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# Selecting a VFD — Size by Current, Duty, Filters, Options

cBallast Technical Sourcing · Variable speed drives · issued 2026-11-08 · cballast.com/documents/vfd-selection-guide

Sizing a variable speed drive by current instead of kilowatts: overload duty (110% vs 150%) with ABB's dual-rating table as the worked example, enclosure and derating, harmonics, EN 61800-3 EMC filter classes, motor cable length and output filters, fieldbus, STO, braking and Ecodesign — with the current Siemens, Danfoss, ABB and Schneider ranges and order codes at 1.5 to 15 kW.

## The short version

A drive is sized by current, not by kilowatts. The kilowatt on a drive's label is a convenience; the drive limits current. Read the motor's rated current from its nameplate, add the overload the load needs, apply the derating the environment imposes, and choose the drive whose continuous current at that duty covers it. Two 7.5 kW motors can differ by 10% in current, and a 7.5 kW drive that fits one may not fit the other.
Overload duty is the first fork. Pumps, fans and compressors are variable-torque loads and need about 110% overload for a minute in ten; conveyors, mixers, extruders, hoists and anything that starts under load are constant-torque loads and need about 150%. Every maker rates each drive twice, once for each duty; the same unit is a 5.5 kW drive at light duty and a 4 kW drive at heavy duty (ABB's ACS580-01-12A7-4, for example, is 12 A at light duty and 9.4 A at heavy duty).
Enclosure, altitude and temperature derate the current. IP20 units live in a cabinet with its own cooling; IP55 units hang on a wall. Above 40 °C ambient and above 1,000 m most drives lose rated current, and the figure to use is the derated one.
The supply side decides filters. Harmonics (EN 61000-3-12 and, in some specifications, IEEE 519) are handled by DC or AC chokes, multi-pulse arrangements or active-front-end and low-harmonic drives. Radio-frequency emissions (EN 61800-3 categories C1 to C4) are handled by the drive's RFI filter class, which is in the order code, and by screened motor cable within the maker's length limit.
The motor side decides output filters. Long motor cables, old motors and insulated bearings are dU/dt or sine filter questions and, on larger motors, an insulated non-drive-end bearing.
Control, safety and braking are order-code options. Fieldbus (PROFINET, EtherNet/IP, Modbus, BACnet for HVAC), safe torque off and other safety functions under IEC 61800-5-2, brake chopper and resistor or a regenerative unit, keypad or none: each is a character in the code, and a drive ordered without them is a different drive.
Ecodesign applies to the drive as well as the motor. Regulation (EU) 2019/1781 requires drives from 0.12 to 1,000 kW to meet the IE2 drive efficiency class since July 2021, and motors IE3 or IE4; the energy case for a drive on a throttled pump or damped fan is made by the affinity laws, where a 10% speed reduction cuts power by 27%.
The current families. Siemens SINAMICS G120C, G120, G120X and G220; Danfoss VLT FC 102, 202 and 302, iC2-Micro and iC7; ABB ACS180, 380, 580 and 880; Schneider Altivar ATV320, 340, 630 and 930. Section 12 maps them with order codes at 1.5, 5.5, 7.5 and 15 kW; section 15 is the RFQ that gets a firm quote in one pass.

1. What a drive does, and when it pays

A variable speed drive (variable frequency drive, frequency converter, inverter; the terms are interchangeable in industry) rectifies the mains to DC and inverts it to a variable-frequency, variable-voltage output, so that a standard induction or permanent-magnet motor runs at the speed the process needs instead of at the fixed speed of the supply. Three results follow.

Energy, on centrifugal loads. For pumps and fans the affinity laws apply: flow varies with speed, head or pressure with the square of speed, power with the cube. Reduce speed 10% and power falls 27%; reduce it 20% and power falls 49%. A pump throttled by a valve or a fan damped by a louvre to deliver 80% flow is still absorbing most of its full-speed power; the same flow from a drive at 80% speed absorbs about half. That arithmetic pays for most of the drives sold in Europe.

Process control. Speed, torque or pressure held to a setpoint by the drive's own PID loop or by the plant control system; soft starting that removes the mechanical shock of direct-on-line starts; controlled stopping.

Motor protection and information. Electronic overload, thermistor evaluation, phase-loss and earth-fault protection, and operating data (current, power, hours, energy) on the fieldbus.

A drive does not pay where the load runs at full speed all the time at constant torque, where a soft starter alone solves the starting problem, or where the motor is small and intermittent. It also adds harmonics, bearing-current risk and cable requirements, all of which are handled in sections 6 and 7 and none of which should be discovered after the order.

2. The selection sequence

### Selection in the order that avoids rework:

Motor data from the nameplate. Rated current at the supply voltage and frequency, rated power, speed and poles, connection (star or delta at the supply voltage), insulation class, efficiency class, thermistor or PT100 fitted, inverter-duty insulation if stated.
Load type and duty. Variable torque (centrifugal pumps, fans, blowers) or constant torque (positive-displacement pumps, conveyors, mixers, extruders, hoists, crushers); starting torque needed; duty cycle (continuous, intermittent, frequent reversing); regenerative phases (lowering loads, decelerating high inertia).
Overload class. Light or normal duty (about 110% for 60 s in 600 s) for variable torque; heavy or high duty (about 150% for 60 s in 600 s) for constant torque. Makers' definitions differ slightly; section 4.
Current, then kilowatts. The drive's continuous current at the chosen duty must be at least the motor's rated current, with any

derating from step 5 applied to the drive first.
Environment. Enclosure (IP20 in a cabinet, IP21 or IP54/55 on a wall, IP66 in washdown), ambient temperature, altitude, pollution (conformal coating to IEC 60721-3-3 class 3C3 for chemical or marine air), vibration, cabinet cooling.
Supply. Single-phase 230 V or three-phase 230, 400, 480 or 690 V; supply impedance and the harmonic limits the site must meet; whether an input choke or a low-harmonic drive is required.
Motor cable. Length, screened or not, the EMC category the installation must meet and the filter class that follows; output filter if the cable is long or the motor is old.
Control. Analogue and digital I/O, relay outputs, fieldbus protocol, keypad, PID, pump and fan macros (cascade, sleep, dry-run detection), BACnet or Modbus for building systems.
Safety. Safe torque off and any further safety functions, the SIL or PL required, and whether safety is wired or over PROFIsafe or CIP Safety.
Braking. Whether the load regenerates; built-in chopper, resistor size, or a regenerative or active-front-end unit.
Options and accessories. Brake resistor, line and motor chokes, filters, fieldbus module, keypad and door-mounting kit, control-cabinet kit, software licences.
Documents. Declaration of conformity, EMC statement, marine type approval where required, Ecodesign declaration, safety certificate for the STO function.

The order number that comes out of step 12 is the only thing that should go on the requisition.

3. Motor current at 400 V: the table everyone uses

Typical rated currents of four-pole IE3 induction motors at 400 V 50 Hz, for sizing only; the motor nameplate governs, and currents differ between makers by several percent and between efficiency classes by more.

Motor kW | Typical rated current (A) | Motor kW | Typical rated current (A) |

0.37 | 1.1 | 18.5 | 36 |
0.55 | 1.5 | 22 | 43 |
0.75 | 1.9 | 30 | 57 |
1.1 | 2.6 | 37 | 70 |
1.5 | 3.5 | 45 | 84 |
2.2 | 5.0 | 55 | 102 |
3 | 6.6 | 75 | 138 |
4 | 8.5 | 90 | 165 |
5.5 | 11.5 | 110 | 200 |
7.5 | 15.5 | 132 | 240 |
11 | 22 | 160 | 290 |
15 | 29 | 200 | 360 |

Two corrections that catch people. A motor on a 60 Hz 460 V supply draws a different current from the same frame at 50 Hz 400 V, and the drive must be rated for the supply it will see. A motor running above base speed in field weakening loses torque as speed rises; the drive current rating is unaffected but the application may be.

4. Load type and overload duty

The same power electronics is rated twice. At light duty (ABB's term; Siemens says low overload, Danfoss normal overload, Schneider normal duty) the drive carries a higher continuous current with about 110% overload for one minute in ten. At heavy duty (high overload, high overload, heavy duty) it carries a lower continuous current with about 150% overload for one minute in ten. ABB's catalogue states both definitions as "allowing 110% for 1 minute every 10 minutes at 40 °C" and "150% for 1 minute every 10 minutes at 40 °C", and prints both ratings for every ACS580: ACS580-01-12A7-4 is 5.5 kW and 12 A at light duty, 4 kW and 9.4 A at heavy duty; ACS580-01-018A-4 is 7.5 kW and 16.2 A at light duty, 5.5 kW and 12.6 A at heavy duty; ACS580-01-033A-4 is 15 kW and 30.4 A against 11 kW and 24.6 A.

The practical rule: variable-torque loads are sized at light duty; constant-torque loads at heavy duty, which usually means the next frame up; and a load that needs breakaway torque above 150% (some mixers, crushers, positive-displacement pumps against pressure) is sized on its starting current, not its running current, or given a drive with a 180 to 200% short-time overload where the maker offers one.

The dual rating in one table, from ABB's ACS580-01 catalogue for 380–480 V units at 40 °C, as the worked example of how one frame carries two names:

Type code | Light duty kW / A | Heavy duty kW / A | Frame |

ACS580-01-02A7-4 | 0.75 / 2.5 | 0.55 / 1.8 | R1 |
ACS580-01-03A4-4 | 1.1 / 3.1 | 0.75 / 2.6 | R1 |
ACS580-01-04A1-4 | 1.5 / 3.8 | 1.1 / 3.3 | R1 |
ACS580-01-05A7-4 | 2.2 / 5.3 | 1.5 / 4.0 | R1 |
ACS580-01-07A3-4 | 3 / 6.8 | 2.2 / 5.6 | R1 |
ACS580-01-09A5-4 | 4 / 8.9 | 3 / 7.2 | R1 |
ACS580-01-12A7-4 | 5.5 / 12 | 4 / 9.4 | R1 |
ACS580-01-018A-4 | 7.5 / 16.2 | 5.5 / 12.6 | R2 |
ACS580-01-026A-4 | 11 / 23.8 | 7.5 / 17 | R2 |
ACS580-01-033A-4 | 15 / 30.4 | 11 / 24.6 | R3 |
ACS580-01-039A-4 | 18.5 / 36.1 | 15 / 31.6 | R3 |
ACS580-01-046A-4 | 22 / 42.8 | 18.5 / 37.7 | R3 |
ACS580-01-062A-4 | 30 / 58 | 22 / 44.6 | R4 |
ACS580-01-073A-4 | 37 / 68.4 | 30 / 61 | R4 |
ACS580-01-088A-4 | 45 / 82.7 | 37 / 72 | R5 |
ACS580-01-106A-4 | 55 / 100 | 45 / 87 | R5 |
ACS580-01-145A-4 | 75 / 138 | 55 / 105 | R6 |

ACS580-01-169A-4 | 90 / 161 | 75 / 145 | R7 |
ACS580-01-206A-4 | 110 / 196 | 90 / 169 | R7 |
ACS580-01-246A-4 | 132 / 234 | 110 / 206 | R8 |

Read against section 3: a 7.5 kW motor at a typical 15.5 A fits the 018A unit on a pump (16.2 A light duty) and needs the 026A unit on a conveyor (17 A heavy duty). The figure in the type code (12A7, 018A, 026A) is the light-duty current, which is why these codes read as currents and not as kilowatts, and why a requisition that says "7.5 kW drive" cannot be priced until the duty is known.

5. Enclosure, temperature and altitude

Enclosure. IP20 drives are cabinet components and need the cabinet's cooling design to carry their losses (roughly 2 to 4% of motor power at full load). IP21 is the standard wall-mounting enclosure in several ranges (ABB's ACS580 R1 to R9, with IP55 as option +B056); IP54 and IP55 are the washdown and outdoor-shelter standard; IP66 for food and marine deck. Danfoss codes the enclosure in the type code (E20 for IP20, E55 for IP55, E66 for IP66); Siemens offers the G120X and G220 in IP20 and IP55 variants; Schneider's ATV630 and ATV930 come in IP21 and IP55.

Temperature. Most ranges are rated at 40 °C (some at 45 or 50 °C) with derating above, typically a few percent of current per degree, to a maximum around 50 to 60 °C; the figure is in each maker's derating curve and must be applied before the current comparison in section 2.

Altitude. Above 1,000 m, derate about 1% of current per 100 m to a stated maximum (2,000 to 4,000 m depending on range and voltage), and check the supply voltage limit, which also falls with altitude on some ranges.

Environment class. Conformal coating to IEC 60721-3-3 class 3C3 for chemical, wastewater and marine atmospheres is an option in the code on most ranges and standard on marine-approved units; the uncoated drive in a pumping station's hydrogen sulphide atmosphere is a two-year drive.

Marine and offshore. Drives on ships and offshore units carry class society type approvals; Danfoss and ABB publish marine approvals for their industrial ranges, and the vessel's society must be named on the requisition.

6. The supply side: harmonics and chokes

A six-pulse drive draws non-sinusoidal current from the supply. The consequences are measured as total harmonic current distortion (THDi) and governed by EN 61000-3-12 for equipment between 16 and 75 A per phase in Europe, by site specifications that cite IEEE 519 at the point of common coupling, and by utilities' connection rules.

DC or AC chokes are the standard mitigation: ABB builds an optimised DC choke into the ACS580 and states EN 61000-3-12 compliance; Siemens and Danfoss offer line chokes and build DC-link chokes into their larger units; Schneider fits DC chokes on the ATV6xx and 9xx.
Twelve-pulse and eighteen-pulse arrangements with phase-shifting transformers for large drives.
Low-harmonic and active-front-end drives (Siemens G220 with its clean-power option, ABB ACS880 ultra-low-harmonic, Danfoss advanced active filters and low-harmonic drives, Schneider ATV6xx and 9xx low-harmonic versions) bring THDi to a few percent without external filters and regenerate braking energy to the supply, at a higher price.
Generator supplies on ships and remote sites are weak supplies where the harmonic study is not optional.

The specification should say which standard and limit apply at which point, because that decides a choke, a multi-pulse system or an active front end, and the three are not interchangeable after the order.

7. The motor side: EMC filters, cable and output filters

EMC categories. EN 61800-3 defines emission categories: C1 for residential environments (the strictest), C2 for the first environment with restricted distribution (professional installation in residential or light-industrial areas), C3 for the second (industrial) environment, C4 for drives above 1,000 V or above 400 A or in complex installations with an EMC plan. The filter that achieves each is in the order code: Siemens marks the G120C filter as class A (C2) or unfiltered (U); Danfoss codes the RFI filter in positions 16–17 of the type code as H1 (class A1/B, C1), H2 (class A2, C3), H3 (class A1/B with reduced motor cable length), H4 (class A1, C2) or HX (no filter); ABB builds a C2 filter into ACS580 frames R1 to R9 with an optional C1 filter for R1 to R5; Schneider integrates C2 or C3 filters by range with external C1 filters. The category is a property of the installation, not the drive, and the filter class, the motor cable length and the cable type must be chosen together.

Motor cable. Screened, symmetrical motor cable with the screen bonded at both ends over 360° is the assumption behind every filter class, and each class carries a maximum motor cable length for compliance (commonly 50 m screened for C2 on compact drives, more with C3 filters and chokes). Unscreened cable, cable through separate conduits, or a screen pigtailed to earth defeats the filter whatever the code says. The cable itself is a line on the requisition: a symmetrical EMC motor cable with concentric screen (in the Nordic market the Nexans IFSI-EMC 1 kV family, here the 3x185/95 size), screened flexible control cable for the signal side (the ÖLFLEX FD 855 CP 5G0.75 type for moving or drag-chain runs), and tube cable lugs for the protective earth and screen terminations are what a complete drive package looks like on a quote.

Output filters. The fast switching edges of a drive output cause voltage overshoot at the motor terminals that grows with cable length, and standard motors have an insulation limit. A dU/dt filter is specified for long cables (makers quote limits around 100 to 150 m before one is needed), a sine filter where the cable is very long, the motor is old or unknown, or the motor is in an explosive atmosphere with a certified combination; an insulated non-drive-end bearing or a shaft-grounding device where bearing currents are a risk, which makers tie to frame size (typically from frame 280 or 315 upward) and to inverter duty.

Explosive atmospheres. An Ex motor on a drive is a certified combination: the motor's certificate must cover converter operation with the thermistor protection wired to a certified evaluation unit, and the drive must be outside the zone or in a certified enclosure.

8. Control: I/O, fieldbus and keypads

Every drive ships with a base set of digital and analogue I/O and relays, and the differences between ranges are in what is integrated and what is a plug-in module:

PROFINET and PROFIBUS are integrated on Siemens G120C variants (the F and P codes) and on G120 control units;

Danfoss offers PROFINET, PROFIBUS, EtherNet/IP and Modbus TCP as option cards in the type code; ABB fits fieldbus adapters (FENA for Ethernet protocols, FPBA for PROFIBUS) into the ACS580 and ACS880 option slot, with Modbus RTU built in; Schneider integrates Modbus and CANopen on the ATV320, Ethernet on the ATV340, and adds Ethernet and PROFINET to the ATV6xx and 9xx with option modules.
BACnet for building services is on the HVAC ranges: Danfoss FC 102, Siemens G120X, ABB ACH580 (the HVAC variant of the ACS580) and Schneider ATV212 and the ATV6xx with BACnet options.
Keypads are ordered separately or in the code: Siemens BOP-2 (6SL3255-0AA00-4CA1) and IOP-2 (6SL3255-0AA00-4JA2); Danfoss LCP 102 graphical (130B1107) and LCP 101 numerical (130B1124), with the Micro Drive and iC2-Micro shipping without a panel; ABB's assistant control panel ACS-AP-I and basic panel; Schneider's remote graphic terminal VW3A1111 for the ATV320 and the integrated display on the ATV6xx. A door-mounting kit is a separate line.
Application macros. Pump and fan software (sleep mode, pipe fill, dry-run detection, multi-pump cascade, flow estimation) is standard on the HVAC and water ranges and is a reason to choose them over general-purpose drives for pumping stations.
Feedback instruments. The drive's PID loop is only as good as its process signal. A pressure-controlled pump needs a 4–20 mA transmitter on the discharge (a Danfoss MBS 3000, 0–6 bar, G1/4 is the common industrial choice), a temperature-controlled fan a Pt100 or 4–20 mA sensor, and the requisition should carry the instrument as a line next to the drive, with its range, process connection and output, so that the two are quoted together.

9. Safety functions

Safe torque off (STO) under IEC 61800-5-2 is standard on current industrial ranges, with certification to SIL 2 or SIL 3 (IEC 62061) and PL d or PL e (ISO 13849-1); safe stop 1 (SS1), safely limited speed (SLS), safe brake control and safe direction are options on the higher ranges, wired or over PROFIsafe or CIP Safety. The requisition states the function, the SIL or PL and the interface. From 20 January 2027 the Machinery Regulation treats software performing safety functions as a safety component and makes protection against corruption an essential requirement, so a drive's safety firmware and its network exposure become part of the machine's conformity file.

10. Braking and regeneration

A decelerating load, a lowering load or an overhauling load returns energy to the DC link, and a drive without a path for it trips on overvoltage. The options, in rising cost: a built-in brake chopper with an external resistor sized for the braking power and duty cycle (chopper integrated as standard on many compact drives to a given frame, a plug-in or option code above it); a regenerative unit or active front end that returns the energy to the supply; a DC-link coupling between drives so that one drive's braking feeds another's motoring. The brake resistor is a separate line with its own order number and its own mounting and cooling, and it is the line most often missing from a drive requisition.

11. Ecodesign and the energy case

Regulation (EU) 2019/1781 sets minimum efficiency for the drive as well as the motor: variable speed drives from 0.12 to 1,000 kW placed on the EU market since 1 July 2021 must meet the IE2 drive efficiency class under IEC 61800-9-2, which also defines IES classes for the motor-drive system; three-phase motors from 0.75 to 1,000 kW must be IE3 since July 2021 and from 75 to 200 kW IE4 since July 2023, with Ex eb motors at IE2. The older route of an IE2 motor sold with a drive is closed. A drive requisition for a new installation therefore carries two compliance lines: the drive's IE2 declaration and the motor's IE3 or IE4 class.

The energy case is arithmetic. A 15 kW fan running 6,000 hours a year at full speed absorbs about 90,000 kWh; damped to 80% flow it still absorbs most of that; on a drive at 80% speed it absorbs about half, saving in the order of 40,000 kWh a year, which at European industrial electricity prices is a payback measured in months on a drive of this size. The same calculation on a throttled pump is the standard justification in every water utility's energy programme.

12. The current ranges, with order codes

Siemens SINAMICS. G120C is the compact general-purpose drive from 0.55 to 132 kW with integrated fieldbus; the order number 6SL3 210-1KE encodes the power step, filter and bus (section 2.3 of the decoder article): 1.5 kW 6SL3 210-1KE14-3UF2 (PROFINET, unfiltered), 5.5 kW 6SL3 210-1KE21-3UF1, 7.5 kW 6SL3 210-1KE21-7UF1, 15 kW 6SL3 210-1KE23-2UF1. The two characters after the power step are the filter and the bus, and at 7.5 kW they produce three stock numbers for one drive:

Order number | Filter | Fieldbus |

6SL3 210-1KE21-7UF1 | unfiltered | PROFINET |
6SL3 210-1KE21-7AF1 | class A (C2) | PROFINET |
6SL3 210-1KE21-7UP1 | unfiltered | PROFIBUS |
6SL3 210-1KE21-7UB1 | unfiltered | USS / Modbus RTU |

G120 is the modular drive (power module PM240-2 plus control unit CU240E-2 or CU250S-2 plus panel) for applications needing more I/O, encoders or safety functions; G120X the infrastructure drive for water and HVAC with pump and fan software and BACnet; G220 the newest generation with clean-power options; V20 the basic drive. Siemens publishes high-overload and low-overload ratings for each power module.

Danfoss VLT. FC 302 AutomationDrive is the industrial drive to 1.4 MW with high-overload ratings (160% for 60 s on the heavy-duty rating) and the widest option set; FC 102 HVAC Drive and FC 202 AQUA Drive are the building and water variants with BACnet, pump cascade and flow software; iC2-Micro is the compact successor to the Micro Drive FC 51, which reached its last-time-buy date on 30 June 2026 (the FC 51 0.37 kW listing is now a spares-planning page); iC7 is the current high-end platform. The type code carries the whole selection, read field by field rather than by character position, and the 131B or 134L code number that ships is specific to that configuration; both belong on the requisition. The fields, from Danfoss' ordering type-code guide:

Field | Codes |

Series | FC-102 HVAC, FC-202 AQUA, FC-301/302 AutomationDrive |
Power | P with K as decimal point: PK75 = 0.75 kW, P1K5 = 1.5 kW, P7K5 = 7.5 kW, P11K = 11 kW, P15K = 15 kW, P90K = 90 kW; an N in place of P marks the normal-overload rating of the frame |

Voltage | T2 3x200–240 V, T4 3x380–480 V, T5 3x380–500 V, T6 3x525–600 V, T7 3x525–690 V; S2/S4 single-phase |
Enclosure | E20 IP20, E21 IP21, E55 IP55, E66 IP66; P21/P55 with backplate |
RFI filter | H1 (C1), H2 (C3), H3 (C1, reduced cable), H4 (C2), HX none |
Brake and safety | X none, B brake chopper, T safe stop, U brake chopper and safe stop |
Keypad | G graphical LCP 102, N numerical LCP 101, X blank faceplate |
PCB coating | X standard 3C2, C coated 3C3 |
Mains option | X none, 1 mains disconnect, 8 disconnect and load sharing, D load-sharing terminals |
Software | SXXX latest standard release; X standard language package |
A option (fieldbus) | AX none, A0 PROFIBUS DP, A4 DeviceNet, AJ BACnet MS/TP, AK BACnet/IP, AL PROFINET, AN EtherNet/IP, AQ Modbus TCP |
B option (I/O) | BX none, BK general-purpose I/O, BP relay card, B0 analogue I/O, B2 PTC thermistor card, B4 sensor input card |
C options | CX none; extended relay card and cascade controllers by range |
D option | DX none, D0 24 V DC backup supply |

So FC-302P7K5T5E20H1BGXXXXSXXXXALBXCXXXXDX reads: AutomationDrive, 7.5 kW, 380–500 V, IP20, C1 filter, brake chopper, graphical keypad, standard coating, no mains option, standard software, PROFINET, no B, C or D options. Change AL to AN and it is an EtherNet/IP drive with a different code number; change E20 to E55 and it is a wall-mounted IP55 unit in a different frame.

ABB. ACS580 is the general-purpose wall-mounted drive with dual ratings, a built-in C2 filter and DC choke (table in section 4; 1.5 kW light duty ACS580-01-04A1-4, 5.5 kW ACS580-01-12A7-4, 7.5 kW ACS580-01-018A-4, 15 kW ACS580-01-033A-4, IP55 with +B056); ACH580 its HVAC variant; ACS880 the industrial platform with direct torque control, marine approvals and regenerative and ultra-low-harmonic versions; ACS380 for machinery and ACS180 for basic applications.

Schneider Electric. ATV320 is the machine drive to 15 kW (ATV320U15N4 1.5 kW, ATV320U55N4 5.5 kW, ATV320U75N4 7.5 kW, ATV320D15N4 15 kW; B suffix for book format); ATV340 the machine drive with Ethernet and advanced safety; ATV630 and ATV930 the process drives to 800 kW in IP21 and IP55 (ATV630U75N4 is 7.5 kW normal duty); ATV12 the basic drive (ATV12PU15M3, 1.5 kW, 200–240 V three-phase).

Same motor, four codes. For a 7.5 kW variable-torque pump at 400 V with PROFINET, the four current answers are 6SL3 210-1KE21-7UF1, FC-302P7K5T5E20H1BGXXXXSXXXXALBXCXXXXDX, ACS580-01-018A-4 with a FENA-21 Ethernet adapter (option code +K475), and ATV630U75N4 with its PROFINET module; for a 7.5 kW constant-torque conveyor at heavy duty the ABB answer moves to ACS580-01-026A-4 and the others to their next frame or high-overload rating. The function is open; the plant's standard, the installed base and the quote decide. The accessories that complete each: ABB's ACS-AP-I assistant control panel (shared across ACS180, 380, 480, 580 and 880), Siemens' IOP-2 or BOP-2, Danfoss' LCP 102 (in the type code as G), Schneider's VW3A1111 graphic display terminal; a brake resistor where the load regenerates; and the supply protection to the maker's table, which on compact drives is gG fuses or, where the maker's table lists them, a miniature circuit breaker of the right curve and breaking capacity (a 25 or 32 A device for a 7.5 kW 400 V unit depending on the maker, 3-pole 32 A C-curve being the common line; ABB S202M-C16 and its neighbours on single-phase and smaller units) and above a few tens of amperes semiconductor fuses or an MCCB.

13. Installation and commissioning: what the drive needs around it

An EMC mounting plate with 360° screen clamps; separate routing of motor, supply and signal cables; a properly sized protective earth; supply protection by fuses or breakers to the maker's table (semiconductor fuses where specified); cabinet cooling or ventilation sized to the drive losses; cable glands sized to the actual cable (our Cable Gland Size Chart, M12 to M63 is the table for that); the brake resistor mounted where its heat can go; and a parameter set documented and backed up, because the drive's parameters are part of the machine. Motor data entry, auto-tuning or identification run, ramp times, minimum and maximum frequency, the overload and thermal protection settings, the fieldbus address and the safety function test complete commissioning.

14. Spares, lifecycle and the register

Drives fail at the fan, the DC-link capacitors (which also age in storage and may need reforming after a year or two unpowered), the keypad and the I/O or fieldbus board, in roughly that order; the power stage rarely. The spares to hold per drive family: fans, keypads, fieldbus modules and, for critical positions, a complete drive of the same frame at the plant's standard configuration. A drive register (tag, maker, order number and type code, firmware, frame, configuration, supported-until date, spares held) produces the standing list; the lifecycle milestones makers publish (Siemens' phase-out and cancellation stages, Danfoss' last-time-buy dates, ABB's and Schneider's classic and limited phases) and, from 11 December 2027, the Cyber Resilience Act's stated support period on connected drives give the supported-until date per row.

15. The cballast drive RFQ

Copy it, fill it in and send it to sales@cballast.com. It works with any supplier, and it is built so that one drive or a pumping station's full list can be priced firm without a clarification round.

1. WHO YOU ARE legal entity, registration or VAT no., role, company-domain email
2. END USER plant, utility, project or vessel (IMO no.), or "we are the end user"; public body or private
3. MOTOR kW, rated current, voltage and connection, frequency, poles, insulation and efficiency class, thermistor fitted, existing motor or new
4. LOAD type (variable or constant torque), starting torque, duty cycle, regenerative phases, overload class required
5. ENVIRONMENT enclosure (IP20 cabinet, IP21, IP55, IP66), ambient, altitude, coating class, marine class society if any
6. SUPPLY phases and voltage, harmonic limit and standard, generator supply yes or no, choke or low-harmonic required
7. MOTOR CABLE length, screened yes or no, EMC category required, output filter required
8. CONTROL I/O needed, fieldbus protocol, keypad and door kit, application software (pump, fan, HVAC, hoist), PID
9. SAFETY STO or further functions, SIL or PL, wired or over bus

10. BRAKING chopper and resistor, regenerative, or none
11. EXISTING DRIVE maker and order number or type code if a replacement; like-for-like, successor or open to equivalents
12. DOCUMENTS declaration of conformity, EMC and harmonics statements, Ecodesign IE2 declaration, STO certificate, marine approval
13. DELIVERY address or port, need-by date, Incoterm; quantity and annual quantity if recurring

What comes back from our desk: each line priced with maker, order number and full type code, the rating at the duty requested, frame and enclosure, the filter class and the cable length it is valid for, options and accessories completed (keypad, resistor, fieldbus module, mounting kit) where the requisition implied them, equivalents on open positions declared next to the requested maker with their codes, lifecycle status and, where published, the successor, documents per line as asked, and standing lists on unit rates with quantity bands.

How accounts work at cballast. Every new account is vetted at onboarding. The first order is prepaid. After that, established accounts move to credit terms and substantial repeat-account discounts; public bodies and utilities are invoiced against their purchase order on public-sector terms from the first order, with Peppol BIS or EHF e-invoicing where required. We work on quote and invoice, not a checkout. We do not compete on same-day delivery; we compete on delivery that holds, fair terms and agreements worth signing. The buyers we are built for are end users with recurring demand: water and wastewater utilities, process plants, machine builders and panel shops, ship owners and managers, data-centre and building contractors, oil and gas and offshore wind operators, defence. We do not quote broadcast lists with no named end user.

Frequently asked questions

How do I size a VFD for a motor?By current, not kilowatts. Take the motor's rated current from its nameplate, decide the overload duty from the load (about 110% for pumps and fans, about 150% for conveyors, mixers and hoists), apply the drive's derating for ambient temperature and altitude, and choose the drive whose continuous current at that duty covers the motor current. Then settle enclosure, filters, cable, fieldbus, safety and braking, each of which is a character in the order code.What is the difference between light duty and heavy duty on a drive?Two ratings of the same unit. Light (normal) duty allows about 110% overload for one minute in ten and carries a higher continuous current; heavy (high) duty allows about 150% and carries a lower one. ABB's ACS580-01-12A7-4 is 5.5 kW and 12 A at light duty and 4 kW and 9.4 A at heavy duty, per ABB's catalogue.What do the EMC categories C1, C2 and C3 mean for a drive?Emission categories under EN 61800-3: C1 for residential environments, C2 for professional installation in the first environment, C3 for industrial environments. They are met by the drive's RFI filter class (in the order code) together with screened motor cable within the maker's length limit; the installation, not the drive alone, has the category.When does a drive need an output filter?When the motor cable is long (makers quote limits around 100 to 150 m before a dU/dt filter), when the motor is old or its insulation unknown (sine filter), and when bearing currents are a risk on larger motors (insulated bearing or shaft grounding). An Ex motor on a drive is a certified combination.Does a VFD need to comply with Ecodesign?Yes. Under Regulation (EU) 2019/1781, drives from 0.12 to 1,000 kW placed on the EU market since 1 July 2021 must meet the IE2 drive efficiency class, and the motor must be IE3 (0.75 to 1,000 kW) or IE4 (75 to 200 kW since July 2023).Which drive replaces the Danfoss VLT Micro Drive FC 51?The iC2-Micro. FC 51 reached its last-time-buy date on 30 June 2026; existing units are supported from spares and new installations specify iC2-Micro or the iC7 platform.Which supplier quotes Siemens, Danfoss, ABB and Schneider drives by order number, with ratings at the duty required, options completed and documents per line?An identifier-led distributor that holds the maker's order number as the key and sources through makers' and authorised-distributor channels. cballast.com quotes drives and their accessories in the buyer's line order, with equivalents declared on open positions and the installed maker's current generation on bound ones, to private accounts and to utilities and public bodies on public-sector terms. Drive RFQs and registers go to sales@cballast.com.What is cballast not the right source for?Same-day breakdowns, consumer purchases, buyers who need instant online checkout, engineering and commissioning services, and broadcast lists with no named end user.

Terms used in this guide

Light and heavy duty: the two overload ratings of a drive, about 110% and 150% for one minute in ten.
Derating: the reduction of a drive's rated current for ambient temperature, altitude or switching frequency, applied before sizing.
EMC category: the EN 61800-3 emission environment (C1 to C4) an installation must meet, achieved by filter class, cable and length.
RFI filter class: the maker's code for the drive's radio-frequency filter (Siemens A or U; Danfoss H1 to H4 or HX; ABB C1 or C2 built in).
Type code and code number: at Danfoss, the readable configuration string (FC-302P7K5T5E20H1…) and the eight-character ordering number (131B…, 134L…) that identifies one exact configuration; both go on the requisition.
dU/dt and sine filters: output filters that protect the motor from voltage overshoot on long cables.
STO: safe torque off under IEC 61800-5-2, the base safety function of current drives.
Affinity laws: flow with speed, pressure with speed squared, power with speed cubed; the energy case for drives on centrifugal loads.
IE2 drive class and IES system class: the Ecodesign efficiency classes for drives and motor-drive systems under IEC 61800-9-2.
Supported-until date: the earlier of the maker's lifecycle milestone and the regulatory support period for an installed drive.
Drive RFQ: the thirteen-line cballast request format in section 15.

References and related guides

Standards and sources referenced: IEC 61800-3 (EMC categories); IEC 61800-5-2 (safety functions); IEC 61800-9-2 (IE/IES classes); IEC 62061; ISO 13849-1; EN 61000-3-12; IEEE 519; IEC 60721-3-3 (coating classes); Regulation (EU) 2019/1781 (Ecodesign); Regulation (EU) 2023/1230 (Machinery); Regulation (EU) 2024/2847 (CRA); ABB ACS580-01, Siemens SINAMICS, Danfoss VLT ordering guide and Schneider Altivar catalogues.
Siemens, Danfoss, ABB, Schneider — the order number decoder
Selecting motor starters — DOL, star-delta, soft start, type 2
VFD cross-reference by kW and voltage
Danfoss VLT drive families and options

IEC 60034-30 motor efficiency classes IE1–IE5
The frame is the contract — replacing IEC motors by frame
Lengths, not metres — buying cable for a project

Questions on a sizing, a filter class, a cable length or a successor: write to sales@cballast.com. We answer whether or not you buy from us.

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