Low Voltage
Hazardous Area Motors

1 EXPLOSIVE ATMOSPHERE

An atmosphere is considered as explosive when the amount of gas, vapor, dust or fibers is such that a spark originated from an electric circuit or an overheating from an equipment may cause an explosion.
In reference to surrounding equipment, preventive construction measures are taken so as to avoid that the area around them is flamed.

2 EUROPEAN STANDARDS FOR EXPLOSIVE ATMOSPHERE DESIGNED MOTORS

In Europe, all motors designed for explosive atmospheres must meet IEC and CENELEC Standards and ATEX Directive 94/9/EC, which is mandatory since July 2003.

2.1 IEC STANDARDS

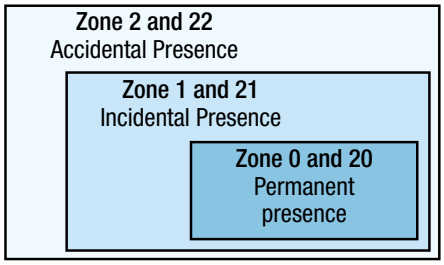
The IEC Standard classifies the risk areas into zones and groups:

- The zones are classified according to frequency and period of time that the explosive atmosphere is present.
- The division into groups is based on the aggressiveness of the environment.

Zone classification:

Gases and Vapours	Zone 0	Environment where the explosive atmosphere is present continuously or for long periods of time.
	Zone 1	Environment where the probability of existing an explosive atmosphere is associated with normal operation of the equipment.
	Zone 2	Environment where an explosive atmosphere will probably not be present under normal operating conditions and, if any, this will be for short periods of time.

Dusts	Zone 20	Environment where flammable dust is present continuously or frequently under normal operating conditions in enough amount to generate an explosive concentration of mixed dust with air and/or areas where may occur excessive amount of dust with no further control.
	Zone 21	Area that is not classified as Zone 20. However, where flammable dusts may occur under normal operating conditions in enough amount to generate an explosive concentration of dust mixed with the air.
	Zone 22	Areas that are not classified as Zone 21. However, where flammable dust may occur frequently and is present for short periods of time, or where the amount of dust may occur just under abnormal operating conditions causing an explosive mixture.



Group classification:

GROUPS	Mines	Equipment manufactured for underground operation mines	I	Methane may be present (grisu)
	Other Explosive Atmospheres	Equipment manufactured for other types of industry (surface industry), being subdivided based on the characteristics of the materials present	IIA	acetone, ammonia, benzene, butane, butanol, alcohol butylic, ethane, ethanol, ethyl acetate, gasoline, hepthanes, hexanes, natural gas, methanol, naphtha, propane, propanol, toluene, esthirene, solvents in general
			IIB	acetaldeide, cyclopropane, diethylic ether, ethene, carbon monoxide
			IIC	acetylene, butadiene, ethene oxide, hydrogen, propylene oxide, gases containing over 30% of hydrogen

2.2 CENELEC STANDARDS

CENELEC Standard provides criteria to determine the classification of the equipment into groups and categories:

Group classification:

GROUP I (Mines)	
Categories	
M1	Equipment designed to operate in environments where the explosive atmosphere is frequently present.
M2	Equipment that must be powered off if there is any risk of explosion. Explosive atmosphere is frequently present.

GROUP II* (Surface Industry)			
Categories			Zone
1	Equipment with high level of protection. Explosive atmosphere is present continuously or for long periods of time	1G (gas) 1D (dust)	0 (gas) 20 (dust)
2	Equipment with high level of protection. Explosive atmosphere may occur occasionally.	2G (gas) 2D (dust)	1 (gas) 21 (dust)
3	Equipment with normal level of protection. The explosive atmosphere will probably not occur.	3G (gas) 3D (dust)	2 (gas) 22 (dust)

** Gases are subdivided into IIA, IIB and IIC, as per IEC Standards.*

2.3 ATEX DIRECTIVE 94/9/EC

Valid since March of 1996, this European Directive is mandatory since July 2003. If provides a classification for motors into areas containing explosive atmospheres. More than product specification, the present Directive gives special attention to the production process including design, production itself and sale.
The certification for the system is provided together with the product certification. ATEX Directive 94/9/EC also classifies the equipment to operate in explosive atmospheres into groups and categories following the same classification bases used by CENELEC.

3 CLASSES OF TEMPERATURE

The minimum temperature causing an explosion of a gas, vapour of explosive mixture is called ignition temperature. To avoid any risk of explosion, the motor surface temperature must always stay below the ignition temperature of the explosive mixture.
The internal and external temperature of the electrical equipment must be strictly checked to avoid ignition of an explosive mixture. So the equipment is classified into classes of temperature, as per table below:

Class of Temperature (ºC) GGROUP II* (Surface Industry) IEC / CENELEC	Maximum motor surface temperature (ºC)	Ignition temperature of the explosive mixture (ºC)
T1	450	>450
T2	300	>300
T3	200	>200
T4	135	>135
T5	100	>100
T6	85	>85

4 MOTORS FED BY VARIABLE FREQUENCY DRIVES

Notes: Ex e motor line fed by VFD requires additional certification.

4.1.1 Temperature class

Ex d and Ex de motor line fed by VFD are suitable to operate at temperature class T4.
Note: For Ex nA motor line, please considerer page 23

4.1.2 Application of filters

- Motors with voltages up to 575V do not require application of filters if the criteria below are followed accordingly:

Rated Voltage	Insulation System	TECHNICAL CRITERIA FOR VFD APPLICATION			
		Voltage Spikes motor terminals (maximum)	dV/dt inverter terminals (maximum)	Rise Time(*) inverter terminals (minimum)	MTBP(*) Minimum Time Between Pulse
Vrated ≤ 460V	Standard Insulation	≤ 1430V	≤ 5200 V/µs	≥ 0,1 µs	≥ 6 µs
460V < Vrated ≤ 575V	Reinforced Insulation	≤ 1780V	≤ 6500 V/µs		

(*) Informed by the converter manufacturer.

Note: Nameplate showing voltage 380-415V / 660-690V – 50Hz and 440-480V – 60Hz, and fed by VFD on voltage

660-690V – 50Hz or 480V – 60Hz require filters.

- Motors fed by VFD with voltage range of 575V up to 690V require filters.

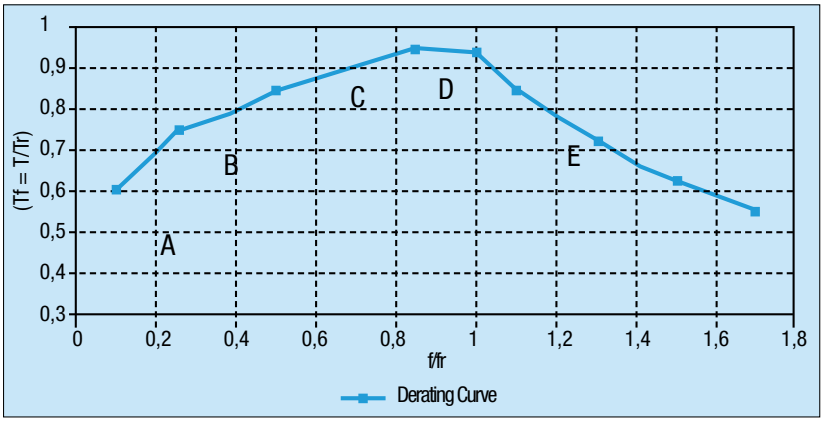
4.1.3 Switching Frequency

The minimum switching frequency is 2.5 kHz.

4.1.4 Type of load torque

For load with quadratic torque, motor can be operated at frequency range from 10% up to 100% of the rated frequency if the load torque at the rated frequency is 95% of the motor rated torque.
For load with constant torque, motor can be worked at frequency range of 10% up to 100% of the rated frequency if the load torque is lower than motor torque derating curve as showing below.
To operate at frequency above the rated frequency, use the derating curve and check if breakdown torque is appropriate for the application in the maximum run speed.

Note: For maximum motor speed selection, item 4.2.1. showing mechanical speed limits must be considered.



PART	DERATING CURVE	
	FREQUENCY RANGE	DERATING
A	0.1 ≤ f/fr < 0.25	Tf = (f/fr) + 0.50
B	0.25 ≤ f/fr < 0.50	Tf = 0.4(f/fr) + 0.65
C	0.50 ≤ f/fr < 0.83	Tf = 0.3(f/fr) + 0.70
D	0.83 ≤ f/fr ≤1.0	Tf = 0.95
E	f/fr > 1.0	Tf = 0.95 / (f/fr)

4.2 Mechanical Characteristics

4.2.1 Mechanical Limit Speed:

The mechanical limit speeds of the motor are indicated on the table below:

MOTOR	SPEED (RPM)			
	2 pole	4 pole	6 pole	8 pole
90 – 100	7000	7000	7000	7000
112	7000	6000	6000	6000
132	6000	5500	5500	5500
160	5000	5000	5000	5000
180	4500	4000	4000	4000
200	4000	3800	3800	3800
225	3600	3600	3600	3600
250	3600	3600	3600	3600
280	3600	3000	3000	3000
315	3600	2500	2500	2500
355	3600	1800	1800	1800

Note: For maximum motor speed selection, the derating curve of item 4.1.4 must be considered.

For other applications, please contact WEG.

4.2.2 Bearing insulation

For “Ex d” and “Ex de” motors, on frames 315S/M and 355M/L* when used with VFD’s must use insulated bearings.

(*) Other frame sizes, on request.

5 PROTECTION CATEGORIES FOR ELECTRIC MOTORS

5.1 TYPE Ex d – EXPLOSION PROOF

It is a type of protection where the parts that may ignite an explosive atmosphere are closed into enclosures which are capable to withstand a pressure during an internal explosion of an explosive mixture and to avoid that explosion leaves this enclosure and reaches an external explosive atmosphere.
An induction electric motor (of any protection) is not totally sealed, that is, air goes in and out. While in operation, it becomes heated up and the internal air gets to a higher pressure compared to the external pressure (air is blown out): when motor is switched - off, the internal pressure decreases, allowing in this way entrance of air (which in this case is contaminated).
The motor surfaces do not need to be totally enclosed to avoid flame propagation. The minimum opening required to avoid passage of flames depends on the gas or vapour that is present.
Therefore, there will always be flame passages on the motor. The safety level on an explosion proof motor is on the fact that it must ensure that all flame passages never exceed the standardized dimensions that the motor is physically suitable to withstand an internal explosion without transmitting to the external environment.
Ex d protection will not allow that an internal explosion propagates to the external environment. To ensure safety to the system, WEG provides a control of the openings and the finishing of joints once these are responsible for the volume of gases exchanged between inside and outside of the motor.

The main characteristics of Ex d motors are as follows:

- Reinforced frame, terminal box and endbells
- Greater contact surface between motor components
- Reduced clearance between motor shaft and bearing cap to avoid transmission of sparks and the external environment
- Water pressure test on all components (frames, endbells, terminal box, terminal box covers)

Application:
Environments containing flammable gases or vapour continuously, intermittently or periodically in enough amount to generate explosive or flammable mixtures arising out of repairs or maintenance services.
The most common locations of Zone 1 and 2, group IIA and IIB are those where the following gases are found present: oil, naphtha, benzene, ammonia, propane, diethylic ether, acetone, alcohol, industrial methane, natural gas.
The main applications include fans, blowers, crushers, conveyor systems, mills, cranes and other applications located in areas that require explosion proof motors.

5.2 TYPE Ex de – EXPLOSION PROOF WITH INCREASED SAFETY TERMINAL BOX

Ex de motors differ from Ex d motors only on the configuration of terminals and terminal box. The terminal box with increased safety terminal block prevents from any ignition source that may occur such as sparks, excessive heating, etc.

The main characteristics of Ex de motors are:

- Terminal box components as well as connection cables must be firmly fastened (without allowing any movement)
- Special terminal block to avoid arcs and sparks and standardized distance between terminals (increased safety terminal block)
- Double grounding must be provided (one on the foot and the other on terminal box covers)

Application:
Same as described for Ex d motors.

5.3 TYPE Ex e – INCREASED SAFETY

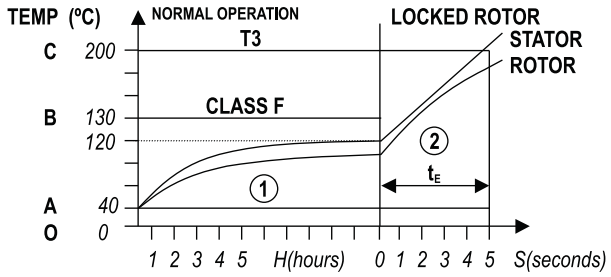
This is an electric equipment which under normal operating conditions will not cause arcs, sparks or overheating enough to cause ignition of an explosive atmosphere which it has been designed to. These motors are similar to standard motors.

However, they are fitted with special features as follows:

- Temperature rise 10K below the maximum temperature allowed for the insulation class
- Commitment with “time tE” (maximum time for switching off through protection device)
- Terminal box components as well as connection cables must be firmly fastened (without allowing any movement)
- External grounding on the frame is mandatory
- Frame grounding must be connected with terminal box grounding
- Drip cover must be applied on vertical applications
- Reduced output x frame ratio
- Special care when manufacturing the winding along with applying double impregnation layer (frames 63 up to 200)
- For frames 225S/M and above resin continuous flow impregnation
- Special terminal block to avoid arcs and sparks and standardized distance between terminals (increased safety terminal block)
- Drain holes on endbells

5.3.1 TIME tE

It is the time required for the motor winding, when starting current goes through it, to reach the limit temperature, starting from the achieved temperature under normal service duty and considering the ambient temperature on its maximum value.
The protection device must be designed so as to avoid any risk under all operating conditions. This protection device must operate, without fault, not only on overload cases, but also on locked rotor conditions. On this way, the value of time tE must be such that, when rotor is locked, motor must be switched off by a protection device that depends on the current, before time tE gets to the end.



On the chart above, the interval OA represents the maximum ambient temperature, and OB is the temperature reached under normal operating duty. In case there is any failure with further rotor locking, the condition is represented on the interval 2 of the chart. The motor temperature increases fastly up to interval OC which must be shorter than motor classification temperature T. So, care must be taken to ensure motor is switched-off within time tE.

Application:

Environments where the probability of existing an explosive atmosphere is associated with normal operation of the equipment in amount enough to cause an explosion.
The environments are classified as Zone 1 and 2, groups IIA, IIB and IIC. The most common gases included in this classification are: acetone, ammonia, benzene, butane, butanol, buthylic alcohol, ethane, ethanol, acetate of ethyl, gasoline, heptanes, hexanes, natural gas, methanol, oil naphtha, propane, propanol, toluene, esthirene, solvents in general, acetaldehyde, cyclopropane, diethylic ether, ethane, carbon monoxide, acetylene, butadiene, ethane oxide, hydrogen, propylene oxide and gases containing over 30% of hydrogen.

5.4 TYPE Ex n – NON-SPARKING

This type of protection is applied to electric equipment which do not cause ignition of an explosive atmosphere under normal operating conditions.

The Ex n motor is built identically to a normal TEFC motor, with the following characteristics:

- Terminal box components as well as connection cables must be firmly fastened (without allowing any movement)
- Increased safety terminal block to avoid arcs and sparks, along with standardized distance between terminals

Application:
Environment where an explosive atmosphere will probably not be present under normal operating conditions and, if any, this will be for short periods of time, that is, an explosive atmosphere may be present accidentally.
The environments are classified as Zone 2, groups IIA, IIB and IIC. The most common gases included in this classification are: acetone, ammonia, benzene, butane, butanol, buthylic alcohol, ethane, ethanol, acetane of ethyl, gasoline, heptanes, hexanes, natural gas, methanol, oil naphtha, propane, propanol, toluene, esthyrene, solvents in general, acetaldehyde, cyclopropane, diethylic ether, ethane, monoxide of carbon, acetylene, butadiene, oxide of ethane, hydrogen, oxide of propylene and gases containing over 30% of hydrogen.

5.5 Cast Iron Motor for Zone 21

These motors are designed to avoid that sparks, arcs or external superficial heat produced, cause the ignition of the dust (cloud or layer). WEG Zone 21 motors are standard motors with special degree of protection that not allow the ingress of dust.

The main characteristics of a Cast Iron Motor for Zone 21 are:

- Degree of protection: IP6X
- Temperature classification: Zone 21: maximum motor guarantee external surface Temperature T125°C – Temperature limitation because of the presence of dust clouds (for materials with ignition temperature above 125°C) and presence of dust layers (up to 5mm).

Application:
These motors are designed to operate in areas that can release flammable dust or in atmospheres where explosions can occur due to a mixture of air and dust. The main applications include sugar refining plants, breweries, cement works, textiles and pharmaceutical, chemical and agricultural process industries.

6 GENERAL INFORMATION

Type of Protection	Ex d	Ex de	Ex e	Ex n	Cast Iron for Zone 21
Designation	Explosion Proof	Explosion Proof with Increased Safety Terminal Box	Increased Safety	Non-sparking	DIP
Objective	Keep an internal explosion not allowing to propagate to the external environment	Explosion not allowing to propagate to the external environment, with special attention to terminal box	Ensure non occurrence of arcs, sparks or overheating under normal operationor on starting	Ensure non occurrence of arcs, sparks or overheating under normal operation	Avoid that sparks, arcs or external superficial heat produced, cause the ignition of the dust
Time t_E	Not applied	Not applied	Applied	Not applied	Not applied
Construction	Rugged frame	Rugged frame, with special characteristics on the terminal box	Similar to standard motor, with special characteristics on the terminal box	Similar to standard motor, with special characteristics on the terminal box	Similar to standard motors, with degree of protection IP 66
Output/frame ratio	Standard	Standard	Reduced	Standard	Standard

Terminal box	Explosion Proof	Explosion proof with increased safety terminal block	Increased safety terminal block	Increased safety terminal block	

7 WEG MOTORS NAMEPLATE IDENTIFICATION

- Type EEx d – Explosion Proof / Explosion Proof with Brake

CE 0102 Ex II 2 G Ex d II B T4 CESI 01 ATEX XXXX

- Type EEx de – Explosion Proof with Increased Safety Terminal Box

CE 0102 Ex II 2 G Ex de II B T4 CESI 01 ATEX XXXX

- Type EEx e – Increased Safety

CE 0102 Ex II 2 G Ex e II C T1,T2,T3 PTB 01 ATEX XXXX

- Type EEx nA – Non Sparking

CE 0102 Ex II 3 G Ex nA II T3 / CE 0102 Ex II 3 D T 125°C

- Cast Iron for Zone 21

CE 0102 Ex II 2 D tD A21 IP 6X T 125°C

Caption:
Identification code of the notified body
Group for the equipment
Category for the equipment
G - Gas / D - Dust
Type of protection against explosion
Protection by enclosure
A21 Level of protection
Group of the equipment
Gas subdivision
Class of Temperature
Certifying Entity
Year
ATEX directive
Certificate Number

For Ex nA motors, the letter A means that all motor components are non-sparking.

Ex d / Ex de - Explosion Proof Motors
Cast Iron Frame
Improved Efficiency EFF2

Standard Features:

- Three-phase, multivoltage, IP55, TEFC
- Output: 0.55 up to 315kW
- Frames: 90 up to 355M/L
- Voltage: 220-240/380-415V (up to 100L)
  380-415/660V (from 112M and up)
- Class “F” insulation (ΔT=80K)
- Continuous duty: S1
- Design N
- Ambient temperature: 40°C, at 1000 m.a.s.l.
- Squirrel cage rotor/Aluminium die cast
- Stainless steel nameplate AISI 316
- Dimensions according to IEC-72
- Performance characteristics according to IEC 34
- Regreasing nipple from frame 225S/M and above
- Metric threaded cable entries on the terminal box
- Thermistors (1 per phase) fitted in frame 160M and above
- Suitable for inverter duty applications
- Color: RAL 5010

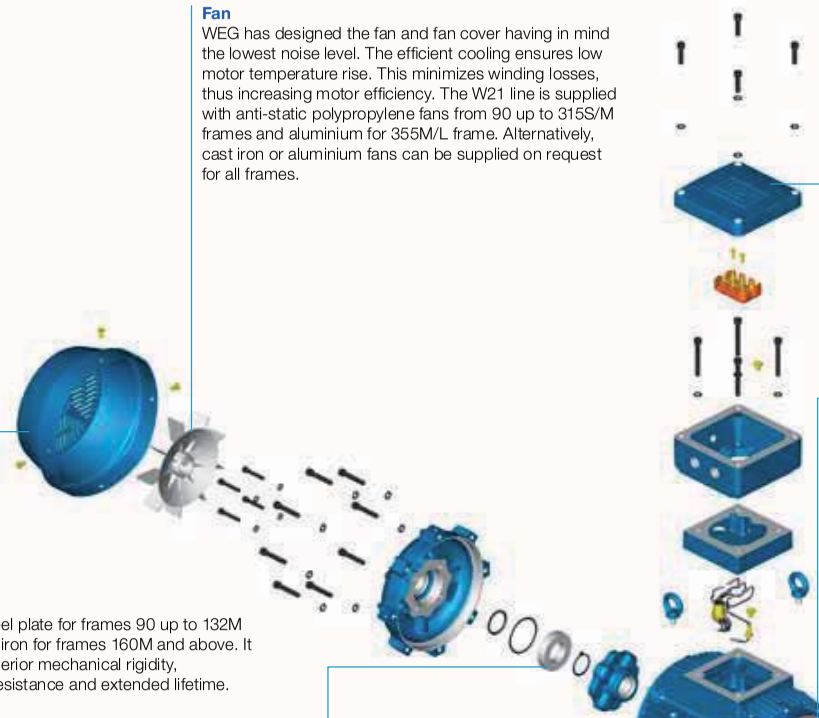
Options Available:

- Degree of Protection: IP56, IP65 or IP66 (W)
- Bearing seals:
  - Lip seal
  - Oil seal
  - Labyrinth taconite seal and W3seal for frames 90S and above
- Thermal protection:
  - Thermistors: frame 132M and below
  - Thermostats
  - RTD-PT 100
- Space heaters
- Design H
- Class “H” insulation
- Roller bearings for frame 160M and above

More options available, on request

Typical Applications:

- Pumps
- Fans
- Crushers
- Conveyor belts
- Mills
- Centrifugal machines
- Presses
- Elevators
- Packaging equipment
- Grinders and others.



Fan
WEG has designed the fan and fan cover having in mind the lowest noise level. The efficient cooling ensures low motor temperature rise. This minimizes winding losses, thus increasing motor efficiency. The W21 line is supplied with anti-static polypropylene fans from 90 up to 315S/M frames and aluminium for 355M/L frame. Alternatively, cast iron or aluminium fans can be supplied on request for all frames.

Terminal Box
Made of cast iron made with plenty of internal space. The terminal box can be rotated in 90º intervals, having one or two threaded holes to connect the power supply cables. Power supply connection components are certified, then reducing short-circuit inside the terminal box. The grounding system is placed inside and outside of the terminal box for improved safety.
* Available as top or side mounted.

Winding
The wire is enameled with class H. Supplied with patented WISE (WEG Insulation System Evolution), which allows three times longer motor lifetime designed to work in environments with excess of moisture and suitable for VFD application. The winding is designed to obtain the smallest Joule losses and temperature rise.

Rotor
High pressure die cast rotor dynamically balanced, thus reducing vibrations. Built with premium electrical grade steel lamination to improve efficiency.

Shaft
WEG uses SAE/AISI 1040/45 steel as standard, which provides high mechanical strength, preventing bending under load and minimizes fatigue which extends lifetime. Specially designed to withstand torques caused during motor acceleration and deceleration. It´s size is larger than the standard motor and, upon special design, motor can have second shaft end.

Fan Cover
Made of steel plate for frames 90 up to 132M and of cast iron for frames 160M and above. It offers a superior mechanical rigidity, corrosion-resistance and extended lifetime.

Seals
WEG Explosion Proof Motors are fitted with either Lip seal or Labyrinth Tachonite as standard (see standard features list) to provide the best possible protection.

Bearings
WEG motors are fitted with the highest quality bearings selected from the best manufacturers in the world and designed to ensure long life of the motor even under heavy operating conditions.

Frame
WEG motors are made of FC-200 high-grade cast iron. The frames are provided with fins aiming at improving the heat dissipation and adequately spaced to minimize air blockage due to build up of dirt. Motor designed to ensure that surface temperature is lower than ignition temperature of the gas that is present in the environment. Mechanical components are designed towithstand an explosion inside the motor without causing any risk to outside areas since there is no flame flame propagation through flame path. The motors can be mounted in any position, horizontal and vertical, withstanding the maximum axial and radial thrusts.

Nameplate
Stainless steel nameplate ensuring a permanent record of all motor data.

Stator
Built with premium electrical grade steel lamination to reduce electrical losses and operating temperature.

Endshields
Made of cast iron, they are provided with external fins for better temperature dissipation, thus increasing bearing life.

Ex d / Ex de - Explosion Proof Motors - Cast Iron Frame
Improved Efficiency EFF2

Output		IEC Frame	Full load torque C_n (Nm)	Locked rotor current I_l/I_n	Locked rotor torque T_l/T_n	Break-down torque T_b/T_n	Inertia J kgm²	Allowable locked rotor time Hot/Cold (s)	Weight (kg)	Sound dB (A)	Rated speed (rpm)	400 V						Full load current I_n (A)
												% of full load						
												Efficiency η			Power Factor (Cos φ)			
kW	HP											50	75	100	50	75	100	
II Pole - 3000 rpm																		
0.75	1	90S	2.44	7	2.8	3.3	0.00181	25/55	31.7	64	2880	72	76.1	78.2	0.69	0.79	0.84	1.65
1.1	1.5	90S	3.67	7.2	2.9	2.9	0.00181	15/33	31.7	64	2870	76	79	80	0.71	0.81	0.87	2.28
1.5	2	90S	4.95	6.5	2.4	2.8	0.00181	12/26	31.7	64	2840	79.6	82	82.2	0.72	0.81	0.87	3.03
2.2	3	90L	7.42	6.6	2.8	3	0.00242	9/20	33.7	64	2840	82.2	83.7	83.4	0.69	0.8	0.85	4.48
3	4	100L	9.76	7.2	2.6	2.8	0.00616	9/20	45.5	67	2880	83.2	85.7	85.6	0.77	0.85	0.88	5.75
4	5.5	112M	13.37	7.6	2.7	3.1	0.00842	15/33	59.9	64	2890	85	87.5	87.5	0.76	0.84	0.88	7.5
5.5	7.5	132S	17.95	8	2.7	3.2	0.02056	18/40	85.3	68	2935	84	87.1	88.3	0.73	0.82	0.87	10.3
7.5	10	132S	24.05	7.3	2.4	2.9	0.02056	10/22	85.4	68	2920	86	87.5	88	0.76	0.84	0.88	14
11	15	160M	35.78	8.3	2.6	3.1	0.04706	12/26	144.8	70	2945	87.8	90.1	90.3	0.77	0.85	0.88	20
15	20	160M	47.7	7.8	2.5	3.2	0.05295	10/22	151.6	70	2945	89.6	91.1	91.2	0.76	0.84	0.88	27
18.5	25	160L	59.63	8.2	2.6	3.3	0.06471	10/22	168.9	70	2945	90.4	91.9	91.7	0.75	0.84	0.88	33.1
22	30	180M	71.43	8.2	2.8	3.1	0.11351	13/29	218.5	70	2950	90.5	92	92.1	0.78	0.86	0.89	38.7
30	40	200L	94.76	7.5	2.8	2.8	0.2063	19/42	289.6	74	2965	90	92	92.7	0.77	0.85	0.88	53.1
37	50	200L	118.45	7.6	2.9	2.9	0.22424	19/42	305	74	2965	91.3	92.8	93	0.75	0.84	0.88	65.3
45	60	225S/M	142.14	7.9	2.6	3.5	0.44846	24/53	460.3	82	2965	91.6	93.3	93.6	0.85	0.89	0.91	76.3
55	75	250S/M	177.67	8.5	2.8	3	0.50227	15/33	513.9	82	2965	91.8	93.5	93.8	0.84	0.89	0.91	93
75	100	280S/M	236.1	7.5	2.4	2.8	1.08256	44/97	782.9	83	2975	91.4	93.6	94.2	0.81	0.87	0.89	129
90	125	280S/M	295.12	8.1	2.3	2.8	1.27083	35/77	845.4	83	2975	92	94.1	94.5	0.79	0.87	0.9	153
110	150	315S/M	354.15	7.6	2.3	2.8	1.41204	40/88	972.8	84	2975	93	94.4	94.9	0.79	0.85	0.89	188
132	175	315S/M	413.87	7.5	2.3	2.8	1.64738	31/68	1034.3	84	2970	93.2	94.8	95	0.82	0.88	0.9	223
160	220	315S/M	520.29	7.3	2.2	2.5	2.11806	25/55	1164.6	84	2970	94.1	95	95.4	0.85	0.89	0.9	269
200	270	355M/L	635.33	7.2	1.8	2.6	4.82631	70/154	1830	81	2985	93.5	95	95.4	0.89	0.91	0.92	329
250	340	355M/L	800.05	7.8	2.2	2.5	5.74561	65/143	1972	81	2985	94.4	95.8	96	0.88	0.91	0.92	409
HIGH-OUTPUT DESIGN																		
75	100	250S/M	236.9	8.3	3	3.4	0.55609	10/22	570	82	2965	92.5	93.6	93.6	0.83	0.88	0.9	129
110	150	280S/M	354.15	7.6	2.3	2.8	1.41204	40/88	878	83	2975	93	94.4	94.9	0.79	0.85	0.89	188
IV Pole - 1500 rpm																		
0.55	0.75	90S	3.7	6.4	2.7	2.8	0.00392	17/37	31.6	49	1425	69	73	75	0.6	0.72	0.78	1.36
0.75	1	90S	4.91	6.5	2.7	2.8	0.00392	14/31	31.7	49	1430	71	74.4	74.4	0.58	0.71	0.79	1.84
1.1	1.5	90S	7.53	5.5	2.4	2.5	0.00392	9/20	31.8	49	1400	72.5	76.2	76.2	0.61	0.75	0.82	2.54
1.5	2	90L	9.96	6.4	2.7	2.5	0.0056	9/20	34.6	49	1410	75	78.6	78.6	0.63	0.75	0.82	3.36
2.2	3	100L	14.84	6.7	2.7	2.9	0.00842	14/31	45.1	53	1420	81	82.3	83	0.65	0.78	0.83	4.61
3	4	100L	20	6.7	2.5	2.6	0.00918	8/18	46.6	53	1405	81.5	82.6	82.6	0.68	0.78	0.84	6.24
4	5.5	112M	27.02	6.9	2.6	2.8	0.01607	10/22	62.3	56	1430	83	84.3	84.2	0.67	0.78	0.84	8.16
5.5	7.5	132S	35.96	8	2.4	3	0.04264	10/22	83.6	60	1465	85.2	87.5	88	0.65	0.78	0.84	10.7
7.5	10	132M	47.95	8	2.5	2.8	0.05427	8/18	95.1	60	1465	86.4	88.4	88.6	0.7	0.8	0.86	14.2
11	15	160M	72.41	6	2.3	2.5	0.08029	16/35	142.8	67	1455	87.6	89.4	89.9	0.7	0.79	0.84	21
15	20	160L	96.55	6	2.3	2.4	0.10539	13/29	162.7	67	1455	89	90.4	90.6	0.69	0.79	0.84	28.4
18.5	25	180M	119.46	7	2.7	2.8	0.17939	18/40	212.4	64	1470	89.8	91.5	92.1	0.68	0.79	0.84	34.5
22	30	180L	143.35	7.5	2.8	2.8	0.21528	14/31	229.9	64	1470	91	92.2	92.4	0.67	0.78	0.83	41.4
30	40	200L	190.48	6.5	2.2	2.5	0.33095	17/37	289.7	69	1475	91.8	93	93	0.75	0.82	0.85	54.8
37	50	225S/M	237.3	7.2	2.3	2.7	0.62988	20/44	404.6	70	1480	91.2	92.2	92.8	0.76	0.85	0.88	65.4
45	60	225S/M	285.72	7	2.3	2.7	0.76985	16/35	433.8	70	1475	91	92.9	93.5	0.76	0.85	0.88	78.9
55	75	250S/M	357.15	7	2.3	2.6	0.97981	16/35	508.8	70	1475	93	93.5	93.7	0.78	0.86	0.89	95.2
75	100	280S/M	472.99	6.7	2.1	2.4	1.84681	31/68	777.5	76	1485	92	93.6	94	0.79	0.85	0.88	131
90	125	280S/M	591.24	7.1	2.4	2.5	2.56947	31/68	869	76	1485	92.3	93.9	94.2	0.8	0.86	0.88	157
110	150	315S/M	709.49	7.1	2.3	2.6	2.81036	27/59	1036.1	77	1485	92.8	94.4	94.4	0.78	0.85	0.88	191
132	175	315S/M	827.74	7.5	2.3	2.6	3.37243	13/29	1121.1	77	1485	93	94	94.6	0.78	0.85	0.88	229
160	220	315S/M	1044.1	7	2.4	2.7	3.77391	22/48	1189.9	77	1480	93.3	95.1	95.5	0.75	0.83	0.87	278
200	270	355M/L	1272.8	6.6	2.3	2.2	6.34151	44/97	1808.1	79	1490	94.8	95.2	95.4	0.78	0.85	0.87	348
250	340	355M/L	1602.78	6.9	2.2	2.5	7.57882	36/79	1921.6	79	1490	94.3	95.2	95.8	0.8	0.86	0.88	428
280	380	355M/L	1791.35	7.1	2.2	2.4	9.0224	39/86	1770	79	1490	95	95.7	95.8	0.81	0.87	0.88	479
315	430	355M/L	2027.05	6.7	2.2	2.4	9.92464	42/92	2198.5	79	1490	94.8	95.9	96.2	0.79	0.86	0.88	537
HIGH-OUTPUT DESIGN																		
75	100	250S/M	476.2	7.2	2.4	2.6	1.15478	12/26	556	70	1475	92.5	93.6	93.7	0.77	0.85	0.87	133
110	150	280S/M	709.49	7.1	2.3	2.6	2.81036	27/59	935.2	76	1485	92.8	94.4	94.4	0.78	0.85	0.88	191

Notes:
**Class "F" insulation with ΔT105K*
Standard voltage, connection and frequency: 220-240V Δ 50Hz *380-415V Δ 50Hz*
380-415V Y 50Hz *660-690V Y 50Hz*
The values shown are subject to change without prior notice. To obtain guaranteed values please access our website.

Ex d / Ex de - Explosion Proof Motors - Cast Iron Frame
Improved Efficiency EFF2

Output		380 V								415 V							
		Rated speed (rpm)	% of full load						Full load current I_n (A)	Rated speed (rpm)	% of full load						Full load current I_n (A)
			Efficiency η			Power Factor (Cos φ)					Efficiency η			Power Factor (Cos φ)			
kW	HP		50	75	100	50	75	100			50	75	100	50	75	100	
II Pole - 3000 rpm																	
0.75	1	2870	72.5	76	77.8	0.73	0.81	0.86	1.7	2890	71.5	76	78.4	0.66	0.77	0.82	1.62
1.1	1.5	2850	76.5	78.8	79.5	0.75	0.84	0.89	2.36	2880	75.5	78.9	80.2	0.68	0.79	0.85	2.24
1.5	2	2830	80	81.5	81.2	0.75	0.84	0.89	3.15	2850	79.1	82.2	82.5	0.68	0.79	0.85	2.98
2.2	3	2820	82.8	83.6	83.3	0.75	0.84	0.87	4.61	2850	81.5	83.6	84.3	0.64	0.76	0.83	4.37
3	4	2870	83.5	85.6	85.1	0.8	0.86	0.89	6.02	2890	82.8	85.6	85.6	0.74	0.84	0.87	5.6
4	5.5	2880	85.5	87.5	87.2	0.8	0.86	0.89	7.83	2900	84.5	87.4	88.2	0.72	0.82	0.87	7.25
5.5	7.5	2930	84.5	87.5	88.2	0.77	0.85	0.89	10.6	2940	83.5	86.8	88.2	0.69	0.8	0.85	10.2
7.5	10	2910	86.5	87.5	87.5	0.8	0.87	0.9	14.5	2925	85.5	87.4	88.1	0.71	0.81	0.86	13.8
11	15	2940	88.3	90.1	90.2	0.8	0.86	0.89	20.8	2950	87.3	90	90.4	0.74	0.83	0.87	19.5
15	20	2935	90.1	91.2	91	0.81	0.87	0.89	28.1	2950	89.1	91	91.2	0.72	0.81	0.87	26.3
18.5	25	2940	90.7	92	91.5	0.78	0.86	0.89	34.5	2950	90.1	91.8	92	0.73	0.83	0.86	32.5
22	30	2945	91	92.1	92	0.82	0.88	0.9	40.4	2955	90	91.9	92.1	0.75	0.84	0.87	38.2
30	40	2960	90.5	92.1	92.6	0.8	0.87	0.89	55.3	2970	89.5	91.8	92.7	0.73	0.83	0.87	51.8
37	50	2960	91.7	93	93	0.8	0.87	0.89	67.9	2965	90.8	92.6	93	0.7	0.81	0.86	64.4
45	60	2960	91.9	93.4	93.5	0.86	0.9	0.92	79.5	2970	91.5	93.3	93.9	0.84	0.88	0.9	74.1
55	75	2965	91.8	93.2	93.5	0.86	0.91	0.92	97.1	2970	91.6	93.5	94	0.82	0.88	0.91	89.5
75	100	2970	91.9	93.6	94.3	0.84	0.88	0.9	134	2980	91	93.6	94.2	0.78	0.85	0.88	126
90	125	2970	92.3	93.9	94.5	0.82	0.88	0.9	161	2975	91.5	94.1	94.5	0.77	0.86	0.89	149
110	150	2970	93.1	94.4	94.9	0.81	0.87	0.9	196	2975	92.2	94.4	94.8	0.75	0.83	0.88	183
132	175	2965	93.5	94.7	94.8	0.84	0.89	0.91	232	2970	93	94.8	95.2	0.8	0.87	0.9	214
160	220	2970	94.2	95	95.3	0.86	0.9	0.91	280	2975	94	95	95.4	0.83	0.88	0.89	262
200	270	2980	93.7	95	95.3	0.9	0.92	0.92	347	2985	93.3	94.9	95.4	0.88	0.9	0.91	321
250	340	2980	94.5	95.8	96	0.9	0.92	0.93	425	2985	94.3	95.8	96.1	0.87	0.91	0.92	393
HIGH-OUTPUT DESIGN																	
75	100	2960	92.6	93.3	93.3	0.85	0.89	0.91	134	2965	92.5	93.7	94.2	0.81	0.87	0.9	123
110	150	2970	93.1	94.4	94.9	0.81	0.87	0.9	196	2975	92.2	94.4	94.8	0.75	0.83	0.88	183
IV Pole - 1500 rpm																	
0.55	0.75	1420	70.2	74.8	75	0.64	0.75	0.8	1.39	1430	68	73.8	75	0.55	0.68	0.75	1.36
0.75	1	1415	72	74.6	74	0.62	0.74	0.81	1.9	1440	70	74.4	74.4	0.54	0.68	0.77	1.82
1.1	1.5	1390	73.5	76.4	75.5	0.67	0.8	0.85	2.6	1410	70.5	76.2	76.2	0.56	0.71	0.8	2.51
1.5	2	1390	76.5	78.7	77.8	0.67	0.79	0.85	3.45	1420	73.5	78.5	78.8	0.58	0.72	0.8	3.31
2.2	3	1410	81.5	82	81.7	0.69	0.81	0.85	4.81	1430	80.5	82.3	83	0.61	0.75	0.81	4.55
3	4	1390	82	82.3	82	0.7	0.8	0.86	6.46	1415	80.5	82.5	82.7	0.65	0.75	0.82	6.15
4	5.5	1420	84	84.5	84	0.72	0.81	0.86	8.41	1440	82	84.2	84.2	0.62	0.74	0.82	8.06
5.5	7.5	1460	86.5	88.1	88	0.72	0.82	0.86	11	1470	84	86.8	87.8	0.6	0.74	0.82	10.6
7.5	10	1465	87	88.6	88.4	0.75	0.84	0.88	14.6	1470	85.6	88	88.6	0.65	0.77	0.83	14.2
11	15	1450	88.3	89.6	89.2	0.74	0.82	0.85	22	1460	86.8	89	89.8	0.65	0.76	0.82	20.8
15	20	1450	89.5	90.5	90.1	0.73	0.82	0.86	29.4	1460	88.4	90.3	90.6	0.67	0.78	0.83	27.8
18.5	25	1465	90.3	91.7	91.7	0.72	0.81	0.85	36.1	1470	89.3	91.3	92.1	0.65	0.76	0.82	34.1
22	30	1465	91.5	92.4	92.3	0.72	0.81	0.85	42.6	1475	90.5	92	92.5	0.63	0.75	0.81	40.8
30	40	1470	92.2	93	92.6	0.78	0.84	0.86	57.2	1480	91.5	93	93.2	0.72	0.8	0.84	53.3
37	50	1475	91.6	92.4	92.5	0.79	0.86	0.89	68.3	1480	90.8	92.1	92.9	0.72	0.83	0.87	63.7
45	60	1475	91.3	92.8	93.5	0.8	0.87	0.89	82.2	1480	91	92.9	93.5	0.72	0.83	0.87	77
55	75	1475	92.8	93.5	93.4	0.83	0.88	0.91	98.3	1480	92.5	93.4	93.6	0.77	0.85	0.89	91.9
75	100	1480	92.1	93.4	93.6	0.82	0.87	0.89	137	1485	91.5	93.6	94	0.76	0.84	0.87	128
90	125	1480	92.6	94.1	94.2	0.82	0.87	0.89	163	1485	92	93.9	94.2	0.78	0.85	0.88	151
110	150	1480	92.8	93.6	94.2	0.8	0.86	0.88	202	1485	92.8	94.4	94.5	0.76	0.83	0.87	186
132	175	1480	93	93.5	94.3	0.81	0.86	0.89	241	1485	92.2	94.7	94.7	0.76	0.84	0.87	223
160	220	1480	93	95	95.4	0.78	0.85	0.88	290	1485	94.2	95.1	95.5	0.73	0.82	0.86	271
200	270	1485	94.8	95	95.2	0.8	0.86	0.88	363	1490	94.5	95.1	95.3	0.76	0.84	0.86	339
250	340	1485	94.5	95.2	95.7	0.82	0.87	0.89	446	1490	94.1	95	95.7	0.77	0.85	0.87	418
280	380	1485	95.1	95.6	95.7	0.83	0.88	0.89	499	1490	95	95.6	95.8	0.79	0.86	0.87	467
315	430	1485	95	95.8	96.1	0.83	0.87	0.89	560	1490	94.5	95.8	96.2	0.76	0.84	0.87	524
HIGH-OUTPUT DESIGN																	
75	100	1475	92.6	93.4	93.5	0.8	0.86	0.88	138	1480	92.6	93.7	93.6	0.74	0.84	0.87	128
110	150	1480	92.8	93.6	94.2	0.8	0.86	0.88	202	1485	92.8	94.4	94.5	0.76	0.83	0.87	186

Ex d / Ex de - Explosion Proof Motors - Cast Iron Frame
Improved Efficiency EFF2

Output		IEC Frame	Full load torque C_n (Nm)	Locked rotor current I_l/I_n	Locked rotor torque T_l/T_n	Break-down torque T_b/T_n	Inertia J kgm²	Allowable locked rotor time Hot/Cold (s)	Weight (kg)	Sound dB (A)	Rated speed (rpm)	400 V						Full load current I_n (A)
												% of full load						
												Efficiency η			Power Factor (Cos φ)			
kW	HP											50	75	100	50	75	100	
VI Pole - 1000 rpm																		
0.75	1	90L	7.63	4.8	2.1	2.1	0.00504	16/35	33.3	45	920	70	72.6	72.4	0.54	0.67	0.76	1.97
1.1	1.5	90L	11.51	4.5	2.3	2.3	0.0056	12/26	34.5	45	915	68	71	72.9	0.48	0.62	0.72	3.02
1.5	2	100L	14.94	4.8	2.2	2.5	0.01121	18/40	43.1	44	940	74	77.3	77.5	0.53	0.66	0.74	3.78
2.2	3	112M	22.42	5	2.2	2.3	0.01682	14/31	56.5	48	940	77.5	80.5	80.1	0.53	0.66	0.74	5.36
3	4	132S	29.27	5.3	2	2.2	0.03489	20/44	77.2	52	960	80	82.7	82.5	0.58	0.7	0.77	6.82
4	5.5	132M	40.24	6	2.1	2.3	0.05039	18/40	91.4	52	960	83.6	85.5	85.8	0.59	0.7	0.77	8.74
5.5	7.5	132M	54.87	6.4	2.3	2.4	0.06202	14/31	99.5	52	960	84	85.8	85.8	0.54	0.66	0.74	12.5
7.5	10	160M	72.41	6.1	2.3	2.6	0.12209	17/37	145	56	970	87	88.2	88	0.62	0.74	0.81	15.2
9.2	12.5	160L	90.51	6.5	2.3	2.8	0.14364	12/26	115	56	970	86.5	88	87.6	0.61	0.74	0.81	18.7
11	15	160L	108.62	6.6	2.4	2.9	0.17595	13/29	170.2	56	970	87.2	88.3	88.3	0.62	0.75	0.82	21.9
15	20	180L	145.57	7.5	2.5	2.6	0.30338	9/20	217.9	56	965	89.1	90.1	89.8	0.8	0.88	0.91	26.5
18.5	25	200L	180.1	6	2.1	2.3	0.3767	15/33	270.1	58	975	89.7	90.7	90.2	0.74	0.82	0.86	34.4
22	30	200L	216.12	6	2.3	2.4	0.41258	14/31	280.4	58	975	89	90.9	91.3	0.7	0.79	0.84	41.4
30	40	225S/M	285.24	7.2	2.6	2.7	0.98842	20/44	422.8	61	985	90.5	91.8	91.8	0.77	0.84	0.87	54.2
37	50	250S/M	358.37	7.5	2.7	2.6	1.22377	18/40	490.5	61	980	90.2	92.4	92.5	0.77	0.85	0.87	66.4
45	60	280S/M	427.86	6.8	2.4	2.6	2.29824	24/53	735.8	66	985	90.5	92.3	92.6	0.68	0.78	0.83	84.5
55	75	280S/M	534.82	6.5	2.3	2.5	2.64298	23/51	774.6	66	985	91.6	93.2	93.5	0.71	0.82	0.85	100
75	100	315S/M	713.09	6.7	2.3	2.5	3.44737	20/44	963.1	69	985	91.6	93.5	93.7	0.71	0.81	0.85	136
90	125	315S/M	891.37	6.3	2.1	2.3	3.67719	18/40	993.1	69	985	92.5	94	93.9	0.71	0.81	0.85	163
110	150	315S/M	1069.64	6.4	2.3	2.4	5.28596	18/40	1169.3	69	985	93.4	94.4	94.5	0.71	0.8	0.84	200
132	175	355M/L	1241.61	6.1	2	2.3	8.10159	90/198	1685.3	73	990	92.5	94.7	94.7	0.65	0.75	0.8	251
160	220	355M/L	1560.88	6.2	1.9	2.1	9.53128	72/158	1730	73	990	93	95	95.3	0.67	0.77	0.82	295
200	270	355M/L	1915.63	6.3	2.1	2.3	12.39067	85/187	1910	73	990	93.5	94.5	94.8	0.7	0.78	0.81	376
250	340	355M/L	2400.15	6.1	2.2	2.2	14.77349	64/141	2185	73	995	94	95.1	95.6	0.7	0.79	0.82	460
280	380	355M/L	2696.07	6	2.1	2.2	14.77349	54/119	2185	73	990	94.3	95.2	95.4	0.68	0.77	0.8	530
HIGH-OUTPUT DESIGN																		
45	60	250S/M	430.04	8	2.8	2.8	1.55324	18/40	544.9	61	980	91	92.3	92.6	0.76	0.84	0.87	79.7
75	100	280S/M	713.09	6.7	2.3	2.5	3.44737	20/44	800	66	985	91.6	93.5	93.7	0.71	0.81	0.85	136
VIII Pole - 750 rpm																		
0.37	0.5	90L	5.05	3.5	2.1	2.1	0.00448	29/64	30	43	695	51	59	61	0.43	0.53	0.64	1.37
0.55	0.75	90L	7.63	3.7	2.1	2.1	0.0056	18/40	34.1	43	690	51.6	60	64	0.4	0.5	0.6	2.07
0.75	1	100L	9.96	4.2	2	2.1	0.00952	30/66	41.1	50	705	65	70	71	0.42	0.54	0.63	2.42
1.1	1.5	100L	15.05	4.1	1.7	2.1	0.01289	23/51	44.8	50	700	66	71.5	72.2	0.43	0.56	0.65	3.38
1.5	2	112M	20.07	4.6	2.4	2.4	0.02243	19/42	60.9	46	700	74	75.5	76.3	0.46	0.6	0.68	4.17
2.2	3	132S	29.68	5.3	2.1	2.3	0.0552	19/42	81.9	48	710	78.5	79.3	79.4	0.51	0.64	0.72	5.55
3	4	132M	39.57	5.9	2.5	2.6	0.07527	16/35	94.9	48	710	79	82	82.5	0.52	0.64	0.72	7.29
4	5.5	160M	52.92	5.2	2.2	2.7	0.12209	33/73	144.7	51	730	81.3	84.3	86	0.47	0.6	0.69	9.73
5.5	7.5	160M	72.16	5.2	2.3	2.7	0.14364	23/51	157	51	730	81.5	84.1	85.2	0.46	0.59	0.69	13.5
7.5	10	160L	96.88	4.9	2	2.5	0.16518	15/33	165.8	51	725	83.5	85.7	85.5	0.51	0.63	0.72	17.6
11	15	180L	145.32	6.8	2.3	2.5	0.2758	11/24	208.1	51	725	87	88.5	88.3	0.68	0.79	0.84	21.4
15	20	200L	192.44	4.6	2	2.1	0.3767	23/51	269.8	53	730	86.5	88.6	89	0.56	0.68	0.75	32.4
18.5	25	225S/M	240.55	6.9	2.1	2.8	0.84722	17/37	393.4	56	730	88.5	90.1	90	0.72	0.8	0.85	34.9
22	30	225S/M	288.66	7.5	2.2	2.7	0.98842	19/42	419.3	56	730	89	91	91	0.73	0.82	0.85	41.1
30	40	250S/M	384.87	7.9	2.3	2.9	1.22377	17/37	486.6	56	730	89.5	91.2	91.6	0.7	0.79	0.84	56.3
37	50	280S/M	474.59	6.5	1.9	2.3	2.29824	29/64	700	59	740	90.5	92.2	92.3	0.67	0.77	0.81	71.4
45	60	280S/M	569.51	6.5	2	2.4	2.64298	26/57	765	59	740	90.5	92.1	92.3	0.65	0.75	0.8	88
55	75	315S/M	711.89	6.5	1.9	2.2	3.10263	27/59	845	62	740	91.2	93.1	93	0.69	0.78	0.82	104
75	100	315S/M	949.18	6.6	1.9	2.2	4.36666	20/44	1062	62	740	92	93.4	93.5	0.67	0.79	0.82	141
90	125	315S/M	1186.48	6.8	2.1	2.4	5.28596	23/51	1220	62	740	92.5	93.8	94.2	0.7	0.78	0.83	166
110	150	355M/L	1423.78	6.4	1.5	2.2	11.9324	41/90	1750	70	740	92.5	94.1	94.5	0.63	0.74	0.8	210
132	175	355M/L	1661.07	6.5	1.6	2.2	13.18845	47/103	1800	70	740	93	94.5	94.8	0.63	0.73	0.79	254
160	220	355M/L	2088.2	6.6	1.6	2.2	16.32856	42/92	1710	70	740	93.3	94.7	94.7	0.64	0.75	0.8	305
200	270	355M/L	2562.8	6.8	1.6	2.1	19.46866	37/81	1900	70	740	93.3	94.6	95.2	0.6	0.72	0.79	384
HIGH-OUTPUT DESIGN																		
37	50	250S/M	481.09	8.2	2.3	2.8	1.55324	13/29	540	56	730	89	91.5	91.5	0.68	0.78	0.84	69.5

Notes:
**Class "F" insulation with ΔT105K*
Standard voltage, connection and frequency: 220-240V Δ 50Hz *380-415V Δ 50Hz*
380-415V Y 50Hz *660-690V Y 50Hz*
The values shown are subject to change without prior notice. To obtain guaranteed values please access our website.

Ex d / Ex de - Explosion Proof Motors - Cast Iron Frame
Improved Efficiency EFF2

Output		380 V								415 V							
		Rated speed (rpm)	% of full load						Full load current I_n (A)	Rated speed (rpm)	% of full load						Full load current I_n (A)
			Efficiency η			Power Factor (Cos φ)					Efficiency η			Power Factor (Cos φ)			
kW	HP		50	75	100	50	75	100			50	75	100	50	75	100	
VI Pole - 1000 rpm																	
0.75	1	910	71.5	72.8	71.5	0.58	0.71	0.79	2.02	930	68.5	72.4	72.4	0.5	0.64	0.73	1.97
1.1	1.5	905	71	72	72.9	0.52	0.66	0.76	3.02	925	65	70.5	73	0.45	0.58	0.68	3.08
1.5	2	930	75	77.5	77	0.58	0.7	0.76	3.89	950	73	77.3	77.6	0.5	0.63	0.71	3.79
2.2	3	930	79	80.8	79.7	0.58	0.7	0.76	5.52	950	76	80.3	80.5	0.5	0.63	0.72	5.28
3	4	955	81	83	82	0.61	0.72	0.79	7.04	965	79	82.5	82.6	0.53	0.66	0.74	6.83
4	5.5	955	84.5	85.7	85.4	0.61	0.72	0.79	9.01	965	82.6	85.3	85.9	0.56	0.67	0.75	8.64
5.5	7.5	955	85	86.1	85.6	0.58	0.7	0.77	12.7	965	83	85.5	86	0.5	0.62	0.71	12.5
7.5	10	965	87.5	88.4	87.5	0.66	0.78	0.83	15.7	970	86.5	88	88	0.58	0.71	0.79	15
9.2	12.5	970	87.5	88.2	87.5	0.65	0.76	0.82	19.5	975	85.5	87.8	87.5	0.56	0.71	0.79	18.5
11	15	970	88	88.5	88	0.67	0.78	0.84	22.6	975	86.5	88	88.3	0.58	0.72	0.8	21.7
15	20	960	89	90	89.5	0.82	0.89	0.91	28	970	89	90.5	90.5	0.78	0.87	0.9	25.6
18.5	25	970	90	90.5	89.8	0.76	0.84	0.87	36	980	89.3	90.5	90.5	0.72	0.8	0.84	33.9
22	30	970	89.6	91	91.2	0.74	0.82	0.85	43.1	980	88.4	90.7	91.3	0.66	0.76	0.82	40.9
30	40	980	91	91.8	91.6	0.8	0.86	0.88	56.5	985	90	91.8	92.2	0.73	0.81	0.86	52.6
37	50	980	90.5	92.5	92.4	0.8	0.86	0.88	69.1	985	89.5	92.4	92.6	0.73	0.82	0.86	64.6
45	60	985	91	92.3	92.6	0.72	0.81	0.85	86.9	990	90	92.3	92.7	0.64	0.76	0.82	82.4
55	75	985	92	93.2	93.4	0.74	0.84	0.87	103	990	91.2	93.2	93.6	0.68	0.8	0.84	97.3
75	100	985	92	93.5	93.5	0.74	0.82	0.86	142	990	91.2	93.5	93.8	0.69	0.8	0.84	132
90	125	985	92.8	93.9	93.6	0.74	0.83	0.86	170	990	92.2	93.9	93.9	0.69	0.79	0.84	159
110	150	985	93.6	94.3	94.3	0.74	0.82	0.85	208	985	93.2	94.5	94.6	0.69	0.79	0.83	195
132	175	990	93	94.7	94.5	0.7	0.8	0.82	259	995	92	94.7	94.7	0.6	0.7	0.77	252
160	220	990	93.5	95.2	95.2	0.73	0.8	0.84	304	990	92.5	94.9	95.4	0.63	0.74	0.8	292
200	270	990	94	94.7	94.8	0.74	0.81	0.83	386	990	93	94.3	94.8	0.66	0.75	0.79	372
250	340	995	94.3	95.2	95.5	0.74	0.81	0.83	479	995	93.7	95	95.8	0.67	0.77	0.81	448
280	380	985	94.7	95.3	95.4	0.73	0.8	0.81	551	990	93.9	95.1	95.3	0.64	0.74	0.79	517
HIGH-OUTPUT DESIGN																	
45	60	980	91.5	92.3	92.5	0.79	0.86	0.88	83	985	90.5	92.3	92.7	0.73	0.82	0.86	77.6
75	100	985	92	93.5	93.5	0.74	0.82	0.86	142	990	91.2	93.5	93.8	0.69	0.8	0.84	132
VIII Pole - 750 rpm																	
0.37	0.5	685	54	61	62	0.46	0.56	0.67	1.35	700	48	57	60	0.4	0.5	0.6	1.43
0.55	0.75	680	54	61	64.7	0.44	0.55	0.64	2.02	700	48.5	57.2	62.5	0.38	0.47	0.56	2.19
0.75	1	695	67	71	70.5	0.46	0.58	0.66	2.45	710	63	69	70.5	0.38	0.5	0.6	2.47
1.1	1.5	690	68	72	72	0.47	0.6	0.68	3.41	710	64	70.5	72.2	0.4	0.52	0.62	3.42
1.5	2	695	75	76	76	0.5	0.63	0.7	4.28	705	73	75	76.3	0.43	0.57	0.66	4.14
2.2	3	700	79	79.5	79	0.56	0.68	0.75	5.64	715	78	79	79.5	0.48	0.61	0.7	5.5
3	4	700	80	82.5	82	0.54	0.66	0.74	7.51	715	78	81.5	82.5	0.5	0.62	0.7	7.23
4	5.5	725	82.6	84.8	85.9	0.51	0.64	0.72	9.83	730	80	83.7	86	0.44	0.57	0.66	9.8
5.5	7.5	725	82.5	84.7	85.2	0.5	0.63	0.72	13.6	730	80.5	83.5	85	0.42	0.55	0.66	13.6
7.5	10	720	84.5	86	85.3	0.54	0.66	0.74	18.1	730	82.5	85.5	85.5	0.48	0.6	0.7	17.4
11	15	720	87.5	88.3	87.8	0.71	0.81	0.85	22.4	730	86.5	88.6	88.5	0.65	0.77	0.83	20.8
15	20	725	87.5	88.9	88.9	0.61	0.72	0.77	33.3	730	85.5	88.3	88.9	0.5	0.64	0.72	32.6
18.5	25	730	88.8	90	89.8	0.75	0.83	0.86	36.4	735	88.2	90.3	90.2	0.68	0.78	0.84	34
22	30	730	89.4	90.9	90.5	0.76	0.84	0.86	42.9	735	88.6	91	91.2	0.71	0.8	0.84	40
30	40	730	90	91.3	91.3	0.73	0.81	0.85	58.7	735	89	91.1	91.8	0.66	0.77	0.83	54.8
37	50	735	91	92.2	92.1	0.7	0.79	0.82	74.4	740	90	92.2	92.4	0.64	0.75	0.79	70.5
45	60	735	91	92.2	92	0.7	0.77	0.82	90.6	740	90	92	92.3	0.6	0.72	0.78	87
55	75	735	91.6	93.2	92.8	0.72	0.8	0.83	108	740	90.7	93	93	0.65	0.76	0.8	103
75	100	735	92.4	93.3	93.3	0.7	0.8	0.83	147	740	91.6	93.4	93.4	0.64	0.78	0.81	138
90	125	735	92.9	93.9	94	0.73	0.81	0.84	173	740	92.1	93.7	94.2	0.67	0.75	0.81	164
110	150	740	93	94.2	94.5	0.66	0.77	0.82	216	745	92	94.1	94.5	0.6	0.71	0.78	208
132	175	740	93.5	94.6	94.8	0.66	0.75	0.81	261	745	92.5	94.4	94.8	0.6	0.71	0.77	252
160	220	740	93.8	94.8	94.8	0.68	0.77	0.81	317	745	92.8	94.7	94.7	0.6	0.72	0.79	298
200	270	740	93.8	94.8	95.1	0.65	0.75	0.81	394	745	92.8	94.4	95.2	0.56	0.69	0.77	380
HIGH-OUTPUT DESIGN																	
37	50	730	89.5	91.5	91	0.72	0.82	0.86	71.8	735	88.5	91.5	91.5	0.64	0.76	0.82	68.6