■0-1AA0 | 6110 |
| 36710 | 1153 | 507 | 96.5 | 0.80 | 1290 | 2330 | 1940 | 1.5 | 118.4 | ✓ | ✓ | ✓ | 1FW4507-1HB■0-1AA0 | 6680 |
| 41000 | 1288 | 508 | 96.7 | 0.82 | 1360 | 2220 | 2190 | 1.5 | 139.3 | ✓ | ✓ | ✓ | 1FW4508-1HB■0-1AA0 | 7440 |
| **400 rpm, IP55 degree of protection, IMB3 type of construction** | | | | | | | | | | | | | | |
| 8750 | 366 | 401 | 96.4 | 0.90 | 360 | 580 | 530 | 1.5 | 19.4 | – | – | – | 1FW4401-1HC■0-1AA0 | 3040 |
| 10500 | 439 | 403 | 96.5 | 0.90 | 435 | 700 | 630 | 1.5 | 22.4 | – | – | – | 1FW4403-1HC■0-1AA0 | 3310 |
| 12250 | 513 | 405 | 96.7 | 0.91 | 485 | 850 | 750 | 1.5 | 26.1 | – | – | – | 1FW4405-1HC■0-1AA0 | 3650 |
| 14000 | 586 | 407 | 96.9 | 0.93 | 540 | 930 | 810 | 1.5 | 30.9 | – | – | – | 1FW4407-1HC■0-1AA0 | 4100 |
| 15510 | 649 | 451 | 96.0 | 0.80 | 710 | 1240 | 1100 | 1.5 | 37.9 | – | ✓ | – | 1FW4451-1HC■0-1AA0 | 4010 |
| 18150 | 760 | 453 | 96.4 | 0.82 | 800 | 1380 | 1210 | 1.5 | 44.9 | – | ✓ | – | 1FW4453-1HC■0-1AA0 | 4350 |
| 20900 | 875 | 455 | 96.5 | 0.81 | 950 | 1590 | 1370 | 1.5 | 51.5 | – | ✓ | ✓ | 1FW4455-1HC■0-1AA0 | 4680 |
| 25800 | 1080 | 503 | 96.8 | 0.83 | 1110 | 1880 | 1620 | 1.5 | 89.3 | – | ✓ | ✓ | 1FW4503-1HC■0-1AA0 | 5610 |
| 30635 | 1283 | 505 | 96.8 | 0.81 | 1420 | 2290 | 2270 | 1.5 | 102.6 | ✓ | ✓ | ✓ | 1FW4505-1HC■0-1AA0 | 6110 |
| 35475 | 1485 | 507 | 97.0 | 0.81 | 1610 | [4] | 2270 | 1.5 | 118.4 | ✓ | [4] | ✓ | 1FW4507-1HC■0-1AA0 | 6680 |
| 40000 | 1675 | 508 | 97.2 | 0.83 | 1780 | [4] | [4] | 1.5 | 139.3 | ✓ | [4] | [4] | 1FW4508-1HC■0-1AA0 | 7440 |

**Rated voltage**
- 460 V Y — 4
- 690 V Y — 7
- 400 V Y — 8

Special voltage — 9

Other rated speed with additional plain text — -Z

[1] Temperature class 155 (temperature class F), used according to temperature class 155 (temperature class F)

[2] Maximum torque $T_{max}$ = Overload torque for 120 s (higher overload torques on request)

[3] In the version with two galvanically isolated winding systems, two main terminal boxes 1XB1 631 are required.
 – Not applicable
 ✓ Applicable

[4] Cannot be implemented

**2**

| Rated torque | Rated output [1] | Frame size | Efficiency at 690 V | Power factor at 690 V | Rated current at | | | Norm. max. torque at 690 V [2] | Moment of inertia | Version with two galvanically isolated winding systems [3] | | | Order No. | Weight, approx. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 4/4-load | 4/4-load | 690 VY | 400 VY | 460 VY | $T_{max}/T_{rated}$ | $J$ | 690 VY | 400 VY | 460 VY | | |
| Nm | kW | | % | cos $\varphi$ | A | A | A | | kgm² | | | | | kg |
| **500 rpm, IP55 degree of protection, IMB3 type of construction** | | | | | | | | | | | | | | |
| 8440 | 441 | 401 | 96.8 | 0.91 | 415 | 680 | 610 | 1.5 | 19.4 | – | – | – | 1FW4401-1HD■0-1AA0 | 3040 |
| 10125 | 530 | 403 | 96.9 | 0.90 | 510 | 840 | 740 | 1.5 | 22.4 | – | – | – | 1FW4403-1HD■0-1AA0 | 3310 |
| 11810 | 618 | 405 | 97.0 | 0.90 | 590 | 960 | 830 | 1.5 | 26.1 | – | – | – | 1FW4405-1HD■0-1AA0 | 3650 |
| 13500 | 706 | 407 | 97.2 | 0.95 | 630 | 1080 | 930 | 1.5 | 30.9 | – | – | – | 1FW4407-1HD■0-1AA0 | 4100 |
| 15160 | 793 | 451 | 96.6 | 0.80 | 880 | 1400 | 1390 | 1.5 | 37.9 | – | ✓ | ✓ | 1FW4451-1HD■0-1AA0 | 4010 |
| 17740 | 928 | 453 | 96.8 | 0.81 | 1050 | 1600 | 1580 | 1.5 | 44.9 | – | ✓ | ✓ | 1FW4453-1HD■0-1AA0 | 4350 |
| 20425 | 1069 | 455 | 96.9 | 0.82 | 1170 | 1880 | 1580 | 1.5 | 51.5 | – | ✓ | ✓ | 1FW4455-1HD■0-1AA0 | 4680 |
| 24900 | 1303 | 503 | 97.0 | 0.83 | 1340 | 2200 | 2150 | 1.5 | 89.3 | ✓ | ✓ | ✓ | 1FW4503-1HD■0-1AA0 | 5610 |
| 29565 | 1548 | 505 | 97.2 | 0.84 | 1570 | [4] | [4] | 1.5 | 102.6 | ✓ | [4] | [4] | 1FW4505-1HD■0-1AA0 | 6110 |
| 34235 | 1792 | 507 | 97.3 | 0.84 | 1820 | [4] | [4] | 1.5 | 118.4 | ✓ | [4] | [4] | 1FW4507-1HD■0-1AA0 | 6680 |
| **600 rpm, IP55 degree of protection, IMB3 type of construction** | | | | | | | | | | | | | | |
| 8125 | 510 | 401 | 97.0 | 0.90 | 490 | 800 | 710 | 1.5 | 19.4 | – | – | – | 1FW4401-1HE■0-1AA0 | 3040 |
| 9750 | 612 | 403 | 97.1 | 0.90 | 580 | 940 | 820 | 1.5 | 22.4 | – | – | – | 1FW4403-1HE■0-1AA0 | 3310 |
| 11375 | 714 | 405 | 97.2 | 0.90 | 700 | 1090 | 940 | 1.5 | 26.1 | – | – | – | 1FW4405-1HE■0-1AA0 | 3650 |
| 13000 | 816 | 407 | 97.3 | 0.93 | 750 | 1250 | 1070 | 1.5 | 30.9 | – | ✓ | – | 1FW4407-1HE■0-1AA0 | 4100 |
| 14805 | 930 | 451 | 96.9 | 0.81 | 1050 | 1610 | 1580 | 1.5 | 37.9 | – | ✓ | ✓ | 1FW4451-1HE■0-1AA0 | 4010 |
| 17325 | 1088 | 453 | 97.0 | 0.82 | 1160 | 1870 | 1850 | 1.5 | 44.9 | – | ✓ | ✓ | 1FW4453-1HE■0-1AA0 | 4350 |
| 19950 | 1253 | 455 | 97.0 | 0.83 | 1300 | 2280 | 1850 | 1.5 | 51.5 | ✓ | ✓ | ✓ | 1FW4455-1HE■0-1AA0 | 4680 |
| 24000 | 1507 | 503 | 97.4 | 0.87 | 1490 | [4] | 2160 | 1.5 | 89.3 | ✓ | [4] | ✓ | 1FW4503-1HE■0-1AA0 | 5610 |
| 28500 | 1790 | 505 | 97.4 | 0.86 | 1780 | [4] | [4] | 1.5 | 102.6 | ✓ | [4] | [4] | 1FW4505-1HE■0-1AA0 | 6110 |
| 33000 | 2073 | 507 | 97.5 | 0.84 | 2100 | [4] | [4] | 1.5 | 118.4 | ✓ | [4] | [4] | 1FW4507-1HE■0-1AA0 | 6680 |
| **800 rpm, IP55 degree of protection, IMB3 type of construction** | | | | | | | | | | | | | | |
| 7500 | 628 | 401 | 97.2 | 0.91 | 590 | 990 | 850 | 1.5 | 19.4 | – | – | – | 1FW4401-1HF■0-1AA0 | 3040 |
| 9000 | 753 | 403 | 97.2 | 0.91 | 740 | 1190 | 1010 | 1.5 | 22.4 | – | – | – | 1FW4403-1HF■0-1AA0 | 3310 |
| 10500 | 879 | 405 | 97.3 | 0.92 | 830 | 1460 | 1180 | 1.5 | 26.1 | – | ✓ | – | 1FW4405-1HF■0-1AA0 | 3650 |
| 12000 | 1005 | 407 | 97.3 | 0.92 | 930 | 1500 | 1400 | 1.5 | 30.9 | – | ✓ | ✓ | 1FW4407-1HF■0-1AA0 | 4100 |
| 14100 | 1181 | 451 | 96.9 | 0.82 | 1290 | 2260 | 1810 | 1.5 | 37.9 | ✓ | ✓ | ✓ | 1FW4451-1HF■0-1AA0 | 4010 |
| 16500 | 1382 | 453 | 97.3 | 0.83 | 1470 | 2290 | 2210 | 1.5 | 44.9 | ✓ | ✓ | ✓ | 1FW4453-1HF■0-1AA0 | 4350 |
| 19000 | 1591 | 455 | 97.4 | 0.90 | 1510 | [4] | 2270 | 1.5 | 51.5 | ✓ | [4] | ✓ | 1FW4455-1HF■0-1AA0 | 4680 |

**Rated voltage**
- 460 VY — **4**
- 690 VY — **7**
- 400 VY — **8**

Special voltage — **9**

Other rated speed with additional plain text — **-Z**

Notes for current-calculation:

The stator current from permanent-excited motors can not be calculated as usual with the rated output, converter output voltage, power factor and efficiency. The reason is that the induced voltage at the rated point does not comply with the converter output voltage automatically. The real terminal voltage is depending on the speed, the torque and the integer number of turns.

The stator current of the 1FW4-motor series is proportional to the speed. With it the required stator current for a torque differing from the rated torque can be calculated. The stator current should be calculated exactly with the project tool „SINAMICS MICROMASTER SIZER".

[1] Temperature class 155 (temperature class F), used according to temperature class 155 (temperature class F)

[2] Maximum torque $T_{max}$ = Overload torque for 120 s (higher overload torques on request)

[3] In the version with two galvanically isolated winding systems, two main terminal boxes 1XB1 631 are required.
– Not applicable
✓ Applicable

[4] Cannot be implemented

■ **Special versions**

| Special versions | Order code | Comments |
|---|---|---|
| **Motor protection** | | |
| Motor temperature monitoring using built-in temperature sensor 1 x KTY 84-130 | **A23** | |
| Motor temperature monitoring using built-in temperature sensor 2 x KTY 84-130 | **A25** | |
| 2 PT100 resistance thermometers or 3-wire for 4-wire circuit from terminals, without evaluation unit for rolling-contact bearings | **A40** | |
| 2 PT100 dual resistance thermometers for 3-wire or 4-wire circuit from terminals, without evaluation unit for rolling-contact bearings | **A42** | |
| 6 PT100 resistance thermometers for winding temperature monitoring for 3-wire or 4-wire circuit from terminals | **A65** | |
| Rolling-contact bearing monitor based on SPM shock pulse method, complete alarm box | **H07** | |
| **Motor connection and connection boxes** | | |
| Two-part plate on connection box | **K06** | |
| Cable entry DIN 89280, maximum configuration | **K57** | |
| Rotation of the terminal box through 90°, entry from DE (This option is only possible when the motor can only be implemented with one terminal box). | **K83** | |
| Rotation of the terminal box through 90°, entry from NDE. (This option is only possible when the motor can only be implemented with one terminal box). | **K84** | |
| Rotation of connection box through 180° | **K85** | |
| Undrilled cable entry plate | **L01** | |
| Auxiliary terminal box with cast-iron housing | **M50** | |
| Auxiliary terminal box with stainless-steel housing | **M51** | |
| Separate auxiliary terminal box with cable entry for heater | **M52** | |
| Auxiliary terminal box with aluminium housing | **M88** | |
| **Shaft and rotor** | | |
| Standard cylindrical shaft end, but without keyway | **K42** | |
| Non-standard cylindrical shaft end (only when technically possible); additional plain text stating the dimensions of the non-standard shaft end is required (in mm) | **Y55** | |
| **Coupling** | | |
| Thrust ring for coupling guard | **L15** | |
| Mounting of supplied coupling | **L17** | |
| **Heating** | | |
| Anti-condensation heating for 230 V supply voltage | **K45** | |
| Anti-condensation heating for 115 V supply voltage | **K46** | |
| Anti-condensation heating for 400 V supply voltage | **L08** | |
| Anti-condensation heating for 500 V supply voltage | **L09** | |
| Anti-condensation heating for other supply voltages (with plain text for voltage) | **Y83** | |
| **Colors and paint finish** | | |
| Unpainted (primed) | **K23** | |
| Special paint finish in standard color | **K26** | |
| Normal paint finish not in standard color | **Y53** | |
| Special paint finish not in standard color | **Y54** | |
| **Special mounting technology** | | |
| Mounting of absolute encoder EQN 425 EnDat 2.1 2048 | **H81** | |
| Mounting of absolute encoder HMG111 HTL + SSI | **H82** | |
| Mounting of incremental encoder HOG10 DN 2048 | **H83** | |
| Mounting of incremental encoder HOG11 DN 2048 | **H84** | |
| Mounting of incremental encoder LL861 (2048 pulses) | **H85** | |
| Mounting of a rotary pulse encoder in special design (with plain text for encoder designation) | **Y70** | |
| **Balance and vibration severity** | | |
| Vibration severity grade B | **K02** | |
| Full-key balancing | **L68** | |

| Special versions | Order code | Comments |
|---|---|---|
| **Mechanical design and degrees of protection** | | |
| Bearing design for increased cantilever forces | **K20** | |
| IP56 degree of protection (non-heavy-sea) | **K52** | |
| Bolts for fixing machine to steel foundation | **L31** | |
| T-head bolts, anchor sleeves and soleplates for mounting on a concrete foundation | **L33** | |
| External screws made of stainless steel | **P45** | |
| **Anormal stator winding** | | |
| Anormal stator winding for speeds below 170 rpm | **L1Y** | |
| **Cooling water inlet temperature and ambient temperature** | | |
| Cooling water inlet temperature up to 30 °C (ambient temperature up to 45 °C), torque reduction 3% | **D15** | |
| Cooling water inlet temperature up to 35 °C (ambient temperature up to 50 °C), torque reduction 5% | **D16** | |
| Cooling water inlet temperature up to 40 °C (ambient temperature up to 55 °C), torque reduction 8% | **D17** | |
| Cooling water inlet temperature up to 45 °C (ambient temperature up to 60 °C), torque reduction 11% | **D18** | |
| **Marine version - Acceptance/certification** | | |
| Individual acceptance by classification authority with witness-testing and acceptance inspection certificate 3.1.C | **E09** | |
| Individual acceptance by classification authority | **E10** | |
| Marine design to GL, CT 45 °C, temperature class 155 used according to 155 (F according to F) | **E11** | |
| Marine design to LR, CT 45 °C, temperature class 155 used according to 155 (F according to F) | **E21** | |
| Marine design to BV, CT 45 °C, temperature class 155 used according to 155 (F according to F) | **E31** | |
| Marine design to DNV, CT 45 °C, temperature class 155 used according to 155 (F according to F) | **E51** | |
| Marine design to ABS, CT 45 °C, temperature class 155 used according to 155 (F according to F) | **E61** | |
| Marine design to CCS, CT 45 °C, temperature class 155 used according to 155 (F according to F) | **E71** | |
| Marine design, higher ambient temperature and/or temperature class 155 used according to 130 (F according to B), with plain text for ambient temperature, utilization and classification society | **E80** | |
| **Rating plate and additional plates** | | |
| Second rating plate, separately packed | **K31** | |
| Rating plate with different data | **Y80** | |
| Additional plate with ordering data (customer information in plain text) | **Y82** | |
| **Packaging, safety notes, documentation and test certificates** | | |
| Acceptance test certificate 3.1 according to EN 10204 | **B02** | |
| Documentation on CD | **B21** | |
| Document - EU manufacturer's declaration | **B30** | |
| Document - Electrical data sheet | **B31** | |
| Document - Order dimension drawing | **B32** | |
| Document - Routine test certificate | **B33** | |
| Documentation in German | **D00** | (Documentation in English standard) |
| Documentation in Russian | **D56** | |
| Documentation in Italian | **D72** | |
| Documentation in French | **D77** | |
| Documentation in Spanish | **D78** | |
| Documentation in Portuguese | **D79** | |
| Documentation in Swedish | **D83** | |
| Standard test (routine test), witnessed | **F01** | |
| Visual acceptance and report handover, witnessed | **F03** | |
| Heating test at rated operating point at converter, unwitnessed | **F04** | |
| Heating test at rated operating point at converter, witnessed | **F05** | |

| Special versions | Order code | Comments | 2/7 |
|---|---|---|---|
| **Packaging, safety notes, documentation and test certificates (continued)** | | | |
| Recording of continuous short-circuit characteristic and calculation of losses, unwitnessed | **F16** | | |
| Recording of continuous short-circuit characteristic and calculation of losses, witnessed | **F17** | | |
| Recording of load characteristic (T-n-characteristic curve) on converter, unwitnessed | **F18** | | |
| Recording of load characteristic (T-n-characteristic curve) on converter, witnessed | **F19** | | |
| Noise measurement in no-load operation, no noise analysis, unwitnessed | **F28** | | |
| Noise measurement in no-load operation, no noise analysis, witnessed | **F29** | | |
| Noise measurement in no-load operation, with noise analysis, unwitnessed | **F62** | | |
| Noise measurement in no-load operation, with noise analysis, witnessed | **F63** | | |
| Type test with heat run for horizontal motors, unwitnessed | **F82** | | |
| Type test with heat run for horizontal motors, witnessed | **F83** | | |
| Customized acceptance on customer converter, additional information required | **F99** | | |

**2**

**Dimension drawings**
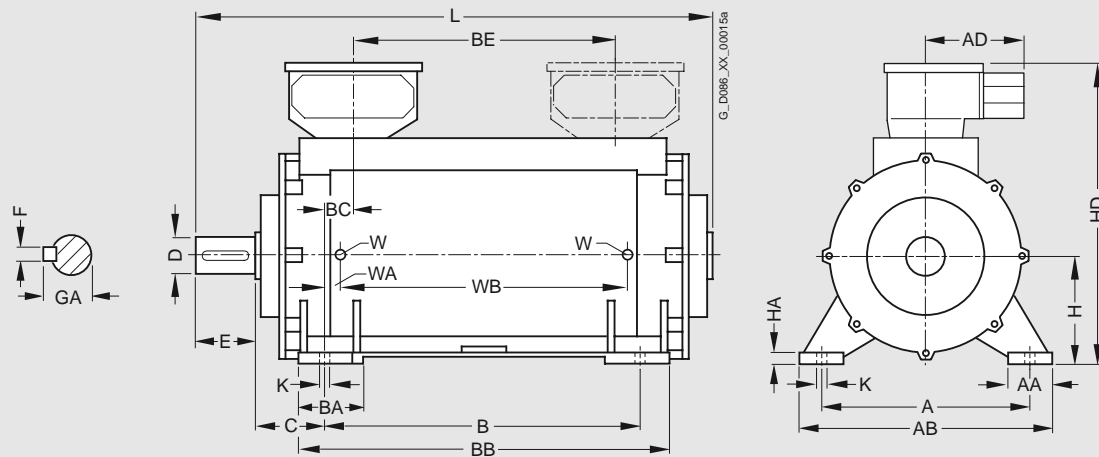


| Type | Dimensions | | | | | | | | | | | | | | |
|------|-----|-----|-----|------|-----|-----|------|-----|-----|-----|-----|-----|------|-----|------|
| | A | AA | AB | AD [1] | B | BA | BB | BC | BE | C | H | HA | HD | K | L |
| **1FW4401** | 750 | 150 | 900 | 400 | 1120 | 260 | 1365 | 155 | 880 | 254 | 400 | 30 | 1180 | 35 | 1880 |
| **1FW4403** | | | | | | | | | | | | | | | |
| **1FW4405** | | | | | | | | | | | | | | | |
| **1FW4407** | | | | | | | | | | | | | | | |
| **1FW4451** | 850 | 180 | 1030 | 400 | 1250 | 265 | 1515 | 165 | 975 | 280 | 450 | 30 | 1280 | 42 | 2090 |
| **1FW4453** | | | | | | | | | | | | | | | |
| **1FW4455** | | | | | | | | | | | | | | | |
| **1FW4503** | 950 | 180 | 1130 | 400 | 1400 | 300 | 1624 | 250 | 935 | 280 | 500 | 40 | 1385 | 42 | 2265 |
| **1FW4505** | | | | | | | | | | | | | | | |
| **1FW4507** | 950 | 180 | 1130 | 400 | 1500 | 300 | 1782 | 135 | 628 | 315 | 500 | 40 | 1385 | 42 | 2415 |
| **1FW4508** | | | | | | | | | | | | | | | |

| Type | Dimensions for shaft extension according to DIN 748 "short" | | | | Dimensions of cooling water connection [2] | | |
|------|-----|-----|-----|------|------|------|------|
| | D | E | F | GA | W | WA | WB |
| **1FW4401** | 150 | 200 | 36 | 158 | G3/4" | 50 | 780 |
| **1FW4403** | | | | | | | |
| **1FW4405** | | | | | | | |
| **1FW4407** | | | | | | | |
| **1FW4451** | 170 | 240 | 40 | 179 | G1" | 63 | 1175 |
| **1FW4453** | | | | | | | |
| **1FW4455** | | | | | | | |
| **1FW4503** | 190 | 280 | 45 | 200 | G11/2" | 85 | 1260 |
| **1FW4505** | | | | | | | |
| **1FW4507** | 190 | 280 | 45 | 200 | G11/2" | 40 | 1440 |
| **1FW4508** | | | | | | | |

[1] For 1XB1 631 terminal box.

[2] The cooling water connection is available on both sides (RHS and LHS of motor).

■ **Further information**

*Structure*



G_D086_XX_00017
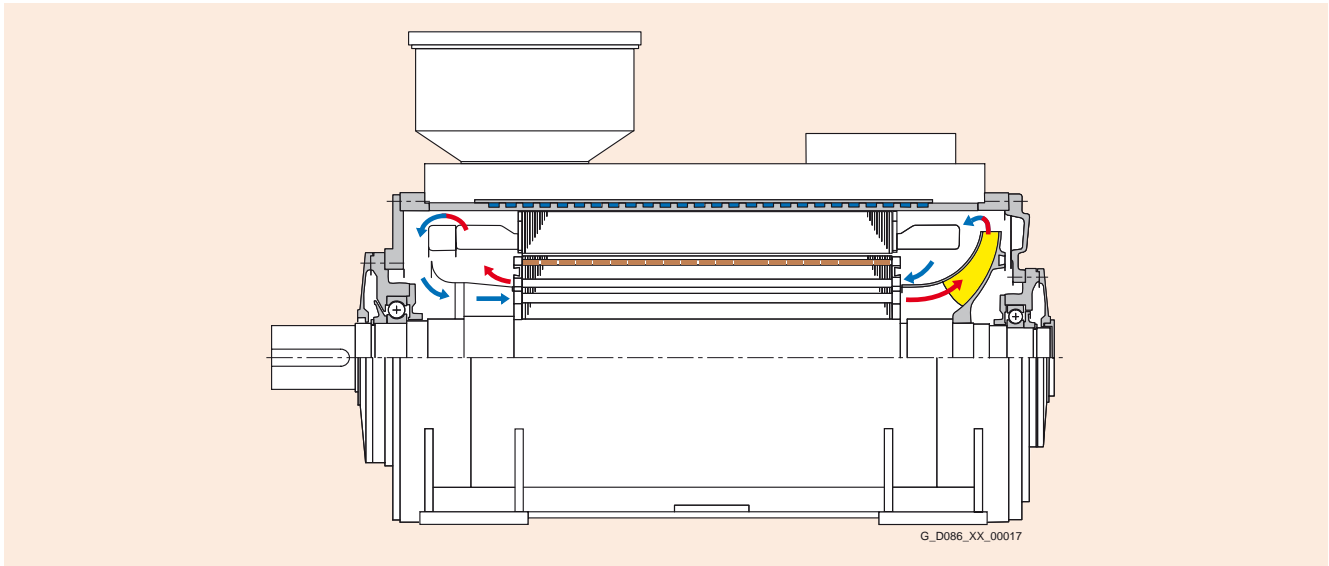
Basic structure of the water-cooled HT-direct motor 1FW4

HT-direct motors have two cooling circuits that can be used to achieve intensive and effective cooling:

- The aluminium fan within the motor provides air circulation between DE and NDE. This cools, in particular, the stator winding overhang, the magnetic rotor and the bearings.
- The heat from the internal air is transferred to the cooling water through the motor housing.

*Frame design*

A welded steel stator housing. The condensation water drainage holes are present and they are sealed during transport. For certain applications (e.g. in shipbuilding and the chemicals industry), external components made from aluminium are not permitted in the case of some customers. In these cases, aluminium components (e.g. terminal boxes) are replaced with other materials.

If external components are not permitted to be made from aluminium, this must be specified in plain text in the order.

*Position of the terminal box and cable entry*

The terminal box is mounted **on the top**, in the **basic version at DE with cable entry from the right** (with view onto DE shaft extension). If a second terminal box is required, this is mounted behind it at NDE.

As an option, cable entry from the LHS is possible (order code **K85**).

When **only one** terminal box is mounted, cable entry is also possible from **DE** (order code **K83**) or **NDE** (order code **K84**).
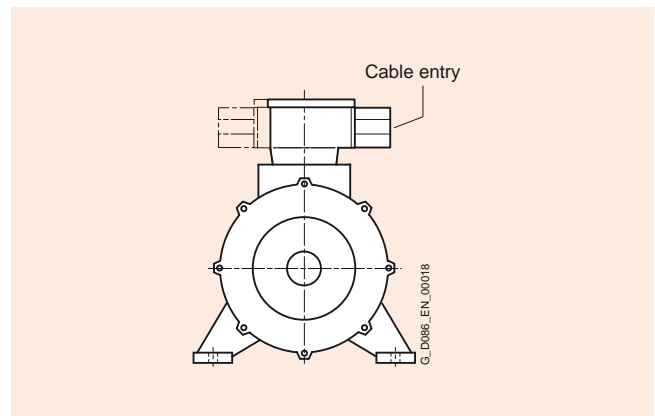


Cable entry

G_D086_EN_00018

Position of the terminal box and cable entry

**2**

■ **Additional information**

*Packing weights and packing dimensions*

Packing weights, tare

| Type 1FW4 . . . | Land transport on battens | Sea transport in wooden cases |
|---|---|---|
| | Type of construction IM B3 | Type of construction IM B3 |
| | kg | kg |
| . . . 401/403/405/407 | 70 | 280 |
| . . . 451/453/455 | 75 | 340 |
| . . . 503/505 | 80 | 390 |
| . . . 507/508 | 85 | 410 |

Packing dimension = Largest motor dimension + Supplement

| Dimensions | Supplements for | |
|---|---|---|
| | Land transport on battens | Sea transport in wooden cases |
| | Type of construction IM B3 | Type of construction IM B3 |
| | mm | mm |
| Length | +250 | +250 |
| Width | +200 | +200 |
| Height | +200 | +500 |

*Water-jacket cooling*

To achieve a high power density, the motor housing is designed with water-jacket cooling.

The cooling water flows through a channel that runs in a spiral in the cooling jacket (from DE to NDE).

The cooling water inlet is at the drive end, on the LHS or RHS of the motor housing as required. The cooling water outlet is at the non-drive end, on the LHS or RHS of the motor housing as required (see dimension drawing). During transportation, the water inlet and outlet holes are sealed.

Cooling water flowrate and water pressure:

| Type 1FW4 . . . | Cooling water flow rate l/min | Maximum permissible water pressure bar |
|---|---|---|
| . . . 401/403/405/407 | 30 | 5 |
| . . . 451/453/455 | 50 | 5 |
| . . . 503/505 | 65 | 5 |
| . . . 507/508 | 80 | 5 |

The water quality must be taken into account:

• The cooling water should be chemically neutral, it should be clean, particles should have been filtered out and the following values must not be exceeded:
  ph value           6.0 to 8.0
  Overall hardness   < 170 ppm
  Chloride          <  40 ppm
  Sulfate            <  50 ppm
  Nitrate            <  10 ppm
  Iron               <    0.2 ppm
  Ammonium      <  10 ppm
  Loose material   < 340 ppm
  Conductance     < 500 µS/cm

• Max. size of any particles carried ≤ 0.1 mm

• No saltwater (sea water)

• If there is a danger of frost, then the appropriate anti-freeze measures are required for operation, storage and transport. For example, emptying and blowing-out with air, supplementary heating system for the cooling ducts.

• Additives must be mixed with the cooling water in appropriate quantities to protect against corrosion and the growth of algae. The type and quantity of additive should be taken from the manufacturer's specifications for these additives and the particular ambient conditions.

Materials used in the cooling circuit

Only steel is used in the cooling circuit. The heatsink material is not resistant to seawater. It is not permissible to directly cool the motors using seawater.

*Different cooling water inlet temperature and site altitude*

Cooling water inlet temperature
(according to EN 60034-1 and IEC 60034-1)

The motors are designed for operation up to a cooling water inlet temperature of 25 °C, but still maintaining all of the specified motor data.

If the HT-direct motors are operated with higher cooling water inlet temperatures, the derating factors in the following table must be taken into account.

Derating factors for cooling water inlet temperatures >25 °C

| Cooling water inlet temperature up to (ambient temperature up to) | 25 °C (40 °C) | 30 °C (45 °C) | 35 °C (50 °C) | 40 °C (55 °C) | 45 °C (60 °C) |
|---|---|---|---|---|---|
| Derating factor $k_T$ | 1.0 | 0.97 | 0.95 | 0.92 | 0.89 |

This results in a maximum torque of the motor of:

$$T_{max} = T_{rated} \cdot k_T$$

$T_{max}$ = Maximum torque in Nm

$T_{rated}$ = Rated torque in Nm

$k_T$     = Factor for different cooling water inlet temperature

If the maximum torque is no longer adequate for the drive, it should be checked whether the motor with the next higher rated torque fulfills the requirements.

Site altitude (according to EN 60034-1 and IEC 60034-1)

For site altitudes >1000 m above sea level, derating factors do not have to be taken into account for water-cooled HT-direct motors. They may, however, affect the dimensioning of the converter.

*Dynamic foundation loading*
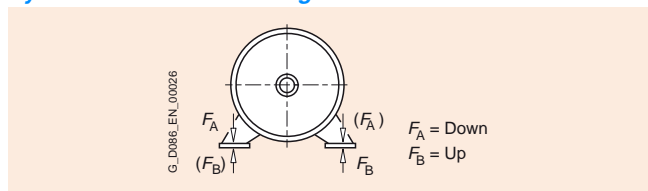


| Type | $F_A$ [1] kN | $F_B$ [1] kN |
|---|---|---|
| 1FW4401-1 . . . | 53 | 22 |
| 1FW4403-1 . . . | 62 | 29 |
| 1FW4405-1 . . . | 72 | 35 |
| 1FW4407-1 . . . | 85 | 44 |
| 1FW4451-1 . . . | 91 | 51 |
| 1FW4453-1 . . . | 111 | 68 |
| 1FW4455-1 . . . | 136 | 90 |
| 1FW4503-1 . . . | 125 | 69 |
| 1FW4505-1 . . . | 148 | 88 |
| 1FW4507-1 . . . | 176 | 110 |
| 1FW4508-1 . . . | 205 | 132 |

[1]   Load at one motor long side (that is for two feet).