

RIGHT FROM  
THE START

# AFE Drives

Low harmonic /  
Regenerative

55–4000 kW

380–690 V

**AuCom**  
MOTOR CONTROL SPECIALISTS

  
**VALIADIS**  
HELLENIC MOTORS

A member of the  
Benshaw Group



**BENSHAW**  
Applied Motor Controls



**RIGHT FROM  
THE START**

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# General electrical specifications

GENERAL (VALID FOR BOTH LIQUID COOLED AND AIR COOLED VERSIONS)		
Mains voltage	LV-LH-400 V/LV-RG-400 V	380–460 V +10 % / -15 %
	LV-LH-690 V/LV-RG-690 V	480–690 V +6 % / -15 %
Mains frequency		48 to 52 Hz and 58 to 62 Hz
Input total power factor		1.0
Output AC voltage	LV-LH/LV-RG-400 V / -690 V	[0–1.2] * Mains supply voltage
Output frequency	LV-LH/LV-RG-400 V / -690 V	0–599 Hz
Switching frequency	LV-LH/LV-RG-400 V / -690 V	3 kHz (adjustable 1.5–6 kHz (max=8 kHz @ Fmnot > 400 Hz), LV-LHD only)
Efficiency at nominal load	LV-RGG-690 V	98 %
	LV-LH/LV-RG-400 V / -690 V	97 %
Harmonics to supply, THDI		< 5 %

All units assembled in an IP54 cabinet including main switch + main contactor or motorized circuit breaker, LCL filter, charging unit, and output chokes.

# Environmental conditions

## Operation

PARAMETER	NORMAL OPERATION
Nominal ambient temperature	0 deg C–40 deg C (Air cooled)/0 deg C–45 deg C (Liquid cooled) For operation at higher temperatures, see below.
Atmospheric pressure	86–106 kPa
Relative humidity, non-condensing	5–95 %
Contamination, according to IEC 60721-3-3	No electrically conductive dust allowed. Cooling air must be clean and free from corrosive materials. Chemical gases, class 3C2 (Coated boards 3C3). Solid particles, class 3S2.
Vibrations	According to IEC 60068-2-6, Sinusoidal vibrations: 10 < f < 57 Hz, 0.075 mm 57 < f < 150 Hz, 1g
Altitude	0–1,000 m, 460 V AFE units, with derating 1 % / 100 m of rated current up to 4,000 m. Coated boards recommended > 2,000 m. 690 V AFE units, with derating 1 % / 100 m of rated current up to 2,000 m.

## Storage

PARAMETER	STORAGE
Temperature	-20 to +60 °C
Atmoapheric pressure	86–106 kPa
Relative humidity, non-condensing	0–90 %

# Operation at higher temperatures

All AuCom AFE units are made for operation at maximum of 40/45 deg C ambient temperature. However it is possible to use the AFE units at higher temperatures with some loss in performance, using derating. Derating Liquid cooled AFE: -1 % per degree Celsius. Maximum is +10 deg C (55 deg C). Derating Air cooled AFE: -2.5 % per degree Celsius. Maximum is +5 deg C (45 deg C).

## Basic I/O data

### CONTROL SIGNAL INPUTS - ANALOGUE (DIFFERENTIAL), 4 CHANNELS

Analogue Voltage / current	0-±10 V / 0-20 mA via switch
Max. input voltage	+30 V / 30 mA
Input impedance	20 kΩ (voltage) / 250 Ω (current)
Resolution	11 bits + sign
Hardware accuracy	1 % type + 1 ½ LSB (Least Significant Bit) fsd (full scale deflection)
Non-linearity	1½ LSB

### CONTROL SIGNAL INPUTS - DIGITAL, 8 CHANNELS

Input voltage	High: > 9 V DC, Low: < 4 V DC
Max. input voltage	+30 V DC
Input impedance	< 3.3 V DC: 4.7 kΩ / ≥ 3.3 V DC: 3.6 kΩ
Signal delay	≤ 8 ms

### CONTROL SIGNAL OUTPUTS - ANALOGUE, 2 CHANNELS

Output voltage / current	0-10 V / 0-20 mA via parameter setting
Max. output voltage	+15 V @ 5 mA cont.
Short-circuit current (∞)	+15 mA (voltage), +140 mA (current)
Output impedance	10 Ω (voltage)
Resolution	10 bit
Maximum load impedance for current Hardware accuracy:	500 Ω
Hardware accuracy	1.9 % of full scale deflection (voltage), 2.4 % of full scale deflection (current)
Offset	3 LSB
Non-linearity	2 LSB

### CONTROL SIGNAL OUTPUTS - DIGITAL, 2 CHANNELS

Output voltage	High: > 20 V DC @ 50 mA, > 23 V DC open
	Low: < 1 V DC @ 50 mA
Shortcircuit current (∞)	100 mA max (together with +24 V DC)

### RELAYS, 3 PCS

Contacts	0.1-2 A / Umax 250 V AC or 42 V DC
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### REFERENCE VOLTAGES



+10 V DC	+10 V DC @ 10 mA Short-circuit current +30 mA max
-10 V DC	-10 V DC @ 10 mA
+24 V DC	+24 V DC Short-circuit current +100 mA max (together with Digital Outputs)

# Low harmonics with high efficiency

## GENERAL INFORMATION OVERVIEW

The AuCom Active Front End (AFE) product family includes of LV-LH (low harmonic), LV-RG (regenerative low harmonic). The right choice for every network: The AuCom AFE is a hard-wearing and flexible set of IGBT-based supply rectifiers.

## AuCom AFE product family

AUCOM AFE	LV-LH / LV-RG AIR COOLED	LV-LH / LV-RG LIQUID COOLED
Power range	55–2200 kW	132–4000 kW
Voltage range	3 ph, 230–690 V	3 ph, 230 - 690 V
IP class, cabinet	IP23/54	IP54
Control mode	C: V/Hz, D: Direct torque control or V/Hz	
LCL line filter	Standard	Standard
EMC filter	Standard	Standard
Communication	Modbus RTU	Modbus RTU
Options	Encoder, PTC/PT100, Extended IO, Safe Torque Off (STO) CRIO (only LV-RG), Wireless communication, (WiFi or Bluetooth)	
Serial communication option	RS-232/485 (Modbus RTU)	
Communication options	DeviceNet, Modbus/TCP, Profibus, Profinet IO, EtherNet IP, EtherCAT, CANopen	
Liquid cooling	Standard (heat exchanger optional)	
CE certification		All sizes
Marine certification		DNV

## **AuCom AFE ensures reliable operation in every situation and for every application**

### **TOP END EFFICIENCY AND FLEXIBILITY**

The AuCom AFE, with its high efficiency and low harmonic distortion, is available in a wide power range. It is insensitive to voltage dips or harmonics, provides unity power factor and has a wide power margin. Every aspect of its construction is designed to ensure reliable operation at all times.



### **Main Feature**

- Top end efficiency – LV-LH/LV-RG at 97 %
- Low harmonic distortion to supply, THDi < 5 %
- Power range up to 4MW, 380–690 V supply
- IP54 cabinet solution
- 100 % interchangeable and uniquely self-monitored PEBB power modules
- Project specific adaptation possible
- C/D options including WiFi and Bluetooth wireless communication
- Very compact liquid cooled version (in-built)
- State of the art liquid cooling
- Liquid cooling options include water-to-water and water-to-air heat exchanger
- DNV Marine approval (liquid cooled)

## AuCom AFE ensures cost-efficient and trouble-free operation

AuCom Active Front End drives offer the double benefit of cost savings and increased reliability for your process. The AFE Drives are available in two different versions: Low harmonic drives and Regenerative drives. Both versions offer the same benefits of high reliability, advanced functionality, ease of use and a wide range of options. The AuCom AFE units are supplied as complete solutions in IP54 classified cabinets. The setup is simplified by plug-and-play functionality to the mains supply.

### HOW IT LOOKS LIKE

Air cooled cabinet with top vans: 400 V, 365 A, 200 kW, IP54





## Three advantages at a glance

### COMPLETE AND CERTIFIED SOLUTIONS

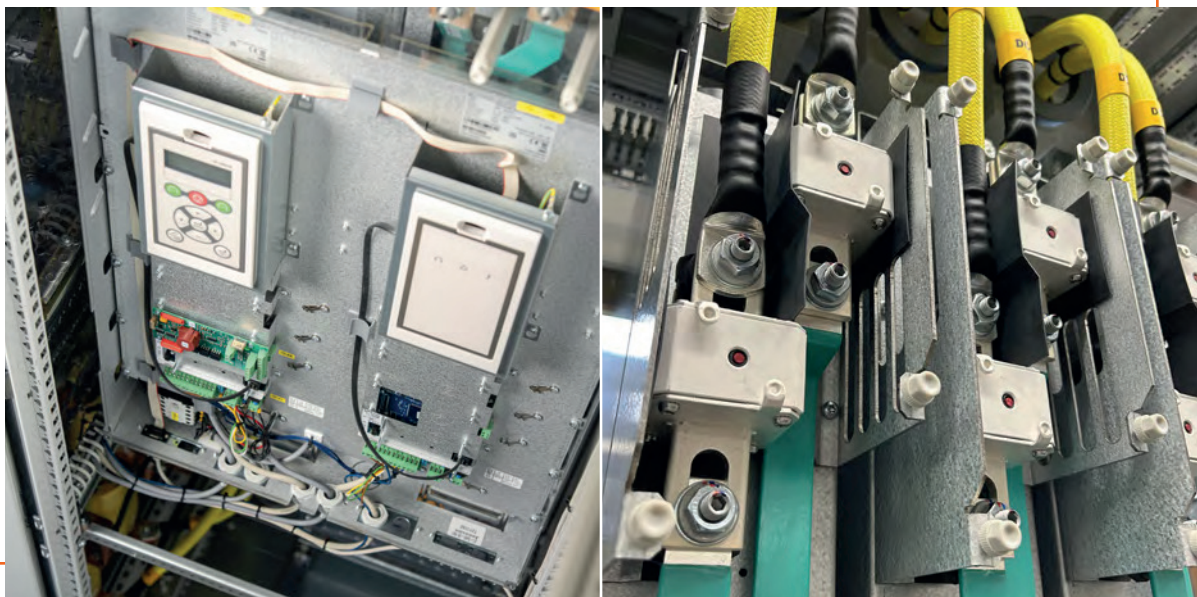
AuCom AFE Drives are supplied as all-in-one solutions, including a robust IP54 classified cabinet, IGBT power modules, LCL filter, circuit breaker, main contactor, charging circuit, EMC filter and output choke. AuCom's full range of liquid cooled AFEs have DNV marine approval.

### TROUBLE-FREE OPERATION

Thanks to state-of-the-art technology, AuCom AFE Drives generate extremely low harmonic distortion and therefore reduces the power losses in the supply systems. They offer a true unity power factor, which makes it possible to optimise the sizing of the distribution transformer and can reduce the electricity transmission tariff. In addition, AuCom AFE Drives provide the possibility to compensate for reactive power. They are insensitive to voltage dips or harmonics from other equipment which could cause them to trip or break down. The voltage boost ensures that the full power of the motor is available in case of mains voltage fluctuations.

### POWER ELECTRONIC BUILDING BLOCK MODULAR SYSTEM

The AuCom AFE is based on a flexible modular Power Electronic Building Block (PEBB) design, where each PEBB is a line or motor inverter in itself, with the exception of the control board. Numerous PEBBs are connected to a common control board and work as a single unit. The PEBB design has many advantages, including redundancy, scalability and service friendliness. The AuCom AFE's electrical and mechanical construction makes installation very simple and user-friendly.



## Power density optimisation with AuComs Compact liquid cooled drives

To make the construction both space and cost efficient, the PEBB is mounted without frames directly into the cabinet which you can find in the AuCom liquid cooled AFE. The flexible modular PEBBs and the very modern cooling system form the basis of a more compact AFE Drive.

That's why a 2MW liquid cooled drive fits in a 2,4 m wide cabinet with the unique PEBB structure and the very modern cooling.

### HASSLE-FREE COOLING

The water-to-water heat exchanger is available as a seawater option. The new cooling system is easily supplied with industrial water from your own water cooling system or via an optional water-to-water heat exchanger section delivered as part of your complete drive solution cabinet.

With the optional water-to-water heat exchanger and pump system, the water-cooling is fed directly from an adjacent part of the cabinet to the bottom of the AC drive for maximum electrical protection. The AuCom AFE has very low requirements on your water pressure, flow and temperature – the cooling water is allowed to have a maximum temperature of 35°C. The cooling section is also available as a water to air heat exchanger type.

### NO AIR-CONDITIONING REQUIRED

The water cooling system is cooling both the drive modules and the LCL-filters, eliminating the need for air conditioner in the switchgear room so there is no need for expensive and high maintenance air-conditioning units in the electrical room with liquid cooling. Mechanically robust construction of the AuCom AFE it very easy to install and use. Without the need for additional fans and air conditioning, noise level is also reduced.



## Network friendly drives with low harmonic

The need for network friendly electronic equipment continues to grow. Low harmonic drives can decrease investment costs in applications such as pumps and fans in the mining, marine, and process industries while also enhancing reliability.

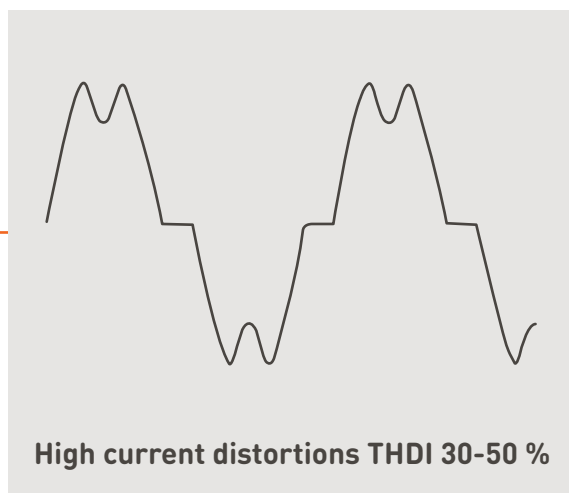
### EXTREMELY LOW HARMONIC DISTORTIONS

Conventional drives typically produce a total harmonic distortion current (THDI) of 30–50 %. In contrast, AuCom’s low harmonic drives produce less than 5 % THDI, fulfilling the IEEE-519 standard. Reducing power losses eliminates the need for over-dimensioned cables and transformers. In addition, lower distortions result in fewer malfunctions in other electronic equipment.

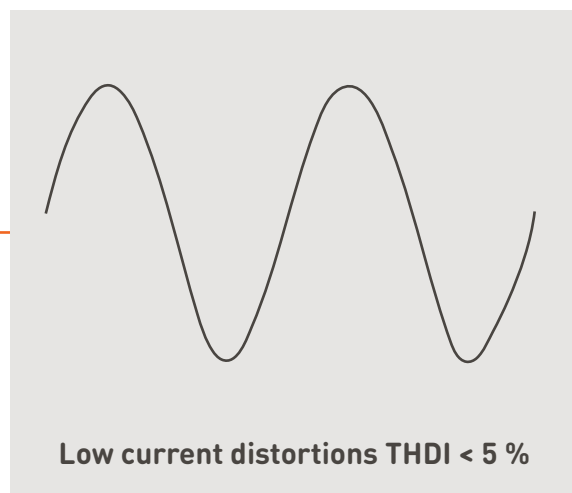
### REACTIVE POWER COMPENSATION

The AC drive is capable of operating at full power in both directions and has a unity power factor. This allows for optimized sizing of the distribution transformer and potentially reduced electricity transmission tariffs. Additionally, it can compensate for reactive power.

**Standard 6-Pulse AC Drive**



**AuCom AFE Drive**



**Low harmonic drives are the answer for applications demanding extremely low harmonic distortions. The results are improved reliability and reduced investment costs.**

## Energy efficient regenerative drives

AuCom regenerative drives offer energy savings and low harmonics in applications with frequent braking, such as test benches, winders, ski lifts, centrifuges and cranes. They provide smooth control and robust yet fast, allowing uninterrupted power flow to and from the mains supply. Regenerative units can also be supplied as DC-bus feeder units.

### REGENERATIVE BRAKING

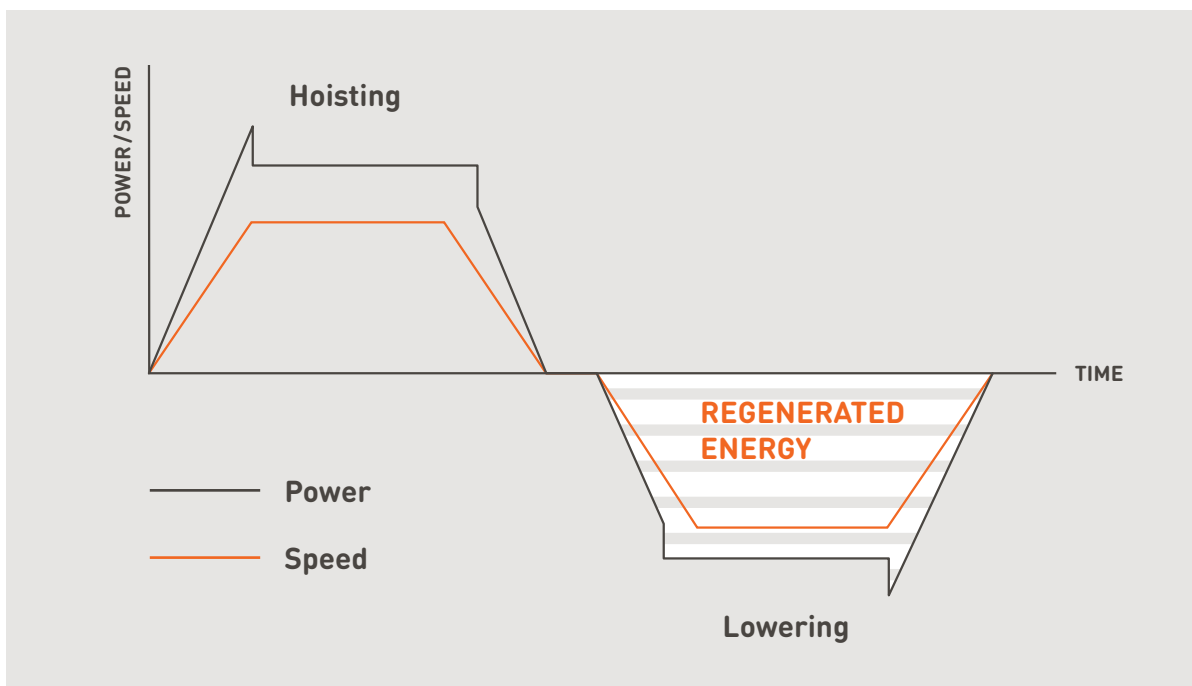
AuCom regenerative drives allow braking energy to be returned to the mains rather than dissipated via braking resistors. This will save considerable energy costs as well as the cost of investing in brake resistors, equipment that has limited lifetime and require cooling or external installation. The regenerative drives are rated for four quadrant operation with 100 % power in both directions, ensuring continuous full braking power.

### TROUBLE-FREE OPERATION

Voltage boosting assures full motor power in case of mains voltage fluctuations. The regenerative drive is nonsensitive to voltage drops or harmonics from other equipment which otherwise could cause it to trip or break down.



**The AFE technology means regenerative energy from lowering can be used for hoisting**



Regenerative drives save energy in, for example, crane operation, by feeding the braking energy back to the mains instead of dissipating it via brake resistors.



## Technical data

### AIR COOLED VERSION

**AUCOM LV-LH - LOW HARMONIC DRIVES &  
AUCOM LV-RG - REGENERATIVE DRIVES**

### AuCom LV-LH / LV-RG typical motor power at mains voltage 400 V

LV-LH (C/D)/ LV-RG (C/D)	MAX <sup>1</sup> OUTPUT CURRENT I <sub>MAX</sub> (A)	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		CABINET WEIGHT (kg)	IP54 CABINET WIDTH (mm) H=2200 D=600
		RATED CURRENT (A)	POWER (kW)	RATED CURRENT (A)	POWER (kW)		
400-109-AF-54-B	131	109	55	87	45	380	800
400-146-AF-54-B	175	146	75	117	55	400	800
400-175-AF-54-B	210	175	90	140	75	480	1000
400-210-AF-54-B	252	210	110	168	90	500	1000
400-250-AF-54-B	300	250	132	200	110	500	1000
400-295-AF-54-B	354	295	160	236	132	680	1200
400-365-AF-54-B	438	365	200	292	160	680	1200
400-430-AF-54-B	516	430	220	344	200	830	1500
400-500-AF-54-B	600	500	250	400	220	830	1600
400-590-AF-54-B	708	590	315	472	250	920	1600
400-730-AF-54-B	876	730	400	584	315	1150	2000
400-810-AF-54-B	972	810	450	648	355	1230	2400
400-1010-AF-54-B	1212	1010	560	808	450	1480	2800
400-1100-AF-54-B	1320	1100	630	880	500	1480	2800
400-1300-AF-54-B	1500	1300	710	1040	560	2100	3000
400-1460-AF-54-B	1752	1460	800	1168	630	2490	3600
400-1710-AF-54-B	2052	1710	900	1368	750	2620	4400
400-2190-AF-54-B	2628	2190	1200	1752	1000	3100	5400

<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Heavy duty, 1 min every 10th minute

## AuCom LV-LH / LV-RG typical motor power at mains voltage 690 V

LV-LH (C/D) / LV-RG (C/D)	MAX <sup>1</sup> OUTPUT CURRENT I <sub>MAX</sub> (A)	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		CABINET WEIGHT (kg)	IP54 CABINET WIDTH (mm) H=2200 D=600
		RATED CURRENT (A)	POWER (kW)	RATED CURRENT (A)	POWER (kW)		
690-109-AF-54-B	131	109	110	87	90	410	800
690-146-AF-54-B	175	146	132	117	110	430	800
690-185-AF-54-B	222	185	160	148	132	540	900
690-250-AF-54-B	300	250	250	200	200	870	1800
690-300-AF-54-B	360	300	315	240	250	870	1800
690-375-AF-54-B	450	375	355	300	315	910	1800
690-430-AF-54-B	516	430	450	344	355	1350	2800
690-560-AF-54-B	672	560	560	448	450	1390	2800
690-750-AF-54-B	900	750	710	600	600	On request	On request
690-1000-AF-54-B	1200	1000	1000	800	800	On request	On request
690-1120-AF-54-B	1344	1120	1100	896	900	On request	On request

<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Heavy duty, 1 min every 10th minute

## Technical data

### LIQUID COOLED VERSION

**AUCOM LV-LH - LOW HARMONIC DRIVES &  
AUCOM LV-RG - REGENERATIVE DRIVES**

### AuCom LV-LH / LV-RG typical motor power at mains voltage 400 V

LV-LH (C/D)/ LV-RG (C/D)	MAX <sup>1</sup> OUTPUT CURRENT I <sub>MAX</sub> (A)	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		CABINET WEIGHT (kg)	WIDTH IP54 CABINET <sup>4</sup> H=2200 D=600 W1 / W2 (mm)
		RATED CURRENT I <sub>NOM</sub> (A)	POWER (kW)	RATED CURRENT I <sub>NOM</sub> (A)	POWER (kW)		
400-250-LC-54-B	300	250	132	200	110	On request	600/1000
400-295-LC-54-B	354	295	160	236	132	On request	600/1000
400-365-LC-54-B	438	365	200	292	160	On request	800/1200
400-590-LC-54-B	708	590	315	472	250	On request	1400/1800
400-730-LC-54-B	876	730	400	584	315	On request	1600/2000
400-810-LC-54-B	972	810	450	648	355	On request	1800/2200
400-1010-LC-54-B	1212	1010	560	808	450	On request	1800/2200
400-1100-LC-54-B	1320	1100	630	880	500	On request	2000/2400
400-1250-LC-54-B	1500	1250	710	1000	560	On request	2000/2400
400-1460-LC-54-B	1752	1460	800	1168	630	On request	3000/3600
400-1710-LC-54-B	2052	1710	900	1368	750	On request	3200/3800
400-2200-LC-54-B	2640	2200	1250	1760	1000	On request	3600/4200
400-2500-LC-54-B	3000	2500	1350	2000	1100	On request	3600/4200

Cabinets complete with incoming breaker/contactor, LCL-filter, EMC-filter, inverters & output chokes.

<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Heavy duty, 1 min every 10th minute

<sup>4</sup> Width cabinet without/with cooling section water/water



## AuCom LV-LH / LV-RG typical motor power at mains voltage 690 V

LV-LH (C/D) / LV-RG (C/D)	MAX <sup>1</sup> OUTPUT CURRENT I <sub>MAX</sub> (A)	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		CABINET WEIGHT (kg)	WIDTH IP54 CABINET <sup>4</sup> H=2200 D=600 W1 / W2 (mm)
		RATED CURRENT I <sub>NOM</sub> (A)	POWER (kW)	RATED CURRENT I <sub>NOM</sub> (A)	POWER (kW)		
690-200-LC-54-B	240	200	200	160	160	On request	600/1000
690-250-LC-54-B	300	250	250	200	200	On request	800/1200
690-500-LC-54-B	600	500	500	400	400	On request	1200/1600
690-750-LC-54-B	900	750	750	600	600	On request	1800/2200
690-1000-LC-54-B	1200	1000	1000	800	800	On request	1800/2200
690-1250-LC-54-B	1500	1250	1250	1000	1000	On request	3000/3400
690-1500-LC-54-B	1800	1500	1500	1200	1200	On request	3400/4000
690-2000-LC-54-B	2400	2000	2000	1600	1600	On request	3600/4200
690-3000-LC-54-B	3600	3000	3000	2400	2400	On request	5200/6000
690-4000-LC-54-B	4800	4000	4000	3200	3200	On request	7200/8800

Cabinets complete with incoming breaker/contactor, LCL-filter, EMC-filter, inverters & output chokes.

<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Heavy duty, 1 min every 10th minute

<sup>4</sup> Width cabinet without/with cooling section water/water

## Cooling sections for AFE Drives

### OPTION WATER/WATER AND WATER/AIR-COOLING SECTIONS INCLUDING IP54 CABINET

#### AuCom liquid cooling section - water to water

COOLING SECTION	MAX POWER LOSSES IN kW (TO WATER)	WATER FLOW IN l/min	CABINET DIMENSIONS H X W X D (mm)	CABINET DIMENSIONS WITH REDUNDANT PUMPS H X W X D (mm)
Cooling section < 14 kW	14	27	2200 x 400 x 600	2200 x 400 x 600
Cooling section < 46 kW	46	70	2200 x 400 x 600	2200 x 600 x 600
Cooling section < 70 kW	70	106	2200 x 800 x 600	2200 x 800 x 600

Cooling section includes: Heat exchanger, pump, pump inverter, expansion tank, valves & cabinet

Max water pressure in 4 bar  
 Max water inlet temperature 35 °C  
 Pipe couplings for in- and out-water G1"

#### AuCom liquid cooling section - water to air

COOLING SECTION	MAX POWER LOSSES IN kW (TO WATER)	WEIGHT (FILLED)	UNIT DIMENSIONS H X W X D (mm)
Cooling unit 12 kW	12	95	813 x 570 x 486
Cooling unit 24 kW	24	230	1079 x 1465 x 731

Rated voltage (pump + ventilator) 380-415 V/50 Hz, 380-440 V/60 Hz  
 Anti-freeze (glycol) mix 30 % glycol, 70 % water  
 Ambient temperature 0-45 °C  
 Water quality (industrial water) See manual

## AuCom AFE - A suitable, energy-efficient choice for every application



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A high-tech power-electronics company at the forefront of design. Leading edge designs based on continuous field research, testing and development.

Comprehensive range of Soft Starter: Low Voltage and Medium Voltage units for standard and heavy-duty applications. Engineering of industrial electronic motor control systems.

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**RIGHT FROM  
THE START**



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