MAKELSAN
Uninterruptible Power Supplies

AUTOMATIC VOLTAGE REGULATOR

User Manual
&
Maintenance Guide

THREE PHASE 3 KVA - 200 KVA

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INTRODUCTION;

Thank you for chosing our product.The product you have bought from us, is under 2 year of warranty coverage of our company.Do you please keep your warranty card to present it to our technical service in case of any failure of your purchased product.It will expedite the running of repair process in consumer's sake.

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1.0 PURPOSE :

In this manual,it has been introduced the principles and conditions about how to handle,use and maintain FULL AUTOMATIC TRIPHASE SERVO REGULATOR that has been bought by our company.

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2.0 SCOPE:

Covers power regulators with a power range between 3 KVA - 200 KVA.
Until it is not contrarily proved by test reports,it has been applied TS EN 60076 or TS 1055 standarts. It includes domestic updated technical specifications.

3.0 RESPONSIBILITY:

The use or the responsible person of depicted product can safely handle and use it by simply following these instructions.

Please read carefully these instructions for the legalty of the warranty conditions and your safety.

Damages caused by misusage,shipment,short circuit,lightning impacts or any deviation from mentionned instructions are all out of warranty coverage.

The maintenance and repair of these regulators can only be made by an authorized technical service.

4.0 SERVICE AND SPARE PART SUPPLY:

Domestic repairings are fulfilled by one of our authorized technical services.

To announce any failure report,please contact with our Factory Technical

Department. Our Customer Complaints section will make all useful observation

and operations at your place,our factory or at technical service and will detect the

cause of damage.

Spare part or any additional equipment can easily be provided by our factory or

technical service.

The regulators have longer life span as long as their nominal power is not exceeded and operate in suitable working conditions as protected from short circuits and over burden impacts.

5.0 EFFECTS TO THE HUMAN AND THE ENVIRONMENTAL HEALTH

As all electric apparels,when the regulators break down,it's flame may cause fire.

Their surrounding should be isolated from people's living place.
Because it is an electrical apparel,it is not to be uncovered by unauthorized people. When the covers are open,there is a high risk of life danger due to a possible electroshock. The apparel energy should be interrupted.

6.0 CARRIAGE AND SHIPMENT

For products weighing more than 20 kg,they have not to be carried via man power but simply forklift pallets.

During transportation it is necessary to avoid any fall or crash of the product.

7.0 ACKNOWLEDGE OF REGULATORS AND START UP

PIC- A	
3 KVA – 45 KVA	
NO	**SEMI MANUFACTURED**
1	PAKO SWITCH
2	W FUSE
3	ELECTRONIC CARD
4	CIRCUIT TRANSFORMER

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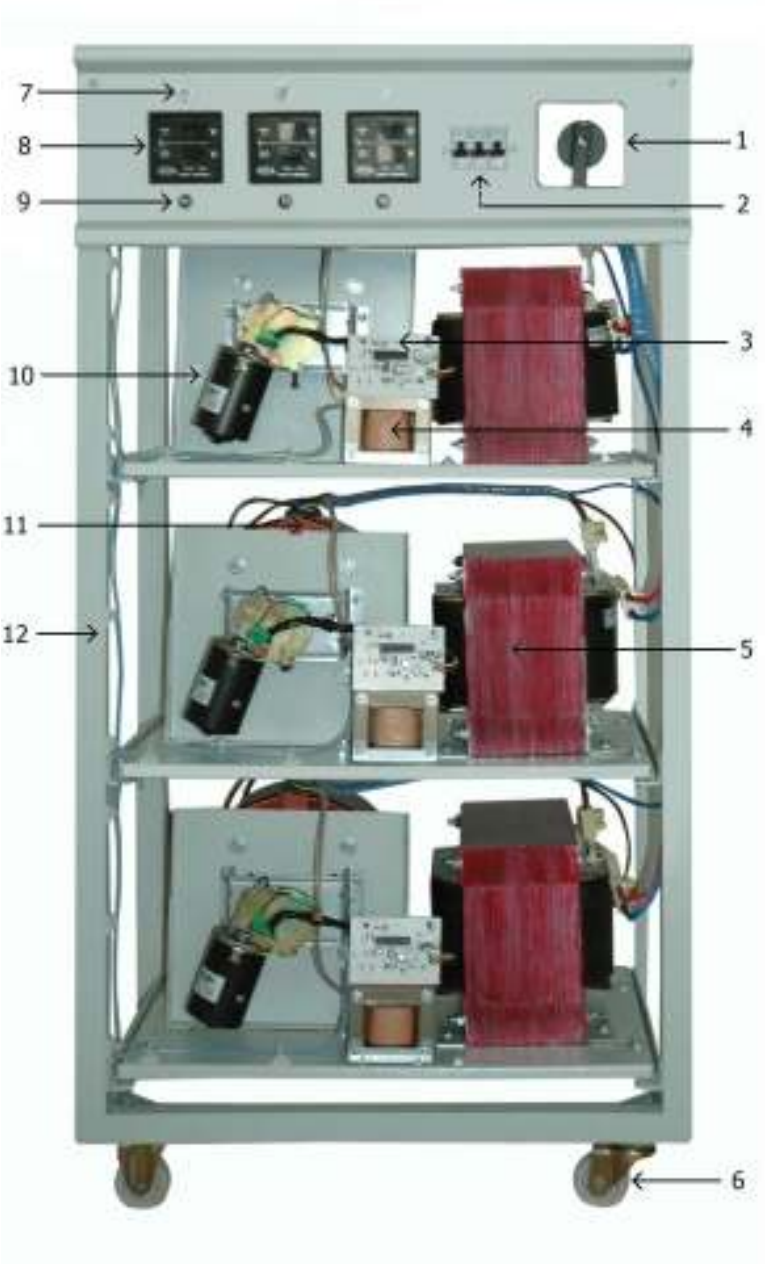
3 KVA---45 KVA

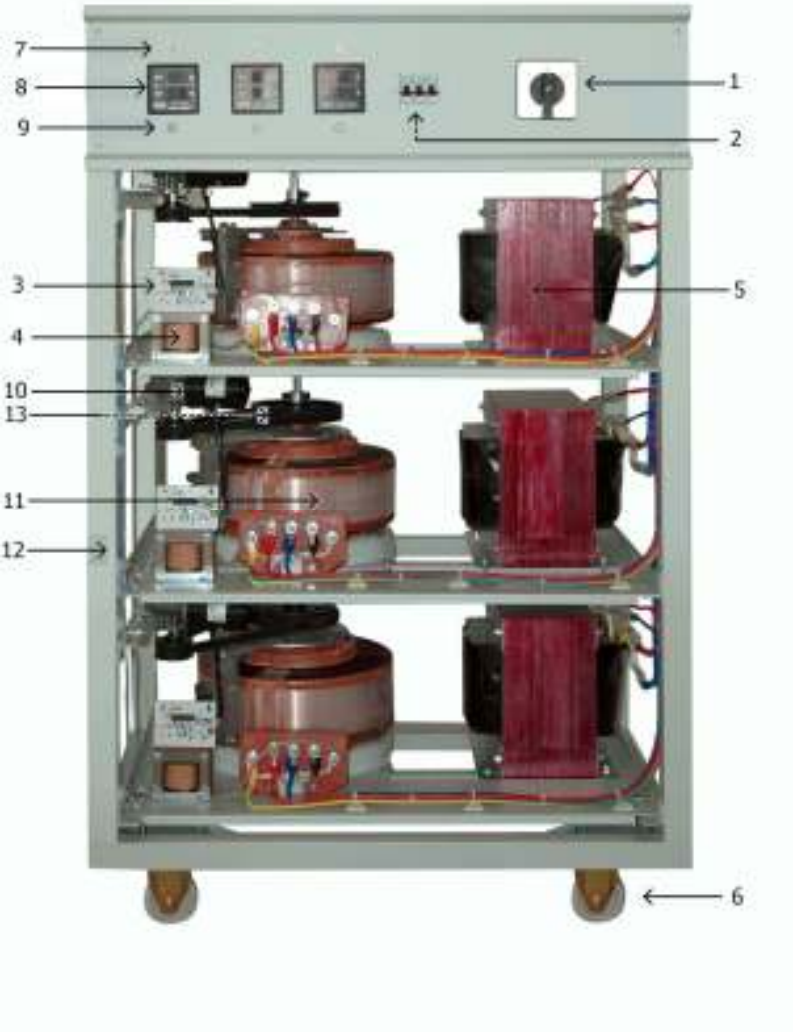


5	FEEDING TRANSFORMER
6	WHEEL
7	SIGNAL LED
8	VOLTMETER
9	(FUSE)
10	SERVO MOTOR
11	VARIAC
12	MAIN CHASSIS
14	FAN (ON DOOR)

A) Stabilizer connections must be ensured by an authorized technical person

B)In stabiliser area;there should be always an earth line against any electrical leakage

60 KVA-150 KVA



PIC – B	
60 KVA – 150 KVA	
NO	**SEMI MANUFACTURED**
1	PAKO SWITCH
2	W FUSE
3	ELECTRONIC CARD
4	CIRCUIT TRANSFORMER
5	FEEDING TRANSFORMER
6	WHEEL
7	SIGNAL LED
8	VOLTMETER
9	(FUSE)
10	SERVO MOTOR
11	VARIAC
12	MAIN CHASSIS
14	FAN (ON DOOR)

A) Apparel connections must be made by authorized personel with a proper technical guidance through mentionned instructions.

B) An earth line must be present at regulator operation area,against any electric leak.

C) Right after the regulator is installed,the Pako Switch must be set to O (zero) as it has been indicated on Pic A/B No:2).W Fuse (Pic A/B,No:2)

Must be kept closed.(when the arm shows below direction,it is shut down)

When chosing connection cables,please use upper section of detected cables.

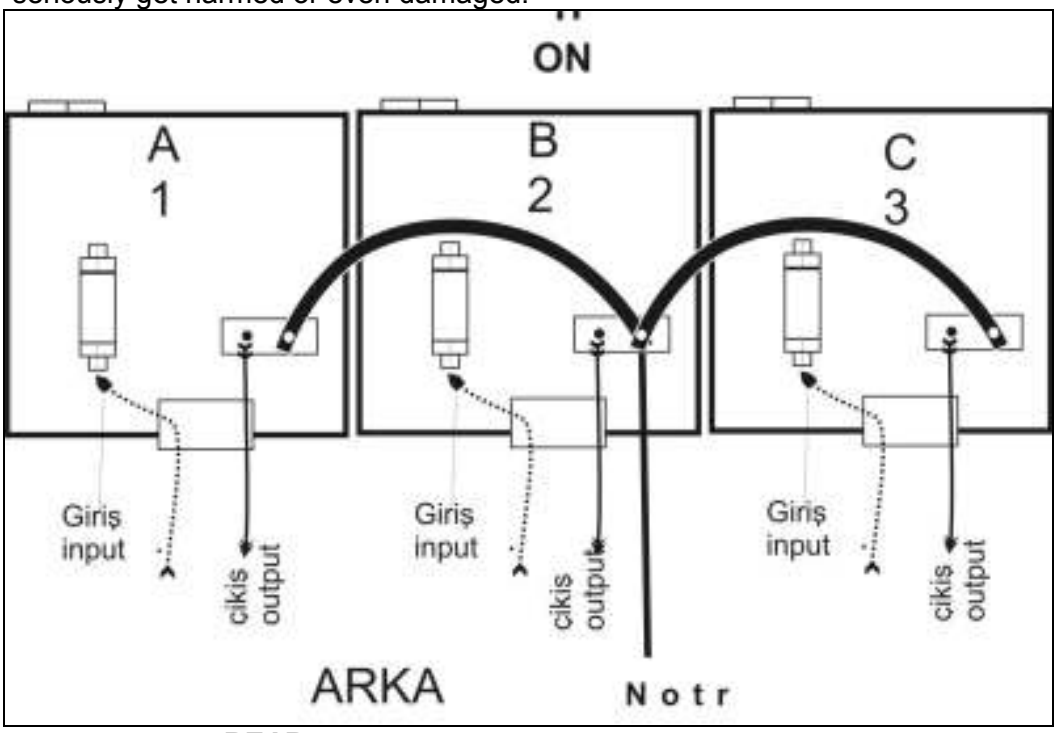
This way you will minimize the line losses.

D) When starting up the regulator,move up the arm of W Fuse (Pic A/(B,No:2).As a second step, set the Pako switch of your regulator at Regulator status.(Pic A/B No:1) .The regulator will be on and start working.

E) When you wish to use the city voltage by taking off the regulator from the circuit,set the Pako Switch(Pic A/B,No:1) to “LINE” status.

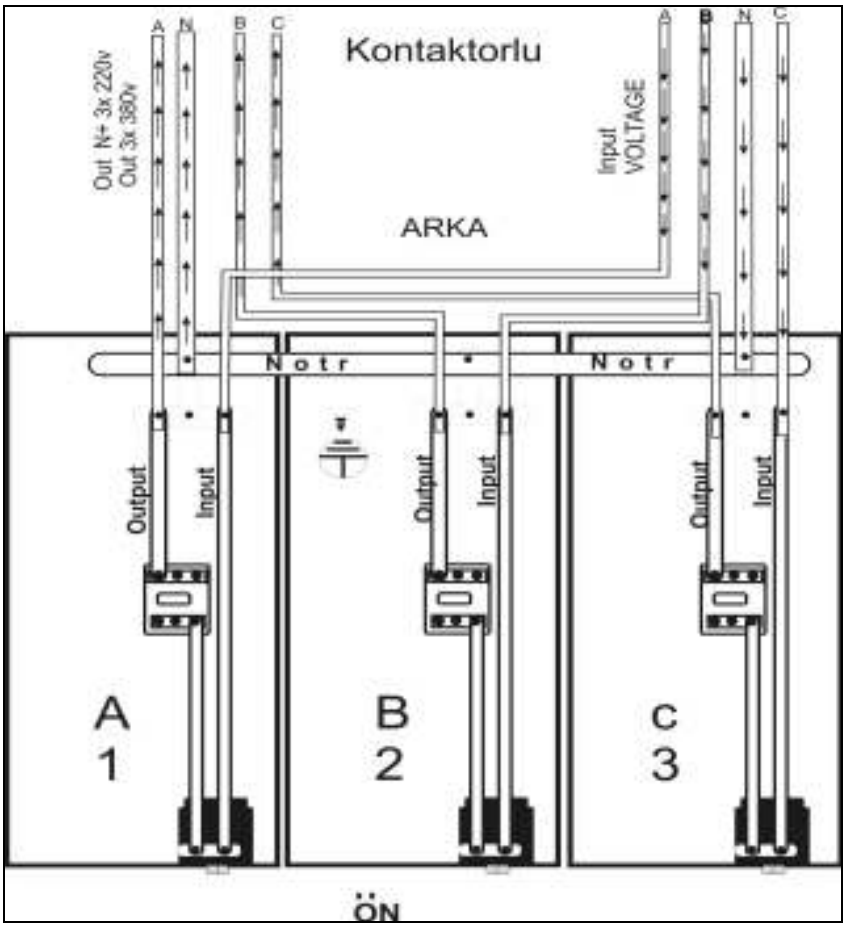
F) If the regulator is not working regularly,Set the Pako Switch (PicA/BNo:1) to “LINE” and you can see the Line voltage from the voltmeter.(Pic A/B No:8).If the regulator produces irregular voltage,to check the FUSES,set the Regulator’s Pako Switch (Pic A/B,No:1) to “LINE” and move downwards the arm of W Fuse (Pic A/B No:2)

G) The power value mentionned on the Regulator sticker,is constituted of the sum of three different phases. That is why the total power in the installation that you will set up,should be divided into maximum number of equal phases.In unbalanced loads,the regulator will work unefficiently so it may seriously get harmed or even damaged.



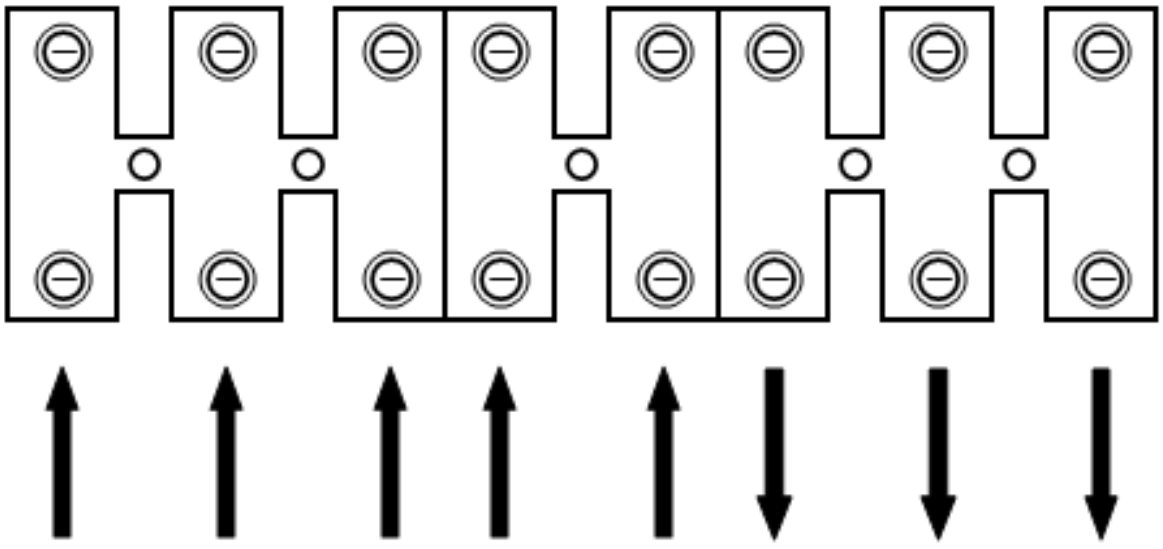
REAR

3 PCS TRIPHASE CONNECTION SCHEMA WITHOUT CONTACTORS (DRAWING 1)



FRONT

3 PCS TRIPHASE CONNECTION SCHEMA (DRAWING 2)



1 **INPUT** **NOTUR** **0UTPUT**

TRIPHASE 3 KVA - 45 KVA CONNECTION SCHEMA

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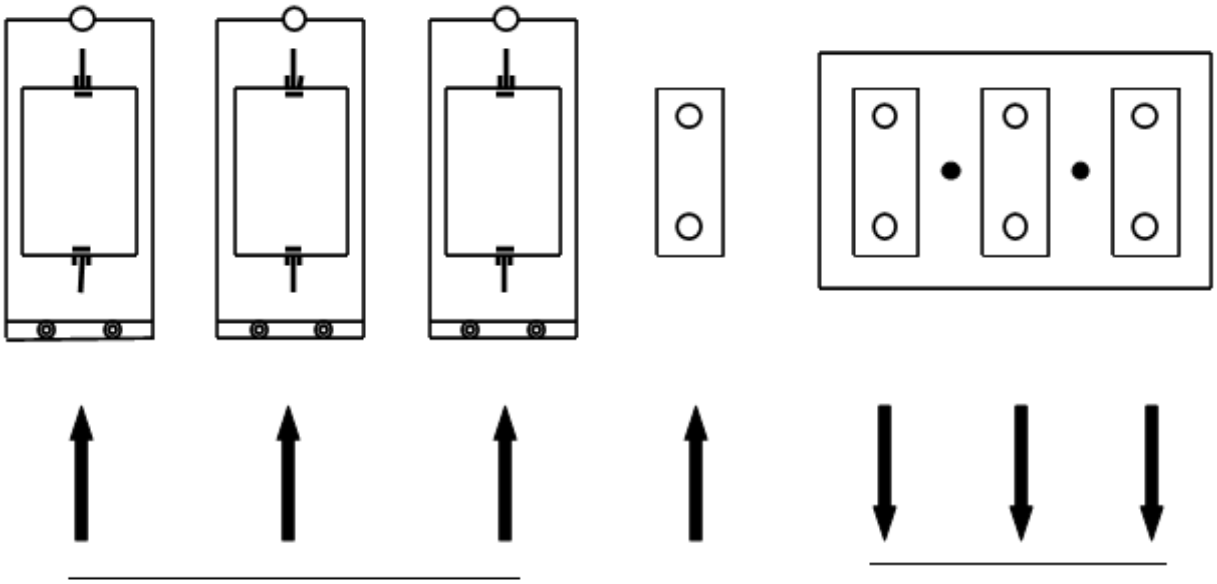
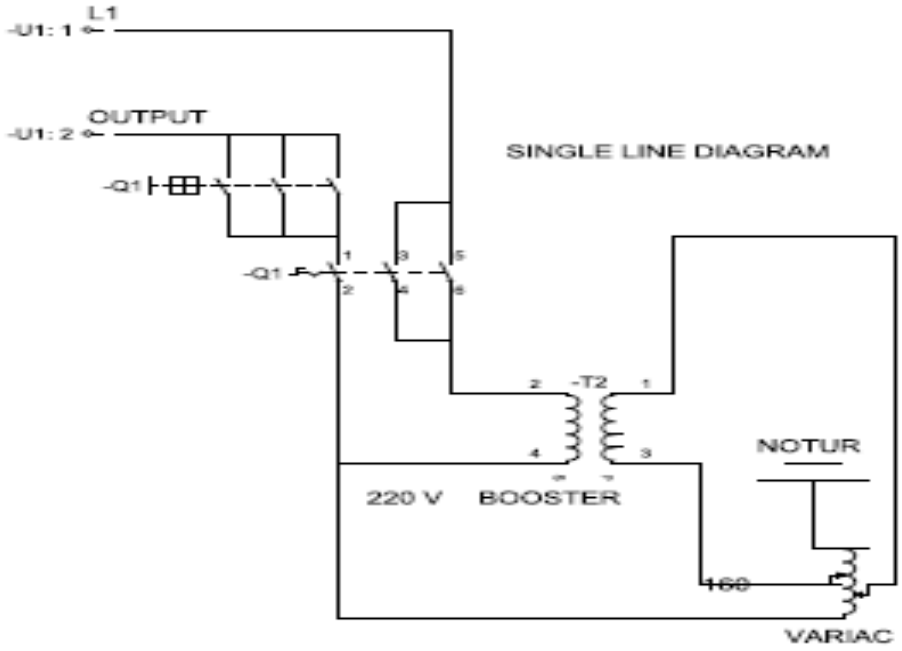


TRIPHASE 60 KVA - 150 KVA CONNECTION SCHEMA

8.0 SERVO REGULATORS WORKING PRINCIPLE

Makelsan Servo Regulators have all a variable transformer which ensures the voltage stabilization.(Variac-Pic A/B,No11),a Servo Motor(Pic A/B,No:10) which commands the auxiliary transformer and an Electronic Card which controls the output voltage.(Pic A/B No:3)



In case like a sudden increase or decline of normal Line voltage ,the electronic control circuit considers it with max.sensibility and let the Servo Motor move quickly. Whilst the motor,according to the signal it gets;by moving right and left the adjusted transformer(T**2**) which it is acoupled with;the voltage in the

secondary coil will be added or substracted to / from the primary coil of Booster transformer.It keeps the output voltage at constant level with max %+-1 tolerence thus,the other additional auxiliary equipments will ensure material's safe working.Via control system which includes quick response time,the high start Torque DC motor system will quickly correct small voltage variances in the input.
When Servo Motor input voltage working limits are exceeded,the output voltage is set to an automatically preferred level,and it is taken off from the circuit by the control circuit.

9.0 APPAREL SPECIFICATIONS AND BASIC DETAILS

Makelsan Servo Controlled regulators are constituted of rectifying toroidal transformer (variac), auxiliary transformer ,servo motor commanding variable transformer and electronic circuits which control this motor according to the output voltage. The control system which contains quick response time,high start torque DC motor system,corrects small voltage changes in the input. When Servo-Motor exceeds input voltage operation limits,the output voltage is automatically set to preferred values and taken off by the control unit. When regulation is complete the electronic brake circuit cuts off the motor energy and Works in silent mood.

1.Wide Power Range: 3 kVA -150 KVA triphase production.

2.Voltage field:

Standart; 160/250/220 V mono phase
275/450/380 V triphase
SPECİAL STABİLİZER 140/240/220 V monophase
242/415/380 V triphase
120/240/220 V monophase
208/415/380 V triphase

3.Regulation speed rate : 80 V/sn.

4.Output deviation : Regulator does not have any deviation when it is not exceeded the original power limts.

5.Efficiency : Makelsan regulators and transformers have more than 98% of efficiency,because they are produced of high quality silica sheets and B class conductor matieral.

6.Operation Temperature: Regulators can go up to 50°C when the environment is not too acid or wet. Temperatures which are above that,require additional cooling system.

7.Over voltage and Phase protection Unit (Optional) : In overburden fluctuations(low-high),it breaks down the output when one of the phases is gone.When requested voltage is found,it gives output again. If the user prefers,he/she can take the protection unit off the circuit via it's key.

8.By-Pass system: Regülators make by-pass via high quality switches.When some failure occurs,with help of 2x and 6x pole modifier switches,the regulator can be transferred to Line via Switch channel.

9.BASIC ADVANTAGES.

Silent mode.High efficiency

Output without distortion.

Dtermined and uninterruptible feding

Wide correction range.High sensibility.

10.APPLICATION AREAS

SNC equipment frameı.

Warming,Cooling,Air conditioner apparels.

Radio,TV, Emitter Stations.

Electric and Electronic medical equipments.

Rectifiers (Battery Chargers)

Elektric motors.

Tele or other communication devices.

Automatical Welding Machines.

Magnetic Devices

Lightening devices.

Printing machines and sensible electronic Matbaa makineleri ve hassas electronic typsetting machines

Sensible photograph studio devices.

Induction heating devices.

Electro coating systems

All types of electronic touchscreen,embroidery and tricot frames.

Laboratory with Electric and Electronic devices

Test and search laboratories

Factory,hospital,hotel and building entrances.

Other locations and devices which require constant voltage.

11.Triphase Technical Specifications

MODEL		**D.L.T.**											
		3	**6**	**10,5**	**15**	**22,5**	**30**	**45**	**60**	**75**	**100**	**120**	**150**
Power (kVA)		3	6	10,5	15	22,5	30	45	50	75	100	120	160
Input	Phase	3 Phase											
	Voltage	380 VAC											
	Operation Range	275 VAC - 450 VAC / 225 VAC – 400 VAC											

	Frequency	50 Hz
Output	Phase	3 FAZ
	Voltage	380 VAC
	Frequency	50 Hz

CONTROL PANEL	
Display & button	4x20 character LCD screen, menu scanning button, menu selecting button a adjustment button with microprocessor
Warning Message / Both sound and visual	Input low /input high, output low / output high, load>100% and overheat for each phase
Monitoring measured values	Output voltage , line voltage and exact amper
Output maximum protection limit	Adjustable from LCD front panel
Output Minimum protection limit	Adjustable from LCD front panel
Regulation voltage	Adjustable from LCD front panel

Dimensions	Width (cm)	54					60		85			90	
	Depth (cm)	44					44		64			69	
	Heigth (cm)	110					119		140			163	
Weigth (kg)		45	50	100	135	154	183	237	380	410	510	545	625

GENERAL		
Efficiency under load		≥ % 95
Correction Speed		80 V/sec
Protections	Phase Loss	Phase Protection Unit (Optional)
	Hi/Lo Voltage	Contactor(Optional)
	Overload	W – Fuse
	By-Pass	Manual
	Protection Level	IP 20
Noise Level		≤ 45 dB
Working Conditions	Temperature	-10 °C ~ +60 °C
	Humidity	0 - 90 % Condensed Humidity
Cooling		Smart fan

10.0 RULES FOR MAINTENANCE AND USAGE

A) Avoid to keep flammable and non heat prof material aqround the regulator.(above,beneath,right,left)

B) The surrounding environment temperature must be at room temperature,not exposed to sun rays and not to be used in humid and damp places

C) Avoid to penetrate liquid or similar substances inside the material.

D) The working environment must get rid off the bugs,rodent animals and insects.

E) The covers of the regulator are not to be opened by Unauthorized Personel.

F) The regulator is not to get exposed to high temperature,or impact which may cause deformation on outer case of the regulator.

G) The future replacement and renovations made on the apparel must be proper to the apparel's power. ,

H) The appearance of the apparel must be checked once in a month.

İ) The paint of the apparel must be checked on annual basis.

J) The switches and the cables of the apparel must be yearly checked

11.0 ERRORS CAUSED BY MISUSAGE

A) Check the earth line when leak occurs.

B) If the apparel is overloaded,overheating and some sort of smell can be felt. Check immediately the load which is fed

C) When a smell or heating is seen,avoid to use the apparel and contact with the service.

D) If liquid or similar substance penetrates into the apparel,cut off the apparel energy for security.

E) When the cables of the apparel are being damagedc by rodent animals or any other reason;avoid to use the apparel and make necessary changes in the cabel part of the regulator by authorized staff.

F) If the regulator does not give any signal,contact with the technical service for the energy.

G) 12.0 POSSIBLE PROBLEMS,SOLUTIONS;

Problem	**Reason**	**Solution**
Voltmeter do not display correctly	Voltmeter failed,	Check the socket control via Digital Voltmeter.If it is analogue type,do you change it.
	Electronic card failed	Check the neutral connection,if the error is repeated,call the techni cal service.

There is smell coming out	overburden	Check the phase loads,set the apparel to Line mode,and call the technical service.
The apparel doest not display voltmeter.	With protection	Control the contactor and the pako switch.The phase may be cut off..Can't be neutral.The voltage is out of working range.
	Without protection	Pako Switch can be burnt out or the voltmeter can be broken.Call our technical service.
Out of standart On and Off Transitions	With protection	Check the neutrals and the phases.
	Without protection	Draws over current.Out of voltage current standarts.
There is Noise	Overburden,motor connections must be loosened.	Set the apparel to Line mode.Contact with our technical service or sales point.Transmit them these points. -Serial No and kVA, -Problems occuring date.
WARNING: Any intervention should be done by authorized people..		

THE BYPASS:

In Threephase regulators,By rotating manually the Pako Switch, the regulator passes from Line 1 status to Bypass mode.
In Monophase regulators By rotating manually the Pako Switch;the regulator passes from Line 1 status to Bypass mode.

WORKING PRINCIPLE OF THE THERMOSTAT:

For 30-150 Kva

The cooling and refrigeration in Makelsan AVRs is ensured thanks to the thermostat controlled fans.The bottom fans assure the access of clean air into the regulator;while the top fans perform optimum cooling by expulsing the heated air.The user can control the cooling via this thermostat between a temperature interval of 30-90 degrees Celcius.

For 50-3000 Kva

The fans ensure the Access of clean air and the heated air is blown out through the panels.

CABLE CROSS SECTIONS

1.Cable cross sections should be proportional with the output power. For each 6 A of Intensity;we see a 1 mm square cable cross section. For example for a 5 kVA AVR : 5 Kva/220v=3,83 mm square. 3 x 4 mm square Antingron cable will be the right choice.
2.For threephase regulators,the neutral should be strictly connected to the regulator.
(Input and Output in cummon)

PHASE DISTRIBUTION

The user shall not connect much bigger load than the regulator's output power..The regulator output power should be always higher than the connected load.

THE ON/OFF SWITCH KEY

In case of any failure,or any exceeding of Input tolerance limits;the regulator shall start to protect it's system automatically. Under these circumstances;The regulator will get the switch to Bypass mode and the On/Off key to Line status**.**In phase interruptions;the protection will be on.To make use of the two phases,you may also use this On/Off key

TROUBLE SHOOTING

- **If Voltmeter does ot display correctly**

  Check out the socket of the digital voltmeter

- **When you see Error on EPM-04C**

  The EPM-04C's settings are made in the factory.If the lamp Aut2 is not turned on,so the contactor does not give output.Each H-L lamp on the front panel shows H high voltage,L low voltage.V lamp displays phase+neutral or phase+phase.A lamp shows the current

- **If the pako switch is not working**

  Check out the pako switch. The energy cable may be out of plug or the plates may be broken

- **If the fans are not working**

  Check out thermostat settings from the front display

- **Over current/amperage**

  The servo motor can be damaged.The electronic card can be burnt or failed.The phase distribution may be in excess or erroneous.

IN CASE OF FAILURE

Pleaser remove the external panel of your AVR and please control if the variac or booster transformer is burnt.

MOTOR: If the borns/edges are out;put them in their pit and control the pulleys.

CARD : In Monophase regulators,verify the cooler on the card,the connector ends and legs.If there is a burn;check out the motor and card
In threephase regulators,Replace the old card with the spared one if there
İs a burn in the capacitor.

CIRCUIT TRANSFORMER: If there is no electricity,check out the phase(fuse)
See if there is output of 12 V? If not,change the circuit transformer

VARIAC : 1)Check the cables if the variac makes a continuous 360 degree of rotation and if the voltage is making several times of drops and peaks. There might be erroneous connections or detached cables.
2)If the voltage peaks and does not drop,the antenna of the variac can be detached.

SWITCH: Check out manually and see if there are some jammed or detached cables