TAL 13.05 ENG

OPERATING AND MAINTENANCE MANUAL

VERTICAL HOLLOW SHAFT FAN COOLED CAGE ROTOR ASHYNCHRONOUS MOTORS

(Pump Motors)

Rated Outputs : 3 ... 355 kW

ELSAN ELEKTRİK SANAYİİ ve TİCARET A.Ş.

CE TSE K-Q TSE-ISO-EN 9000

ELSAN ELEKTRİK SANAYİİ VE TİCARET A.Ş.

CE

EC DECLERATION OF CONFORMITY
AT UYGUNLUK BEYANI

Document / Belge No: 05-003 *Date / Tarih:* 03.01.2005

Manufacturer / İmalatçı
ELSAN Elektrik Sanayii ve Ticaret A.Ş.

Products / Ürünler
Alternating Current Cage Type Rotor Vertical Hollow Shaft Motors
Alternatif Akım Kafes Tipi Rotorlu Derinkuyu Pompa Motorları
DKPM 100 – 315
3 kW – 370 kW

We declare under our sole responsibility that the asynchronous vertical hollow shaft electric motors with EMTAŞ brand whose sizes and powers given above are in conformity with the following directive and standards.

Yukarıda tipi ve güçleri verilmiş olan EMTAŞ markalı asenkron derinkuyu pompa motorlarımızın, aşağıdaki direktif ve standartlara uygunluğunu beyan ederiz.

Standards Applied / Uygulanan Standartlar
EN 60034-1 EN 60204-1

Directive Applied / Uygulanan Direktif
Low Voltage Directive 2006/95/EC / Düşük Gerilim Direktifi 2006/95/EC

By design, motors are considered as components of the complete machines. The provisions applied to drive systems and their components are out of the scope of EMC Directive 2004/108/EC.

Motorlar tasarım olarak komple bir makinenin parçasıdır. Tahrik edici sistem ve bunun bileşenlerine uygulanabilen kurallar EMC 2004/108/EC direktifi uygulaması dışında bırakılmıştır.

By design, motors, considered as components, comply with the requirements of Machinery Directive 2006/42/EC, provided that the motors are installed, operated and maintained in accordance with our installation instructions. The users should obey the safety rules in our instruction manual and the rules in EN 60204-1.

Tasarım olarak komple bir makinenin parçası olan motorlar, işletme ve bakım talimatına göre kurulduğu, işletildiği ve bakımı yapıldığı takdirde 2006/42/EC Makine Emniyet Yönetmeliği'ne uygundur. Motor kullanıcıları, belgelerimizde verilen emniyet kurallarına ve EN 60204-1 standardında verilen kurallara uymalıdır.

The motors above must not be put into service until the machinery into which they have been incorporated have been declared in conformity with the Machinery Directive.

Motorlar, bağlanacakları makinenin Makine Emniyet Yönetmeliği'ne uygunluğu beyan edilmeden devreye alınmamalıdır.

A. Şakir KINACI
Managing Director / Murahhas Aza

ELSAN Elektrik Sanayii ve Ticaret A.Ş.
Etiler Mahallesi 1458 Sokak No:40
06790 Etimesgut/ANKARA-TURKIYE
Phone / Telefon
(90) 312 244 09 94 Pbx
Fax / Faks
(90) 312 243 14 38
www.elsanas.com.tr

- Specifications and information contained in this manual are subject to change at any time without notice. ELSAN Elektrik Sanayi ve Ticaret A.Ş. assumes no responsibility or liability for any errors or inaccuracies that may appear in this manual.

CONTENTS

GENERAL

This operating and maintenance manual covers low voltage VHS (internally cooled "Vertical Hollow-Shaft") Squirrel cage induction motors cooled using the ambient air flowing inside the machine. Cooling is provided with a fan mounted inside the motor in accordance with method IC 01 (TS 3210 EN 60034-6). Cooling is independent of direction of rotation. Motors produced in accordance with IEC publications.

The Operating and Maintenance Instructions cannot contain specific information regarding all conceivable special applications having special requirements. In this case, the user himself has to make suitable protection arrangements during installation.

Our electric motors are covered with a warranty against faulty materials and workmanship. Motors, which are not operated under conditions explained in this manual, catalogue, rating plate or motors lacking protection systems that are subject to TS 10316–EN 60204-1 are out of warranty.

OPERATING CONDITIONS

Motors are designed to operate at rated voltage and frequency (380V, 50 Hz), at –20 ~ +40°C of ambient temperature and at an altitude of maximum 1000 m. In case of higher ambient temperatures and altitudes, the output should be reduced.

VHS motors are, internally cooled and produced to protection class IP23. (Protected against ingress of solids with dimension of greater than 12mm and against the water coming with an angle up to 60° from the vertical / TS 3209 EN 60034-5) For VHS motors necessary precautions should be taken against particles of dust, water, oil and flammable gas. Open-air operation of motors requires adequate protection against direct atmospheric influences such as rain, snow, ice, dust, sun, etc.

HANDLING

Our VHS motors (except for type 180 which has handling lugs) are equipped with steel eyebolts (DIN 580 or DIN 582). These eyebolts are intended only for lifting the motors without such additional parts as pumps, pipes etc.

GENERAL

RECEIVING AND STORAGE

Upon receiving the motor, inspection for damage or missing parts should be carried out. There should not be any broken, cracked, crushed or missing parts in the motor, and the shaft should be able to rotate freely without any seizing and run-out. For long period storage, clean, dry places with no vibration should be selected. The resistance of windings must be measured after a long storage time (6 months and longer). If resistance is low, the windings must be dried out (See "Insulation Resistance" on page 4 for more).

SAFETY

By handling, assembling, and maintaining according to this guide, motors do not harm any living being. Our motors have earthing connection terminal against static electricity and electric shocks. This terminal should be connected in accordance with the winding diagram before operation.

INSTALLATION

Places where motors operate should be airy, dust-free and dry. Motors should be mounted on a flat surface where no vibration exists. Mounting the motor should be made considering the accessibility to the motor in case of maintenance and repair.

The motor should be installed in a ventilated place, with the air intake and outlet being sufficiently clear; recirculation of exhausted warm air must be prevented. Protect the inlet and outlet grills from dust, oil and any kind of dirt in order to prevent the overheating caused by insufficient cooling.

Temperatures up to and in excess of 100°C can occur on the motor surface during normal operation. For this reason any contact of living beings, cables and other temperature sensitive objects to the surface must be avoided.

INSTALLATION AND FITTING

Electric motors are industrial products. Thus, installation must be done by experienced and qualified persons.

Ratchet: When the power is cut off the residual water in the system tries to drive the pump in reverse direction. The ***non-reverse ratchet*** used in our VHS motors keep the pump and motor from rotating in the reverse direction.

Non-reverse ratchets are refine balanced by drilling the rotating part. If the ratchet is removed it should be marked and reassembled in the same position to retain a fine balanced motor.

INSULATION RESISTANCE

After a long storage period, the insulation resistance between phases and between the windings and the frame should be checked. This measurement is carried out with a megaohmmeter (Megger or similar instrument) at 500V DC. Insulation resistance, measured at 25°C of winding temperature, should be more than 10 MOhms for a new motor, and more than 1 MOhms for a motor that has run for a long time.

Otherwise, cables and terminals should be cleaned and dried out. If insulation resistance is still low the windings need to be dried up at 80ºC using a heater or a furnace. Drying–out process can also be made by applying DC voltage using a transformer to the terminals U1 and V1 with 10% of rated voltage and 20% of rated current.

Insulation resistance should be checked again after motor gets cold following the drying out. Since dangerous voltages are present, **do not touch** the terminals during and immediately after the measurement.

INITIAL START

Make sure that the mains connections (voltage and frequency) coincide with the data on the rating plate of the motor. The dimensions of the connecting cables must be adjusted in line with the rated currents of the motor. Before closing the terminal box make absolutely sure that:

- The connection has been made in accordance with the wiring diagram.
- All terminal box connections are tightened.
- The interior of the terminal box cover is clean and free form foreign particles.
- Unused cable entries are blanked off and the threaded plugs with seals are tightened.
- The seal in the terminal box cover is clean and tightly glued and all sealing surfaces are in the correct state to ensure that the relevant Protection Standard is maintained.

Before starting up the motor check that the machine is correctly installed and aligned, that all mechanical and electrical fixing parts and earthing connections are tightened, and that the auxiliary and additional devices are functionally and correctly connected. The parts under tension and rotating must be secured against unintentional touch.

Start motor and check for desired direction of rotation and assure that no unusual condition develops. If possible run the motor un-coupled initially, checking for abnormal noise and vibration, and for current and voltage balance.

INSTALLATION

Customer is responsible for the protection of the motor against overloading. Always start the motor with an over-current protection device (e.g. thermal-magnetic switch). The current setting should not be higher than 1,05 times the rated current of the motor. If proper over-current protection device is not used or not set correctly, warranty claims with respect to damaged windings becomes void.

BUILT IN THERMAL PROTECTION

Motors can be fitted with optional heat sensors (PTC thermistors). These sensors are used to monitor temperature rise in the windings in order to detect an overload, decrease or loss of cooling, excess ambient temperature or altitude, too many starts per hour and the like. The PTC thermistors connected to the PTC and Phase Protecting Relay help safeguard the motor against winding damage due to overheating. PTC thermistors are mounted in all VHS motors as standard. To protect the motor from overheating the thermistors are connected to the Protection Relay that is furnished free as standard equipment.

The connections of terminals should be made according to the diagrams in the terminal box, and tightness of nuts should be checked. Nuts which are not tightened sufficiently cause motor failure.

NORMAL OPERATION

STARTING AND RUNNING

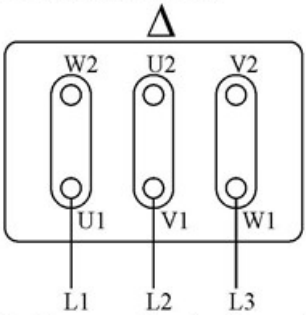
Motors have limits as to the number of starts per hour. Operating outside the limits may thermally overload the motor and thus shorten the insulation life of the winding considerably.

After one hour of running, observe whether any unusual noise, vibration or hotspots develop. If these are excessive, check alignment and other possible causes.

Some initial bearing noise may be present during the running in period. This is normal because the grease has to settle down within the bearing. The noise should disappear after a few hours of operation.

Starting With D.O.L. (Direct-on-line)

All motors are capable of D.O.L. starting when suitable network and other electrical equipments exist (See *Figure-5*).



Figure–5: Diagram for starting with D.O.L.

Starting With Star-Delta (Y/Δ) Connection

It is preferred to start our drip proof motors with star-delta connection in order to use optimum cable, switch and installation materials, and also not to make a shock in the network (See *Figure-6*).

NORMAL OPERATION

When D.O.L. starting method is used, starting torque and current are high (2-3 times the rated torque and 4-7 times the rated current). When star-delta connection is used, starting torque and starting current are reduced to approximately one-third of D.O.L. starting values. Motor starts with star connection, and switches to delta at the speed of approximately 95% of the rated speed.

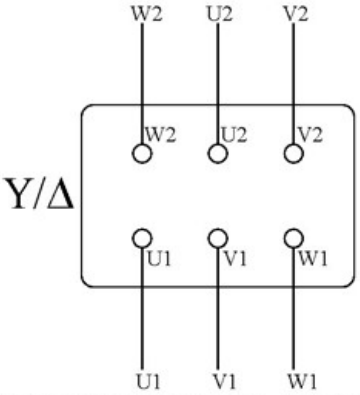


Figure-6: Diagram for starting with star-delta connection

Starting With Soft Starter

Motors are started with soft starter in order to lower the starting current and torque. With these devices, voltage increases step by step until it reaches its rated value thus the torque fluctuations are prevented. Both starting current and time can be adjusted with soft starters. Soft starting can be achieved with the use of autotransformer, with resistances, or with electronic soft starter.

DIRECTION OF ROTATION

The standard direction of rotation is counterclockwise when looking down on the coupling. Motors may be connected for clockwise rotation but all non-reverse pins must be removed from the ratchet on standard machines. Direction of rotation can be changed by interchanging the two ends of network terminals shown in Figure-5 & 6. For clockwise rotating motors please contact us.

MAINTENANCE

Maintenance must be done under safe conditions and it should be ensured that the motor is disconnected from the network and is without any voltage. Besides, be sure that the auxiliary circuits like anti-condensation heaters are also disconnected from the mains.

Do not run the motor which has bearing preload springs without thrust load for more than fifteen (15) minutes. Otherwise, the bearing will damage.

BEARINGS

Our motors are equipped with long life angular contact ball bearings or spherical roller thrust bearings, which can withstand high axial forces.

Lubrication of Thrust (Upper) Bearing

For 3-22 kW (2 Poles) & 3-18,5 kW (4 Poles) VHS Motors:
The motor is packed and dispatched already with greased bearing and the bearing normally needs no further greasing for 6 months. Lubrication is to be carried out every 6 months as follows:

- Remove the grease relief plug, and clean off the dirty grease in relief channel.
- Clean the grease fitting and the grease gun tip. This will prevent the dirt's entrance into the bearing.
- Pump the grease into the grease fitting until new grease comes out of the relief channel.
- In order that the grease to reach every corner in the bearing homogeneously, lubrication should be made while the motor is running.

Do not over-lubricate.

For 30-132 kW (2 Poles) & 22-315 kW (4 Poles) VHS Motors:
The thrust bearing is oil lubricated and the motor is dispatched without lubricant. Lubrication is to be carried out every 6 months as follows:

- Loosen the drain plug and drain the oil. (not needed for new motors)
- Screw the drain plug back again.
- Remove the oil filler plug and fill slowly until the level of oil seen from the sight gauge shows the center.

MAINTENANCE

Lubrication of Guide (Lower) Bearing

Guide bearings are of the deep groove ball type for all VHS motors. These bearings are all dispatched already greased and generally no further lubrication is necessary for 6 months. Lubrication process is the same as in *"Upper Thrust Bearings for 3-22kW (2 Poles) & 3-18,5kW (4 Poles) VHS Motors"*.

The grease/oil types and the lubrication periods are indicated on the lubrication nameplate on the motor. Refer to this nameplate for lubrication details.

It is suggested not to mix different type of greases and oils because they can lose their physical properties and spoil the composition. As a result bearing and motor may be damaged.

Oil lubricated motors are shipped without oil and must be filled until the level of oil seen from the sight gauge shows center.

Oil should be inspected monthly for evidence of moisture or oxidation. The oil must be replaced whenever contamination is noted or every twelve months; whichever occurs first.

Grease lubricated bearings must be inspected once a month for moisture and oxidation by purging a small quantity of grease through the drain. If any contamination is present, the grease must be completely removed and replaced.

MAINTENANCE

The re-lubrication intervals (*hours*) for VHS motors are given as follows:

VHS MOTOR / BALL BEARINGS (72-73 / 62-63 SERIES)		
MOTOR TYPE	**2 POLES**	**4 POLES**
DKPM – G 3	2000	3250
DKPM – G 4		
DKPM – G 5,5	1800	3000
DKPM – G 7,5		
DKPM – G 11	1600	2800
DKPM – G 15		
DKPM – G 18,5		
DKPM – G 22		-
DKPM – S 22	-	2800
DKPM – S 30	1600	
DKPM – S 37		2700
DKPM – S 45	1400	
DKPM – S 55		2400
DKPM – S 75	900	
DKPM – S 90		2300
DKPM – S 110		
DKPM – S 132		
DKPM – S 160	-	2100
DKPM – S 185	-	
DKPM – S 200	-	
DKPM – S 250	-	2000
DKPM – S 280	-	
DKPM – S 315	-	
DKPM – S 355	-	1500

Table-1: Re-lubrication intervals for VHS motors

G: Grease Lubrication for Thrust Bearing
S: Oil Lubrication for Thrust Bearing

Replacement

In general, replacement bearings should be of the same type, and installed in the same relative position, as the original bearings.

MAINTENANCE

Removing:

When removing bearings, apply steady, even pressure parallel to the shaft or lower half-coupling center line. Apply this pressure to the inner race whenever possible. Angular contact bearings which have failed, and are especially tight on the coupling, can sometimes be removed by using the following procedure: separate the bearing by forcing the outer race over the balls; then with a torch, apply quick heat to the inner race while also applying pulling pressure.

Ball bearings should be removed by means of a puller-device after slightly heating the inner ring. Never use a hammer whatsoever.

The inner ring of *cylindrical roller bearings* should be removed by a puller device after heating the inner ring with a torch. If it does not get off, grind the inner ring by creating a groove and break it off.

Mounting:

To mount, heat the ball bearings or the inner ring of the roller bearings in oil or air up to a temperature of approximately 80°C and slip them onto the shaft.

Avoid heavy blows. This will damage the bearings and reduce the bearing life.

Take special care not to damage the windings while disassemble the rotor.

ENDPLAY ADJUSTMENT

The endplay is defined as the total axial float of the rotor. Should the motor be disassembled, the rotor endplay must be adjusted.

- Tighten the locknut until the guide bearing seats against the guide bearing cover.
- Loose the locknut 1/6 turn.
- Lock the locknut with lock washer.

Table-2. Mechanical faults in electric motors

Troubleshooting in Squirrel Cage Three Phase Induction Motors – Mechanical Faults		
FAULT	**CAUSE**	**REMEDIAL MEASURE**
Vibration exists only when the motor is coupled.	Transmission members or driven machine may be faulty.	Check transmission members and fix the problems.
	Centering fault on coupling of motor and driven machine.	Get the shaft axes of motor and driven machine to be concentric.
	Insufficient balance of transmission member or driven machine.	Check the balance of these members.
Vibration exists when there is no coupling.	Bearing is corroded.	Check the bearings and replace the bearings if necessary.
	Bolts are loose.	Tighten the bolts such that they won't get loose again.
	There is short circuit on windings.	See the section for electrical faults.
	Unbalance in transmission members.	Re-balance the rotor with coupling or pulley.
Bearing overheats after motor stars or just after re-lubrication.	Too much grease or oil in the bearing.	Remove the excess grease and pay attention not to lubricate too much.
Bearing overheats after a long running period.	No grease or oil in the bearing.	Lubricate the bearing.
Whistle noise on lubricated bearings.	No grease or oil in the bearing.	Carefully lubricate.
	Fault on bearing cage.	Change the bearing.

TROUBLESHOOTING

FAULT	CAUSE	REMEDIAL MEASURE
Bearing is worn out in a short period.	Overloading of bearing.	Check the loads due to coupling and the whole system. Eliminate the excessive axial and radial loads if they exist.
Motor overheats at full load.	Rotor touches the stator.	Check the bearings and bearing housings and make required corrections. If necessary renew the bearings.
An area of outer race of bearing gets worn out when motor is not running.	Existing vibration coming from outside.	Insulate the motor against the vibrations coming from outside.
An area of outer race of bearing gets worn out when motor is running.	Electrical current exists on the bearing.	Use insulated bearing or consult a specialist.

TROUBLESHOOTING

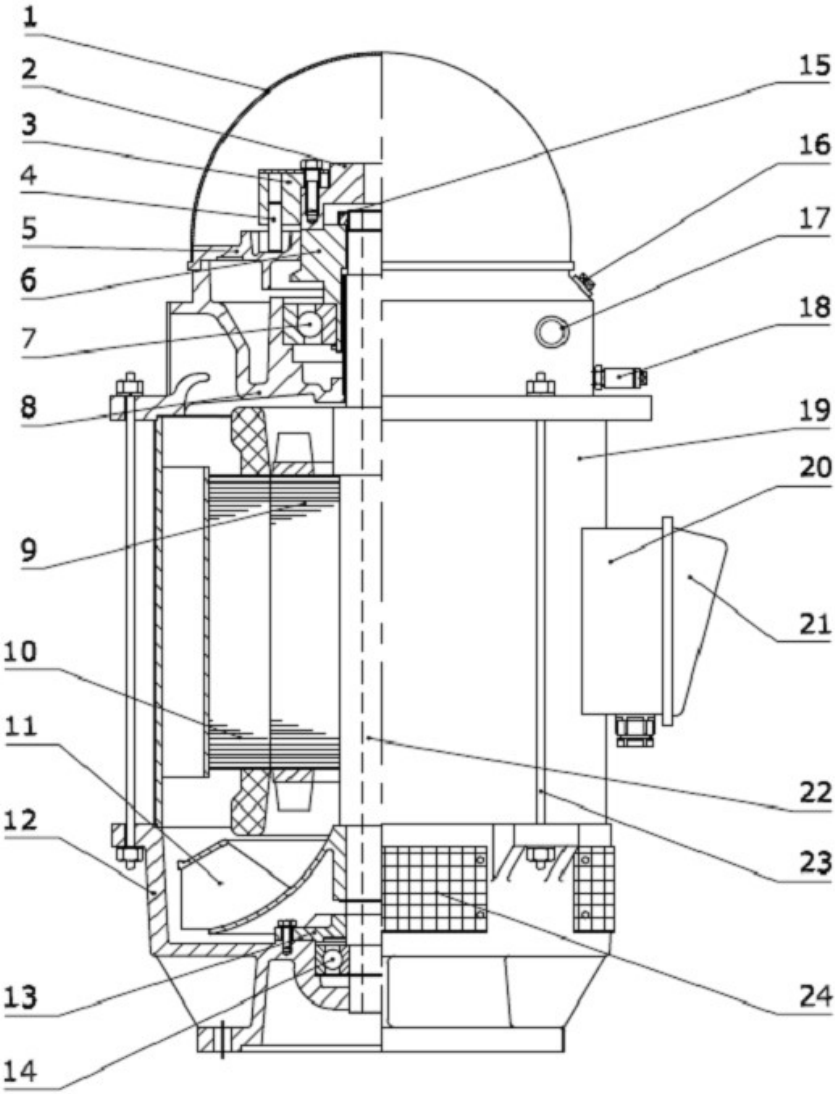
Table-3. Electrical Faults in electric motors

Troubleshooting in Squirrel Cage Three Phase Induction Motors – Electrical Faults		
FAULTS	**CAUSE**	**REMEDIAL MEASURE**
Motor does not run under voltage, no sound coming from motor.	Minimum two phases are interrupted.	Check the switches, cables and related screws and terminals. (Switch off the motor during the changing of ruined plugs.)
	Over-current relay or thermistor switched off the motor.	Check the over-current relay and thermistor.
Motor does not run under voltage, excessive magnetic noise comes from motor.	Interruption of a phase. (A manual help by hand results with the rotation of motor to the same direction that shaft is directed to.)	Check the interrupted phase, if necessary renew the fuse.
Motor does not start under full load. (Magnetic noise is normal.)	Low network voltage.	Measure the voltage.
Motor runs at no load but speed decreases at full load.	Interruption of a phase after motor is started.	Check the network and lines.
	Interruption in the squirrel cage winding. (In this case, ammeter in the stator winding oscillates.)	Check the rotor. If necessary, renew it.
Motor overheats at no load.	Wrong connection. (i.e. "Y" instead of "Δ")	Correct the connection.
	High network voltage.	Measure the current at no load and network voltage.
	Insufficient cooling, air entries blocked.	Clean the air entries.

TROUBLESHOOTING

FAULTS	CAUSE	REMEDIAL MEASURE
Motor absorbs excessive current and overheats at full load.	Motor is overloaded.	Check the absorbed current.
	Low or high network voltage.	Check current and voltage.
	Interruption of a phase.	Search the interrupted phase.
	Rotor touches the stator.	Check the air gap.
Rotor warms up, speed decreases, and motor makes noise.	Fault on squirrel cage windings.	Change the rotor.
Motor stops in a few moments after it starts.	Motor was overloaded.	Get the motor to be loaded as rated.
	Over-current relay is not adjusted correctly.	Adjust over-current relay.
Local warm-ups exist in the stator.	Short circuit may exist in the stator windings.	Renew the stator windings.
	Some windings seem to be roasted.	
Abnormal noise in the motor.	Mechanical or electrical fault may exist.	In electrical faults, noise disappears when the current is cut off. In mechanical faults, noise varies with respect to speed.
		In electrical faults please apply our authorized service. In mechanical faults make required control, if necessary change the bearings.
Too different phase currents.	Different phase voltages.	Check the voltage.
	Interruption of line or windings exists.	Check the line and windings.
	Stator windings touch the chassis.	
	Short circuit in the stator windings.	

MOTOR PARTS



MOTOR PARTS

PART NUMBER	NAME OF PART
1	PROTECTION COWL
2	COUPLING
3	RATCHET SLEEVE
4	RATCHET PINS
5	RATCHET FLANGE
6	BEARING CARRIER
7	THRUST BEARING
8	UPPER FLANGE
9	ROTOR
10	WOUND STATOR
11	FAN
12	LOWER FLANGE
13	GUIDE BEARING COVER
14	GUIDE BEARING
15	LOCKNUT AND WASHER
16	OIL FILLING PLUG
17	OIL LEVEL GAUGE
18	OIL DRAIN PLUG
19	FRAME
20	TERMINAL BOX
21	TERMINAL BOX COVER
22	SHAFT
23	STUD SCREWS
24	AIR OUTLET GRILLS

Table-4. VHS Motor Parts

MOTOR RATING PLATE

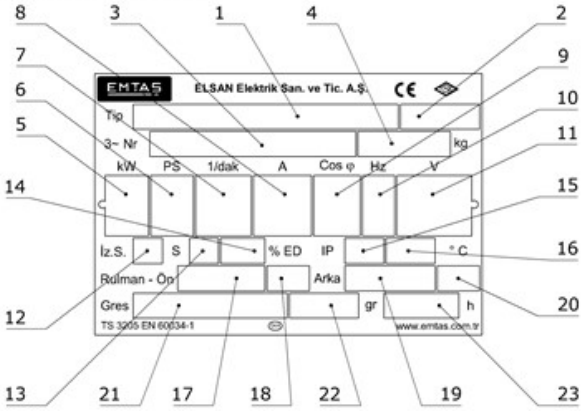


Figure-8. VHS Rating Plate

NUMBER	DESCRIPTION
1	TYPE
2	
3	SERIAL NUMBER
4	WEIGHT
5	RATED POWER, kW
6	RATED POWER, PS
7	RATED SPEED, 1/min
8	RATED CURRENT, A
9	POWER FACTOR
10	NETWORK FREQUENCY, Hz
11	NETWORK VOLTAGE AND CONNECTION TYPE
12	WINDING INSULATION CLASS
13	DUTY TYPE
14	DUTY FACTOR
15	PROTECTION CLASS
16	AMBIENT TEMPERATURE, °C
17	TRUST BEARING NUMBER
18	TRUST BEARING BRAND
19	GUIDE BEARING NUMBER
20	GUIDE BEARING BRAND
21	GREASE TYPE
22	RE-GREASING INTERVAL
23	AMOUNT OF GREASE

Table-5. VHS Rating Plate

NOTE

AUTHORIZED SERVICES LIST

	SERVICE	ADDRESS	PHONE (+90 ... ...)
1	Anıl Elk. Bobinaj	Sultan Orhan Mah. Hasköy San. Sit. 9. Blok No:5 Gebze / KOCAELİ	(262) 646 51 06
2	Aktan Elektrik	Yeni Sanayi 82. Sok. No:6 KAYSERİ	(352) 332 11 22
3	Aslan Bobinaj	Rıza Yalçın Cad. No: 28 Merkez / IĞDIR	5446011810
4	Aygem Plastik	AOSB 10021 Sok. No:11 Çiğli / İZMİR	(232) 376 80 74
5	Bemsan Motor	Küçük San. Sit. C Blok 131/1 Bilecik	(228) 212 74 93
6	Bulut Elk. Bobinaj	San. Sit. 26. Sok. No:5 ELAZIĞ	(424) 224 64 79
7	Can Elk. Bobinaj	Tersaneler Bölgesi G 50 Sok. No:12 Tuzla / İSTANBUL	(216) 494 30 94
8	Dağtekin Elektrik	Turhan Cemal Beriker Bulvarı Mekân Mah. No:728/B Seyhan / ADANA	(322) 441 00 87
9	Demirler Pompa	Küçük San. Sit. B Blok 3 Tip 3. Cad. No:132 GAZİANTEP	(342) 235 31 39
10	Desa Elektrik	Sahil Mah. Ofis Cad. No:25/A Tatvan / BİTLİS	5327168178
11	Elmotsan	İOSB 1471. Sok. No: 59 Yenimahalle / ANKARA	(312) 394 40 91
12	Garanti Bobinaj	Yeni San. Sit. 7. Cad. 5. Sok. No:5-6 MALATYA	(422) 336 09 09
13	Genel Elektro Motor	Çınartepe Mah. Bülent Ecevit Cad. TTK 69 Ambarları Mevkii ZONGULDAK	(372) 268 08 64
14	Günşah Elektrik	Cumhuriyet Mah. Gürpınar Cad. NO:8 Beykent San. Sit. 209-210 B.Çekmece / İSTANBUL	(212) 872 00 66
15	Gürsel Bobinaj	Çakmak Mah. Nizip Cad. No:58/C 27400 GAZİANTEP	(342) 323 34 65
16	Kardeşler Bobinaj	Çepni Mah. İnönü Cad. NO:75 ÇORUM	(364) 213 23 30
17	Makine Market	Rize Cad. Demirkırlar İş Merk. No:70 Değirmendere / TRABZON	(462) 328 14 80
18	Mepsa Makine	Dörtyol Sanayi Çarşısı Yüksek Mah. Eskişehir Cad. No:44 ADAPAZARI	(264) 275 18 49
19	Omaks Bobinaj	Kurtuluş Cad. Arabacılar Sok. No:3 Yıldırım / BURSA	(224) 327 34 14
20	Özfer Elektrik	Teksan San. Sit. C-6 Blok No: 8 ESKİŞEHİR	(222) 228 06 66
21	Seri Bobinaj	Süleyman Demirel Bulvarı Valide Cami Yanı No:103 ISPARTA	(246) 218 28 17
22	Sezmen Bobinaj	Ege Ticaret İş Merkezi 1201/4 sok. No:4/B Yenişehir / İZMİR	(232) 457 14 65
23	Sünbül Trafo	Küçük San. Sit. 5. Cad. No:46 K.MARAŞ	533 619 84 17
24	Teknik Bobinaj İmas Servis	19 Mayıs San. Sit. Adnan Kahveci Bulvarı No:14 KutluKent / SAMSUN	(362) 266 96 81 5353397692
25	Uğur Bobinaj	San. Sit. Ş.Efendi Caddesi No:8 ŞANLIURFA	(414) 312 73 45
26	Uşak Dost Elektrik	İslice Mah. Polis Sok. No: 13/A UŞAK	(276) 215 75 75

AUTHORIZED SERVICES LIST

	SERVICE	ADDRESS	PHONE (+90 ... ...)
27	Ümit Bobinaj	Kurtuluş Mah. Salhane Cad. No:35 Tire / İZMİR	(232) 511 41 67 5365145300
28	Voltaj Elk. Bobinaj	Urfa yolu 1. km No:43 DİYARBAKIR	(412) 237 05 55 (412) 415 06 35
29	Yavuzhan Bobinaj	Karatay San. Sit. Çobandede Sok. No:20 KONYA	(332) 233 29 60

ELSAN Elk. San. ve Tic. A.Ş.
Address: Etiler Mah. 1458.Cad. No:40 Etimesgut - 06796 ANKARA
Phone: (+90 312) 244 09 94
Fax: (+90 312) 243 14 38
E-mail: elsan@elsanas.com.tr - teknik@elsanas.com.tr
Web: www.elsanas.com.tr - www.emtas.com.tr