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since 1950



ISO 9001

SERVICE AND EXPLOITATION INSTRUCTION MANUAL

for three-phase squirrel - cage induction motors

explosion-proof,

comply with requirements for devices

group II, category 3G and 3D

according to requirements of

ATEX Directive 94/9/EC

Cantoni[®]
GROUP

www.cantonigroup.com

GENERAL INFORMATION

Marking of explosion-protected apparatus:


II **3** **G** **Ex** **e** **II** **T3**
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑩


II **3** **D** **Ex** **tD** **A22** **IP65** **T xxx°C**
 ① ② ③ ④ ⑤ ⑥ ⑧ ⑨ ⑩

Specific ATEX markings:

- ① specific marking of explosion protection
- ② equipment Group ATEX (for use in hazardous areas)
- ③ equipment Category ATEX (for use in Zone 2 and Zone 22 areas category)
- ④ for use in flammable Gas/Vapour (G) or Combustable Dust Substances (D)

Marking required by the standards used under ATEX and IECEx

- ⑤ indicates that the product corresponds to one or more of the types of protection which are subject of the specific standards listed in general requirements standards
- ⑥ Indicates the type of protection used for flammable gas / combustable dust
- ⑦ gas group
- ⑧ areas category
- ⑨ ingress protection level
- ⑩ temperature class (for flammable gas) / maximum surface temperature (for combustable dust)

Temperature class	Ignition temperature range of the mixture	Permissible surface temperature of the electrical equipment
T1	>450°C	450°C
T2	>300°C ... ≤ 450°C	300°C
T3	>200°C ... ≤ 300°C	200°C
T4	>135°C ... ≤ 200°C	135°C
T5	>100°C ... ≤ 135°C	100°C
T6	> 85°C ... ≤ 100°C	85°C

Apparatus for hazardous areas with the presence of explosive dusts, gases, vapours or mists

Zone	Apparatus category	Marking	Zone	Apparatus category	Marking
2	3	II 3 G	22	3	II 3 D

Areas are classified with regard to the probability of a potentially explosive atmosphere being present and the length of time for which it is likely to exist.

Guideline figures		Flammable atmosphere present abnormally	Standards
IEC/CENELEC/ EUROPE	Gas	Zone 2	EN 60079-0:2006 EN 60079-7:2007
	Dust	Zone 22	EN 61241-0:2006 EN 61241-1:2004

1. TECHNICAL DESCRIPTION

General description of the designation of BESEL S.A. electric motors:

Ex S (K , L) h 80 - 4 B 1
 (a) (b) (c) (d) (e) (f) (g) (h)

(a) – Explosion-proof motor

(b) – Type of motor

S – three phase motor

(c) – Mounting type according to IEC

(no letter) – foot

K – flange

L – foot + flange

(d) – Series frame size

g – for frame sizes 56 and 63

h – for frame sizes 71 and 80

(e) – Motor frame size according to IEC (56, 63, 71, 80)

(f) – Number of poles - 2, 4, 6

(g) – Frame length for frame sizes 56 to 80

A

B

(h) – Size of flange (if key code (c) = K or L)

(no letter) – flange IM B5 (big)

1 – flange IM B 14/1 (medium)

2 – flange IM B14/2 (small)


The explosion-proof, increased safety squirrel-cage induction motors of frame size 56, 63, 71, 80 are low power enclosed motors.


The motors are manufactured in a way that there is increased safety in case of presence of excessive temperature, existence of arcs and sparks both inside the motor and on its surface during normal work.

Motors are designed for temperature class T3 which means that the maximal temperature of any part of the motor can not exceed +200°C (under the most unfavorable but permissible conditions) or for temperature class T4 – maximal temperature can not exceed +135°C.

The temperature class depends on the kind of explosive atmosphere which surrounds the motor.

Motors are intended to work in zones areas:

2 -  II 3 G

22 -  II 3 D

where dangerous explosive atmosphere is likely to occur (but not in the area where methane occurs).

Parts of motor housing are made of aluminum alloy EN AC-44300 (EN 1706:2010) with magnesium contents $\leq 6\%$ apart from the fan cover which is made of steel sheet.

In the terminal box there is a terminal board which is used for connecting the motor to the mains. The terminal box is equipped with a cable gland M20x1,5 (and M16x1,5 for PTC thermistors), with holder or without, through which the power lead should be inserted and sealed.

The maximum voltage is 420V 50Hz if the motor has built-in PTC thermistors.

The maximum voltage is 690V 50Hz.

There are neutral terminals on the housing and in the terminal box which are used for neutral earthing or grounding of the motor.

Motors are intended to work in a horizontal position of the shaft.

They can work in perpendicular position with the shaft end downwards or upwards provided the axial load of the bearings is not too large and comes from the weight of a rotor, a pulley, a toothed wheel, relatively light clutch or the fan which is fixed on the motor shaft.

Motor should be operated at ambient temperatures from -20°C to $+40^{\circ}\text{C}$.

2. INSTALLATION INSTRUCTIONS

The motor housing protects the motor from being penetrated by a solid body or water in the range defined in EN 60034-5 Standard.

The terminal compartment is in type of explosion protection Ex e. In order to assure a degree of protection of at least IP54 for Gas or IP65 for Dust, certified cable entries shall be used that are suitable for the application and correctly installed.

The electrical connection of the permanently connected cable shall be made in a certified enclosure in type of protection flameproof enclosure „d” or increased safety „e”.

The cable entry may be used only for fixed installations. The user shall ensure adequate clamping of the cable.

In areas with inflammable dust, the gland can be used only for threaded holes.

The cable entry is designed for use in normal industrial atmosphere.

The installation of the cable gland has to be done by properly qualified persons and only with the appropriate tools.

Unused apertures shall be closed with suitable blanking elements.

Motors intended for use in explosive gas atmospheres.

The motor shall be provided with a three-phase inverse-delay overload protective device that not only monitors the motor current but also disconnects the stalled motor within the above mentioned times t_E .

The motor shall only be used for continuous service, involving easy and infrequent starts which do not produce appreciable additional heating.

Motors intended for use in the presence of combustible dust.

The built-in winding PTC thermistors (DIN 44081 or 44082 ...°C) in combination with a protective device shall be installed in the motor circuits in such a way that operation of the PTC thermistors leads to switching-off of the motor.

The ...°C is the temperature of the PTC thermistor.

The maximum voltage is 420V 50Hz.

Each motor must be protected against overload and short-circuit.

There is a direct-on starting used in motors.

They can operate when voltage deviations do not exceed $\pm 5\%$ and frequency do not exceed $\pm 2\%$ of the motor rated values. All of the rated data refer to the rated voltage.

If voltage and frequency exceed of the rated values motors should not be started.

Each motor must be protected against electric shock in accordance with currently valid regulations.

Parts of a driven device coupled to the motor shaft directly should be balanced dynamically with the accuracy of $5\mu\text{m}$, not less.

2.1. ACTIVITIES BEFORE THE INSTALLATION OF A MOTOR

Before you mount the motor to a driven device:

- a) check if the rotor turns freely,
- b) check if parts of a device which is coupled to the motor shaft are balanced dynamically with the required accuracy,
- c) put on parts of a motored device sliding or pushing them lightly without exerting pressure on bearings. Otherwise you will cause damage. At the same time the motor **shaft should be supported on the non-drive end stiffly** so that the pressure should not cause either damage of bearings or damage of a spring washer which cancels axial play of the rotor,
- d) after fixing the motor to a device check whether there is the minimal distance (14mm) between the fan cover and other parts and whether the holes in the cover are not stopped down,
- e) check if supply cable is additionally protected against being pulled out (in motors equipped with cable glands without holders).

Caution:

Access of cooling air to the motor housing cannot be made difficult.

2.2. CONNECTING THE MOTOR TO THE MAINS

2.2.1. Three-phase motors made for voltage base 230/400 V can be connected:

- a) to the mains with line-to-line voltage: $3 \times 400\text{V} \pm 5\%$ 50Hz $\pm 2\%$ when the motor winding is star connected (Y),
- b) to the mains with line-to-line voltage: $3 \times 230\text{V} \pm 5\%$ 50Hz $\pm 2\%$ when the motor winding is delta connected (Δ).

The ways of winding connection and connecting them to the mains are presented on wiring diagrams in the Annex No. 1 of this Manual.

The wiring diagram is on the inside of the lid of a terminal box.

2.2.2. Before you connect the motor check:

- a) if the rated voltage and frequency of the motor corresponds to the voltage of the mains - see item 2.2.1
- b) if winding connections on the terminal board are consistent with a wiring diagram,
- c) if neutral earthing and protective grounding of the motor is correct and firm,
- d) **if the motor has the right overload protection whose time-current characteristic guarantees that the motor will be disconnected from supply voltage in a time shorter than the specified time t_E when the current is equal to starting current,**

t_E – time in which alternating-current winding will heat up from the temperature of rated conditions and with maximal environment temperature to the limit temperature

- e) if the motor has the right protection against short circuit (a fuse or an electromagnetic breaker),
- f) if resistance of the motor insulation in the cool state is not lower than $20M\Omega$,
- g) if the direction of motor rotation is consistent with the direction of driven device rotation, in typical motors the direction is clockwise when you look from the shaft end,

Cautions:

1. In case of moistening (when the resistance of the motor insulation is lower than $20M\Omega$) dry in the temperature not higher than $353K (+ 80^{\circ}C)$.
2. When the motor operates pay attention to how it works and disconnect the motor from the mains in following cases:
 - over-oscillation of the motor (excessive oscillation),
 - considerable decrease of rotational speed,
 - considerable heating of motor and bearings
3. In any case, in motors of all types the earth terminal should be stringently connected with earth conductor (wire).
4. The insulation should be removed from the earth wire 10-12mm in length, the wire end should be twisted and screwed to the earth terminal applying screwing torque that amounts to 2Nm.

3. PERIODICAL INSPECTIONS AND MAINTENANCE OF A MOTOR

Each operating motor should be inspected periodically:

- minor inspection – every 12 months,
- main inspection – every 36 months or after 20 000 working hours

In motors where drive end shields (DE shields) are in direct contact with an oil filling the driven device (for example a gear box) it is necessary to replace a seal (simmering).

The intervals of replacement of the seal are the following:

- If the oil that fills up the gear box reaches the temperature up to $60^{\circ}C$ the replacement should be carried out every 9 000 hours of the device operation;
- If the oil that fills up the gear box exceeds the temperature $60^{\circ}C$ the replacement should be carried out every 6 000 hours of the device operation;

3.1. MINOR INSPECTION AND MAINTENANCE

Minor inspection includes the following activities:

- a) visual inspection and cleaning of the motor and protecting apparatus without disassembly if visual inspection does not reveal such necessity,
- b) measurement of the resistance of motor winding insulation,
- c) measurement of the effectiveness of neutral earthing or the resistance of protective grounding,
- d) measurement of the resistance of feed installation insulation
- e) verification of setting of thermal protection.

3.2. MAIN INSPECTION

Main inspection includes the following activities:

- a) disassembly of the motor which consists in performing operations mentioned below in the following order:
 - unscrewing of the three bolts fixing the fan cover
 - removing of the fan from the shaft by means of a puller
 - unscrewing of the three bolts that fasten bearing shields
 - taking off bearings from the motor shaft by means of a bearing puller or by tapping a wooden hammer on riser heads that stick out of shields
 - removing of the rotor and bearings
 - in case of penetration of motor interior by the oil (operation of the motor with the gear box) - remove the oil and clean up the motor inside;
 - replace the simmering;
 - regenerate the shaft at the point of contacting with the simmer ring.
 - taking off bearings from the motor shaft by means of a bearing puller only in case they must be replaced.

Bearings must be absolutely replaced after 40000 hours of work.

In motors two-sided closed ball bearings type 2Z are applied.

They do not need lubricating (bearings are prelubricated).

Frame size	Type of bearing
56	6201 2Z
63	6202 2Z
71	6203 2Z
80	6204 2Z

- b) checking the conditions of a stator winding which must be cleaned carefully and blown through with compressed air. On winding ends there must not be any damaged places, winding ends must be stiffen. If necessary they should be covered with insulating varnish PK-155 which does not contain a solvent and dried in the temperature not higher than 373 K (+ 100°C),
- c) checking of insulation resistance between particular phases of the windings and between windings and a motor housing,
- d) **repair (re-winding) can be done only with the acceptance of BESEL S.A. when full information including execution, impregnation and methods of testing after the repair of windings is received,**
- e) **verification of setting of protected against overload,**
- f) **it is unacceptable to replace any parts of motor and modification of motor without the acceptance of BESEL SA.**

Caution:

A high-voltage test can be conducted only by a specialist who has required authorizations.

- g) Motor reassembly is performed in reverse order than the disassembly.

All activities connected with disassembly, inspection and reassembly should be performed without damaging of windings, motor housing, end shields and other parts of the motor.

4. ACCEPTANCE TEST AFTER INSPECTION OR REPAIR

After inspection and remounting the motor should be subjected to the following examinations:

- a) to measure winding resistance,
- b) to control if the connections are correct,
- c) to measure insulation resistance in cool state,
- d) to carry out a 2 hours no-load running test of the motor and if it is possible to carry out a test of a rated loaded motor. The test must be long enough for the motor temperature to stop rising in a visible way.

The above researches must be conducted according to the EN 60034-1 standard.

Inspections and acceptances of explosion-proof, increased safety motors ought to be carried out by experienced personnel which is trained in range of different kinds of explosion protections, adequate regulations and general rules of zone of danger classification.

5. TRANSPORT

Motors must be transported only under cover that protects them against getting wet or damp.

Motor cartons should guarantee appropriate protection against mechanical damages, shocks and dust.

During transport they should guarantee proper protection against damages of the shaft end, terminal box, fan cover and varnish coat.

Motors should be transported in crates, metallic pallets or carton boxes.

Motors must not move inside containers which must be stuck.

6. MOTOR WEIGHTS

Motor weights are different for different types of the same frame sizes - according to outputs, mounting forms and added specific details.

Approximate motor weights as a function of stacking length (A, B).

Frame size of motors	Stacking length	
	A	B
	Weight (kg)	
56	3,0	3,4
63	3,6	4,2
71	5,3	6,2
80	8,0	9,5

7. STORAGE

Motors should be stored in dry airy containers free from gases, liquids and corrosive vapours which are harmful for the winding insulation and parts of the motor.

Motors must not be kept in rooms where fertilizers, chlorinated lime, acids and chemical agents etc. are gathered.

The temperature of the environment where motors are stored must not be lower than 278K (+5°C) and relative humidity must not exceed 70%.

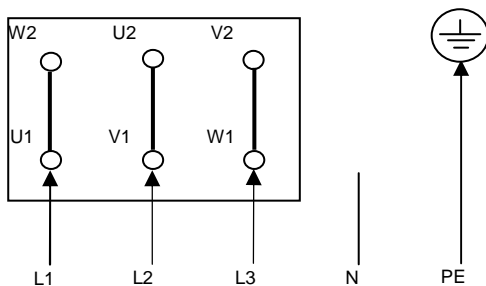
Motors stored after warranty period should be renovated which includes:

- outside cleaning of the motor,
- checking if bearings operate in a correct way and if not damaged bearings must be replaced,
- measurement of the winding insulation resistance (in cool state) and if it is lower than 20MΩ motors must be dried in a temperature not higher than 353K (+80°C).

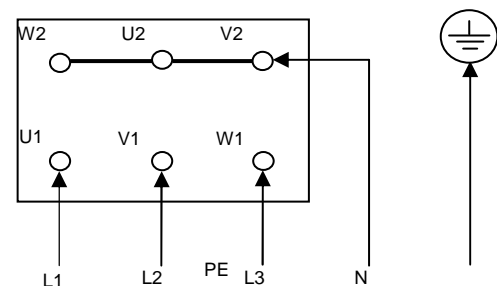
The shaft end must be protected against corrosion by the layer of corrosion preventing grease or an easily removed varnish.

Annex No.1

Delta connected Δ



Star connected Y



Marking	⊕ II 3 G			
Motor type	ExSg56-2A	ExSg56-2B	ExSg56-4A	ExSg56-4B
Rated output (kW)	0,09	0,12	0,06	0,09
Rated voltage (V±5%)	400	400	400	400
Rated current (A)	0,33	0,47	0,27	0,38
Rated frequency (Hz±5%)	50	50	50	50
Power factor	0,68	0,62	0,60	0,62
Rated speed (rpm)	2800	2810	1400	1390
Insulation class	F	F	F	F
I _A /I _N	3,7	3,9	3,25	3,1
t _E for T3 (s)	50,0	40,0	80,0	55,0
t _E for T4 (s)	20,0	15,0	35,0	21,0

Marking	⊕ II 3 G / D			
Motor type	ExSg63-2A	ExSg63-2B	ExSg63-4A	ExSg63-4B
Rated output (kW)	0,18	0,25	0,12	0,18
Rated voltage (V±5%)	400	400	400	400
Rated current (A)	0,5	0,7	0,5	0,6
Rated frequency (Hz±5%)	50	50	50	50
Power factor	0,82	0,82	0,67	0,69
Rated speed (rpm)	2710	2770	1380	1370
Insulation class	F	F	F	F
I _A /I _N	4,0	4,4	3,4	3,7
t _E for T3 (s)	39,5	25,8	50,3	41,1
Temp. limiting switches (in motors Ex tD A22 IP65 T....)	100°C	110°C	100°C	110°C

Marking	⊕ II 3 G			
Motor type	ExSg63-6B			
Rated output (kW)	0,06			
Rated voltage (V±5%)	400			
Rated current (A)	0,55			
Rated frequency (Hz±5%)	50			
Power factor	0,50			
Rated speed (rpm)	920			
Insulation class	F			
I _A /I _N	1,9			
t _E for T3 (s)	70,5			

Marking	⊕ II 3 G / D			
Motor type	ExSg63-2A	ExSg63-2B	ExSg63-4A	ExSg63-4B
Rated output (kW)	0,18	0,18	0,12	0,18
Rated voltage (V±5%)	400	400	400	400
Rated current (A)	0,5	0,6	0,5	0,6
Rated frequency (Hz±5%)	50	50	50	50
Power factor	0,82	0,72	0,67	0,69
Rated speed (rpm)	2710	2840	1380	1370
Insulation class	F	F	F	F
I _A /I _N	4,0	5,2	3,4	3,7
t _E for T4 (s)	14,0	11,5	18,6	14,2
Temp. limiting switches (in motors Ex tD A22 IP65 T....)	100°C	90°C	100°C	110°C

Marking	⊕ II 3 G / D			
Motor type	ExSh71-2A	ExSh71-2B	ExSh71-4A	ExSh71-4B
Rated output (kW)	0,37	0,55	0,25	0,37
Rated voltage (V±5%)	400	400	400	400
Rated current (A)	1,0	1,4	0,8	1,3
Rated frequency (Hz±5%)	50	50	50	50
Power factor	0,90	0,86	0,69	0,59
Rated speed (rpm)	2680	2720	1350	1350
Insulation class	F	F	F	F
I _A /I _N	4,0	4,4	3,7	3,6
t _E for T3 (s)	18,2	12,0	41,7	20,4
Temp. limiting switches (in motors Ex tD A22 IP65 T....)	140°C	140°C	110°C	130°C

Marking	⊕ II 3 G / D			
Motor type	ExSh71-6A	ExSh71-6B		
Rated output (kW)	0,18	0,25		
Rated voltage (V±5%)	400	400		
Rated current (A)	0,8	1,0		
Rated frequency (Hz±5%)	50	50		
Power factor	0,66	0,70		
Rated speed (rpm)	890	870		
Insulation class	F	F		
I _A /I _N	2,8	2,8		
t _E for T3 (s)	26,0	22,1		
Temp. limiting switches (in motors Ex tD A22 IP65 T....)	150°C	150°C		

Marking	Ⓔ II 3 G / D		
Motor type	ExSh71-2A	ExSh71-2B	ExSh71-4A
Rated output (kW)	0,25	0,37	0,18
Rated voltage (V±5%)	400	400	400
Rated current (A)	0,7	1,0	0,7
Rated frequency (Hz±5%)	50	50	50
Power factor	0,80	0,75	0,57
Rated speed (rpm)	2830	2850	1400
Insulation class	F	F	F
I_A/I_N	5,4	5,8	4,2
t_E for T4 (s)	11,8	8,8	19,2
Temp. limiting switches (in motors Ex tD A22 IP65 T....)	90°C	100°C	100°C

Marking	Ⓔ II 3 G / D			
Motor type	ExSh80-2A	ExSh80-2B	ExSh80-4A	ExSh80-4B
Rated output (kW)	0,75	1,1	0,55	0,75
Rated voltage (V±5%)	400	400	400	400
Rated current (A)	1,8	2,4	1,6	2,1
Rated frequency (Hz±5%)	50	50	50	50
Power factor	0,83	0,88	0,72	0,74
Rated speed (rpm)	2760	2780	1370	1370
Insulation class	F	F	F	F
I_A/I_N	4,7	5,5	3,4	4,6
t_E for T3 (s)	10,5	7,2	16,5	20,0
Temp. limiting switches (in motors Ex tD A22 IP65 T....)	110°C	120°C	140°C	130°C

Marking	Ⓔ II 3 G / D	
Motor type	ExSh80-6A	ExSh80-6B
Rated output (kW)	0,37	0,55
Rated voltage (V±5%)	400	400
Rated current (A)	1,3	1,7
Rated frequency (Hz±5%)	50	50
Power factor	0,66	0,72
Rated speed (rpm)	910	880
Insulation class	F	F
I_A/I_N	3,0	3,1
t_E for T3 (s)	30,0	22,0
Temp. limiting switches (in motors Ex tD A22 IP65 T....)	130°C	150°C

Marking	Ⓔ II 3 G / D			
Motor type	ExSh80-2A	ExSh80-4A	ExSh80-4B	ExSh80-6B
Rated output (kW)	0,55	0,37	0,55	0,37
Rated voltage (V±5%)	400	400	400	400
Rated current (A)	1,4	1,3	1,7	1,3
Rated frequency (Hz±5%)	50	50	50	50
Power factor	0,78	0,58	0,64	0,60
Rated speed (rpm)	2850	1420	1420	940
Insulation class	F	F	F	F
I_A/I_N	6,0	4,1	5,5	4,0
t_E for T4 (s)	6,2	11,0	11,5	18,0
Temp. limiting switches (in motors Ex tD A22 IP65 T....)	90°C	100°C	120°C	90°C



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EC DECLARATION OF CONFORMITY

The Manufacturer: **Fabryka Silników Elektrycznych BESEL S.A.**
ul. Elektryczna 8 49-300 BRZEG
POLSKA

I hereby declare that the products:

- 3-phase induction motors series: ExS(K,L)g56- ...
 **II 3 G** and
- 3-phase induction motors series: ExS(K,L)g63- ..., ExS(K,L)h71- ..., ExS(K,L)h80- ..
 ExSKg63-../131, ExSKhR63-../156, ExSKhR71-../131, ExSKhR71-../156,
 ExSKhR80-../131, ExSKhR80-../156,
 **II 3 D/G**

provided with CE marking of conformity complies with the provisions of ATEX Directive 94/9/EC and Low Voltage Directive 2006/95/EEC of 12th December 2006.

and are in conformity with the following standards:

- Polish Standard	PN-EN 60034-1	- European Standard	EN 60034-1
	PN-EN 60079-0		EN 60079-0
	PN-EN 60079-7		EN 60079-7
	PN-EN 61241-0		EN 61241-0
	PN-EN 61241-1		EN 61241-1

By design the machines, considered as components, comply with the requirements of ATEX Directive 94/9/EC, Machinery Directive 2006/42/EC and EMC Directive 2004/108/EC.

Quality Management System fulfils the requirements of standard ISO 9001:2008, certificate IQNET and DQS number DE-002887QM.

Manufacturer's statement:

The machines with installed above products should be declared in conformity with the Machinery Directive

Date: 08.09.2011
 Signed by: Andrzej Wiczorek
 Title: Chief Designer