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## WHO WE ARE

BELOTTI VARIATORI SRL has been active in the electromechanical industry since 1904.

In 1946, we began the production of toroidal variable autotransformers in Milan under the licence of General Radio.

In 1971, we started the production of voltage stabilizers and in subsequent years increased the range till 3 MVA.

Nowadays, backed by more than fifty (50) years of experience in developing our range of products, we have become a leading manufacturer of voltage regulation equipment.

BELOTTI VARIATORI SRL is a dynamic export oriented company who's efforts at satisfying the client originate from a collective package comprising a vast technical know-how, experience, the assurance of quality and strict adherence to various statutory regulations and/or standards for the safety of life and property.

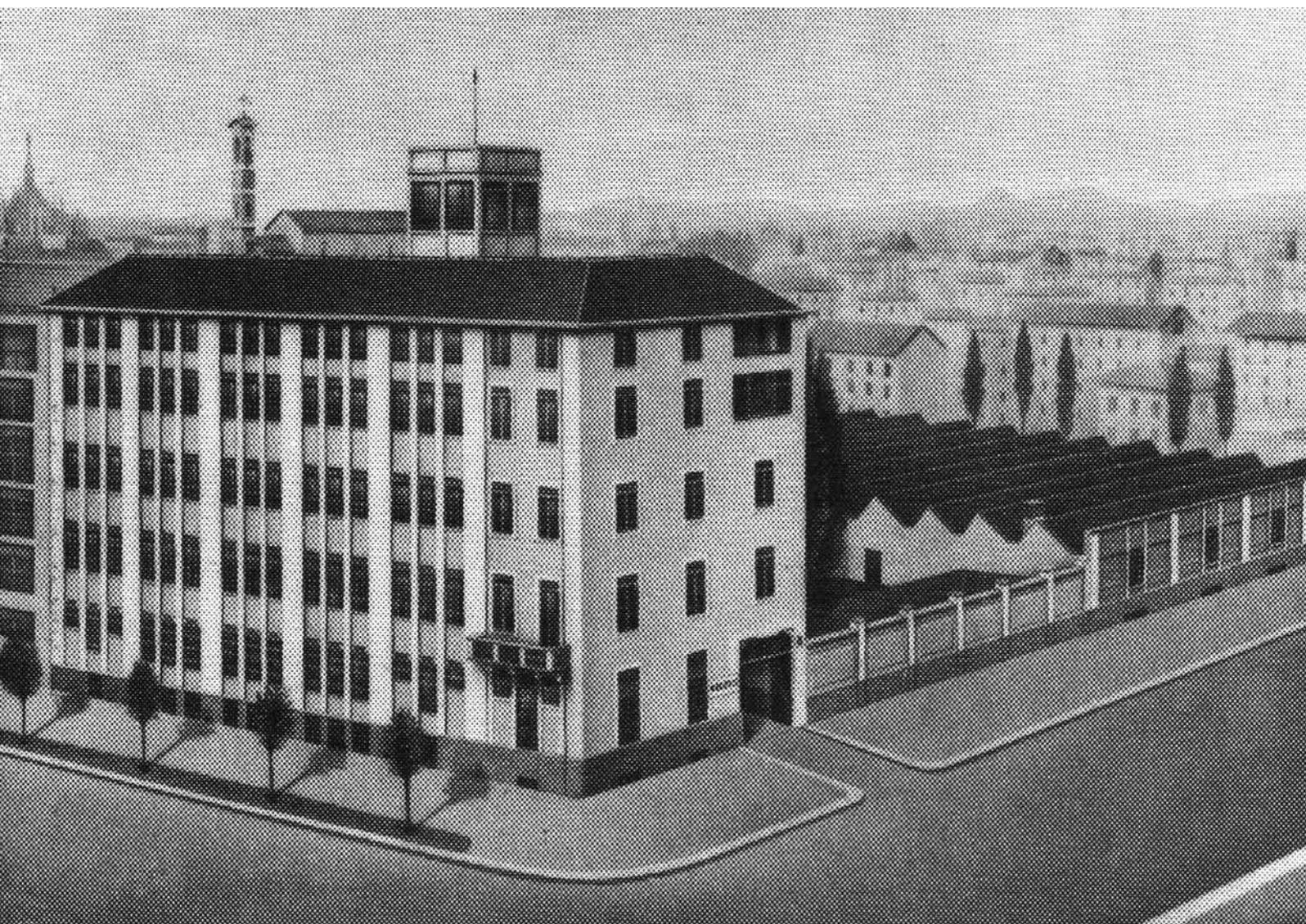
We are located in Milano with plants occupying 3.000 m<sup>2</sup> comprising office, factory and adjacent units.

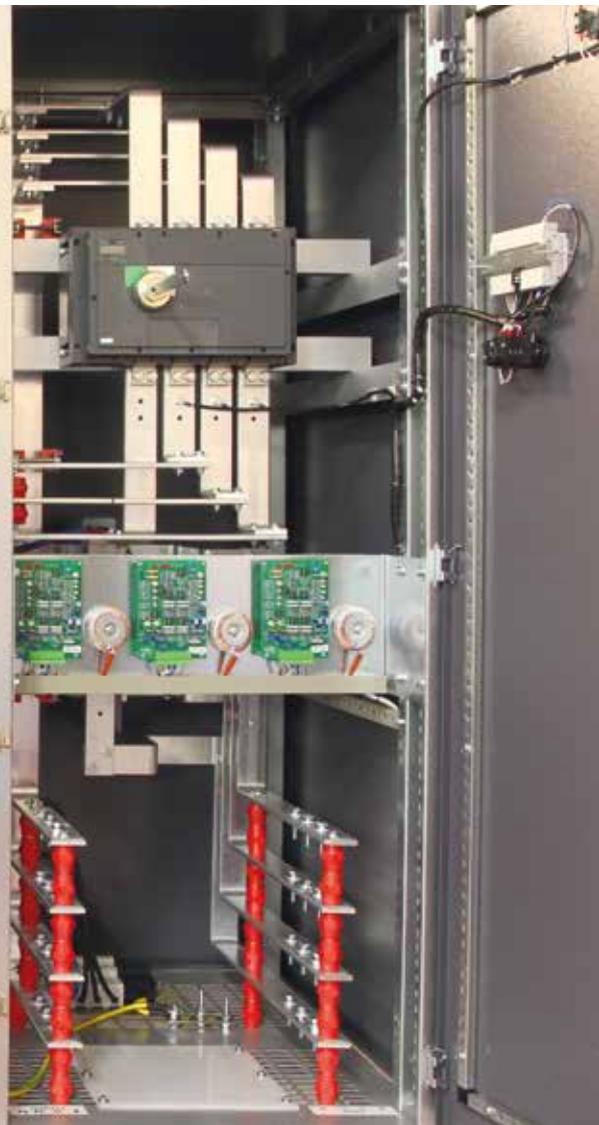
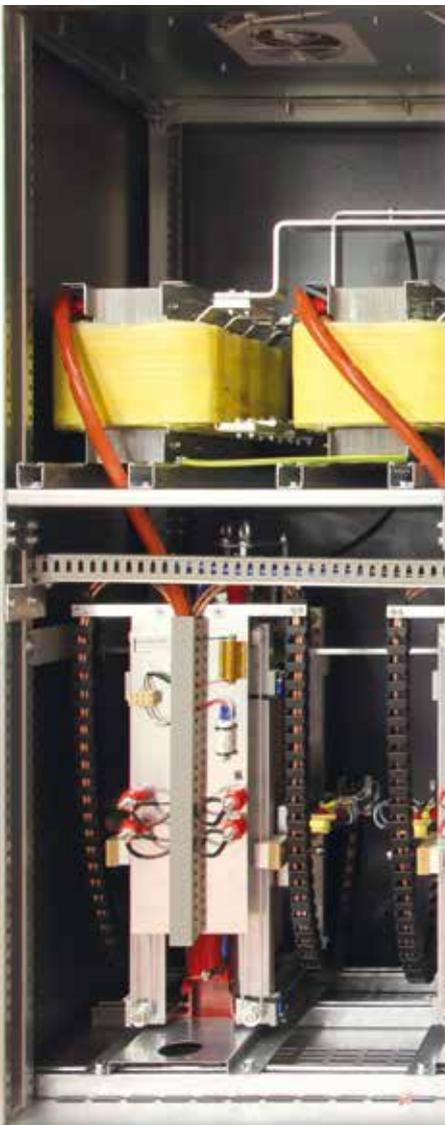
We are suppliers for most important groups all over Europe,

Africa, Middle East and The Soviet Union.

The experience acquired over these years has been essential for complying with the high-quality standards met with in our export activity.

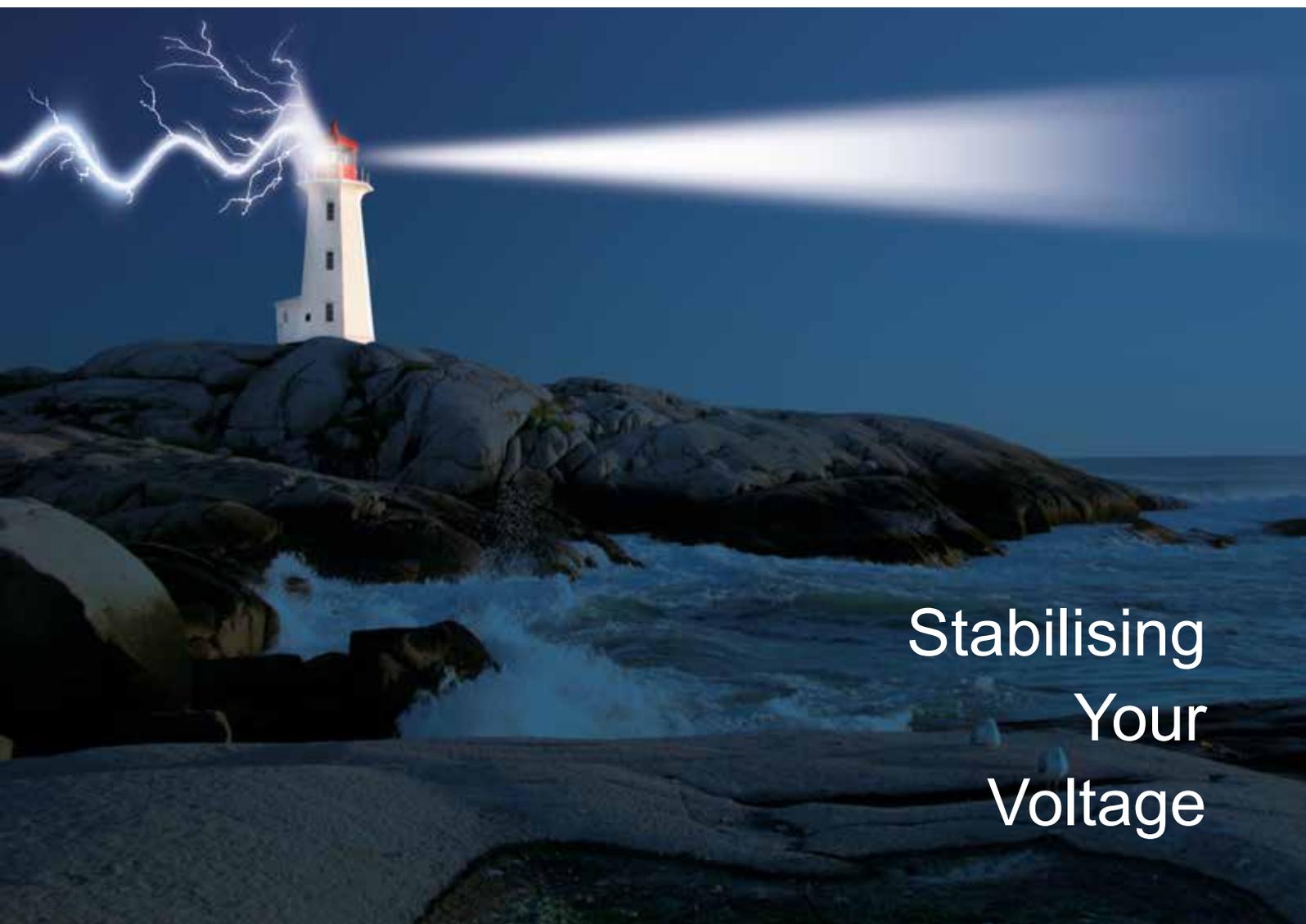
The R&D department ensures a progressive technical advancement through continuous experimentations and innovations to produce high quality and reliable products capable of adapting to different environmental conditions.





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Stabilising  
Your  
Voltage

# FEATURES

A.C. Voltage Stabilizers are designed to ensure a stabilized A.C. supply to essential loads from fluctuating incoming mains. They also find wide applications in most Electrical & Electronic fields and many other Industries such as Research Institutions, Testing Laboratories, Educational Institutions, CNC Machinery, Computers, etc.

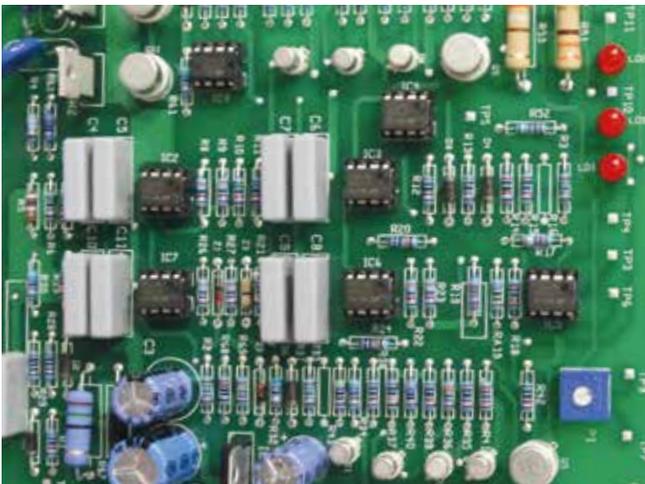
Our BST range of Automatic Voltage Stabilizers manufactured in Milan (Italy), meet the requirements of most applications where stable output is necessary.

The correct operation of all electrical and electronic equipment requires a constant voltage supply in order to function correctly; meanwhile, mains voltage values are often subjected to considerable fluctuations that drives the necessity to have machines able to delivery a constant output voltage, irrespective of any line input voltage variations.

The BST is a Servo Controlled Stabilizer that has a number of features which include the following:

- Extremely high efficiency (mostly 98% or better)
- Virtually zero wave form distortion (THDi/THDu)
- Very low internal impedance
- Negligible phase shift
- Unaffected by low system and/or load power factor
- Output voltage stability
- Negligible temperature drift
- Immune to frequency variation from 47 to 63 Hz
- Faster output voltage correction
- Elimination of motor switching spikes

The main components of the three (3) phase version of the equipment are; three (3) single-phase 'buck/boost' transformers, three (3) motorized single-phase autotransformers with continuously variable transformer ratio (voltage regulator) and three (3) electronic control cards.



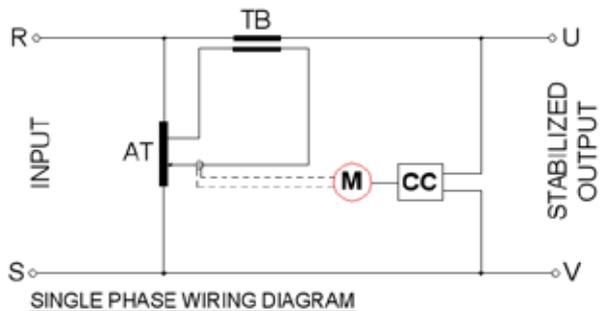
## CONSTRUCTION AND CIRCUIT DESCRIPTION

The BST stabilizer technically consists of a motor driven variable autotransformer feeding the primary winding of a "buck-boost" transformer whose secondary is connected in series between the supply and the load. This "buck-boost" transformer adds or subtracts a correcting voltage to the input. A static control circuit monitors the output voltage and works on the Variable autotransformers' motor thereby correcting any voltage deviations and restoring the later to nominal voltage value.

The variable transformer winding (AT) is connected across the controlled mains supply. The variable output is taken to the primary winding of the transformer TB via a fixed and a variable tapping is provided by brush(es) which traverse a specially prepared track on the winding. When the position of the brush(es) coincides with the position of the fixed tapping, the output voltage from AT will be zero.

The brush-gear is rotated by the geared motor and movement of the brush(es) in either direction from the zero position gives a gradually increasing output voltage.

When the mains supply voltage falls, the Belotti electronic card (BVH Type) sends a control signal to the motor. The motor then moves the brush-gear, of the variable transformer, in such a direction as to cause an in-phase voltage build-up in the secondary winding of transformer TB. This voltage boosts the low mains and continues to build up until the output voltage, of the stabilizer, is restored to normal. When the value of the output voltage has been restored to normal, the Belotti electronic card sends a control signal to the motor and the movement of the variable transformer brush-gear ceases.



SINGLE PHASE WIRING DIAGRAM

TB = BOOSTER TRANSFORMER  
 AT = VARIABLE AUTOTRANSFORMER  
 CC = SOLID STATE CONTROL CIRCUIT  
 M = SERVO MOTOR

Should the mains supply voltage rise, positive control signal is supplied to the motor, which drives the brush-gear of the variable transformer in the opposite direction, reducing the voltage supplied to transformer TB.

When the brush-gear traverses the position of the fixed tapping, the voltage in the transformer is reduced to zero and then begins to build up 180° out-of-phase to the supply voltage. The voltage in the secondary winding of the transformer now opposes the increased input voltage and continues to build up until the stabilizer output voltage is restored again to normal after which the electronic card stops the motor again.

If the variations in the supply voltage are greater than the acceptance range of the stabilizer, the brush-gear of the variable transformer will be driven to one or other of its extremities without full correction being achieved. In order to prevent possible damage to the motor or to the variable transformer, limit switches are incorporated in the motor armature circuit, which break the motor supply when the limit is reached.

### INDEPENDENT REGULATION

(Autonomous regulation of each phase in the three phase Stabilizer BST-TH...IR)

This system guarantees the stabilization of each phase autonomously in the presence of largely unbalanced loads.

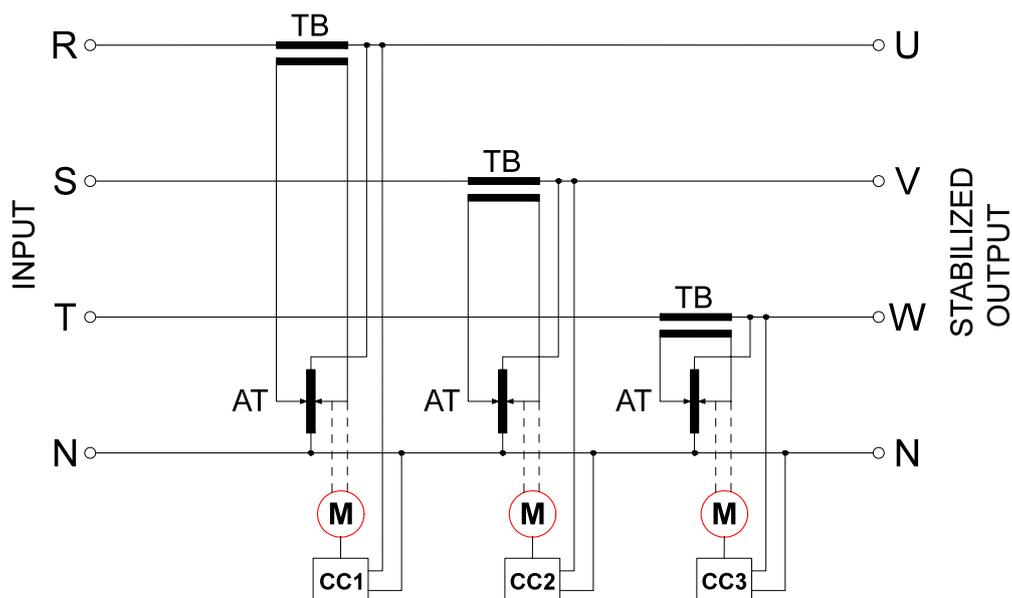
It is a combination of three single-phase units that are perfectly independent from one another. It can be connected to a 4-wire system (with neutral) or a 3-wire system.

### APPLICATIONS

- Data processing equipment
- Transmissions, telecommunications and radar stations
- Test control and measuring systems
- Photocopying and tool machines
- Safety, alarm and lighting plants
- Any electronic or electric equipment sensitive to variable voltage networks

### RATINGS

- Input Voltage: 3x400V (others upon request)
- Input regulation:  $\pm 15\%$ ,  $\pm 20\%$ ,  $(-25 + 15)\%$  and others upon request
- Frequency: 48 ÷ 63 Hz
- Output Voltage: 3x400V ( $\pm 1\%$  till  $\pm 5\%$ )
- Regulation time: from 13 to 35 msec/V (milli seconds per volt)
- Full load efficiency: 98%
- $(-20$  to  $45)^\circ\text{C}$  ambient temperature working range



3 PHASE WIRING DIAGRAM  
EACH PHASE REGULATED INDEPENDENTLY

TB = BOOSTER TRANSFORMER  
AT = VARIABLE AUTOTRANSFORMER  
CC = SOLID STATE CONTROL CIRCUIT  
M = SERVOMOTOR

# CRITERIA FOR CHOOSING A VOLTAGE STABILIZER

## 1) NUMBER OF PHASES (Three-phase)

THREE-PHASE LOAD → three-phase stabilizer  
 SINGLE-PHASE LOAD → single-phase stabilizer

## 2) RATED INPUT VOLTAGE

It is the value of the mains (example: 380V, 400V or 415V).

## 3) FLUCTUATIONS (Range of mains variation)

It is very important in the selection of the machine to know the variations of the incoming mains that indicates the oscillations from a minimum to a maximum value. Normally we calculate the oscillations in percentage.

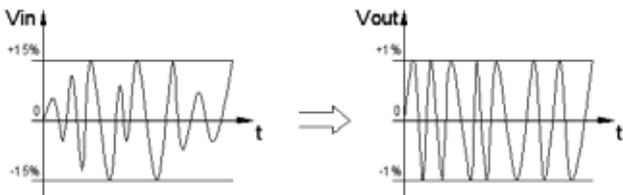
Example: 400V ±15% (min: 340V, max: 460V)  
 400V ±20% (min: 320V, max: 480V)  
 400V (-25 +15)% (min: 300V, max: 460V)

At constant power, the greater the fluctuation in the entry, the greater the size of the machine necessary to ensure the full output power. A variation of input voltage higher than the nominal declared determines a variation of the output voltage outside the stated accuracy. (See point 4)

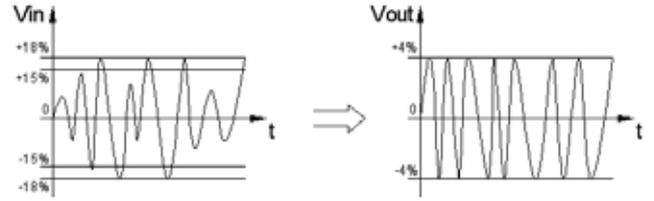
## 4) RATED OUTPUT VOLTAGE

The voltage stabilizer is able to correct the fluctuations in the input and bring a constant output voltage with a precision of ±1%. Examples:

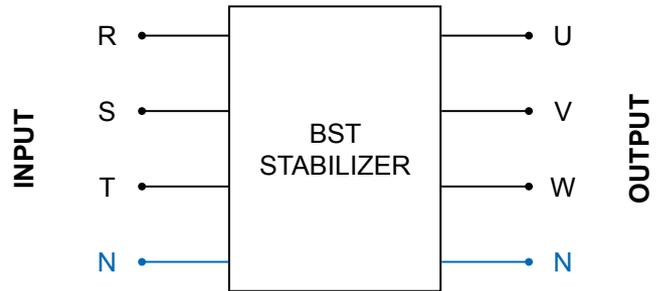
1) Normal variation of the mains: ±15% → correct variation in output: ±1%



2) Unexpected variation of the mains: ±18% → incorrect variation in output: ±4%



3) Input nominal voltage: 400V



INPUT	OUTPUT
400V ±20% (320V - 480V)	400V ±1% (Phase-to-phase voltage (L-L): 400V) (Phase-neutral voltage (L-N): 230V)
400V ±15% (340V - 460V)	
400V (-25 +15)% (300V - 460V)	

The adjustment of the output accuracy is performed by the electronic card independently on each phase and can be adjusted manually using terminal P1 on Belotti card type BHV.

## 5) PRESENCE OR NOT OF THE NEUTRAL LINE

## 6) RATED POWER (kVA) (Absorbed by the system)



# BST-TH SERIES STABILIZER

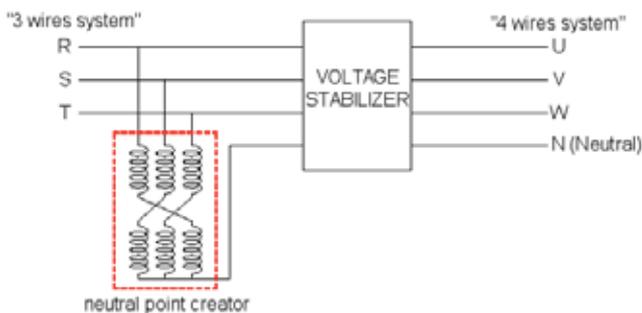
The stabilizers of high-power series, BST-TH, range in power from 400 kVA to 3000 kVA and consist of motorized columnar type variable autotransformers which are contained in a stable built-in case disposed under the base to allow for easy material handling.

To be ahead of competition in this area, we have developed a self-supporting structure which is extremely strong and can be carried without the use of pallets.

The base is made of a folded sheet of 40/10 thickness. This stand is also equipped with appropriate filters for easy maintenance and replaceability.

The range is completed in accordance with the required power and the expected input fluctuation window ( $\pm 15\%$ ,  $\pm 20\%$ ,  $(-25 + 15)\%$ , and others on request).

**IMPORTANT:** The mains should be equipped with the neutral line N (3 phases + neutral). In the absence of neutral a ( $\Delta/Y$ ) transformer or an autotransformer (neutral point creator) must be inserted.



The stabilizer can work even in an unbalanced loads condition.

All our stabilizers are air cooled by natural convection achieved by the integration of forced roof fan extractors on the top of the enclosure cabinet.

The power supply network is checked automatically on the three phases by three electronic cards that suppress power surges on each input phase independently.

## STANDARD SERIES STABILIZER

The standard stabilizer consists of the following electro-mechanical parts:

- N° 3 columnar motorized variable autotransformers (one per phase) VMC series
- N° 3 control cards (BVH type)
- N° 3 groups of booster transformers (one per phase)
- N° 1 main switch input 4-poles suitable power to the machine, including door safety lock
- N° 1 group stabilized output signal lamps
- N° 1 Input Surge Protector (type SLP CL.II (c) IEC 61643-1) (explained later)
- N° 1 panel composed by two LCD colour displays BELOTTI EMS to read all the electrical input and output parameters. (*Explained later*)

### BELOTTI SLP (Input Surge Protector)

This device prevents or limits the occurrence of over-voltages and its resultant effects.

The SLP-275 arrester guarantees the protection of low-voltage networks and connected appliances against voltage surges induced by a lightning strike or disturbances and failures in high-voltage networks or against industrial surge voltages.

- CLASS II (C) IEC 61643-1 → STANDARD
- CLASS I+II (B+C) IEC 61643-1 → OPTIONAL (*on request*)

Arresters able to divert surges arising from nearby or distant lightning strikes or switch operations.



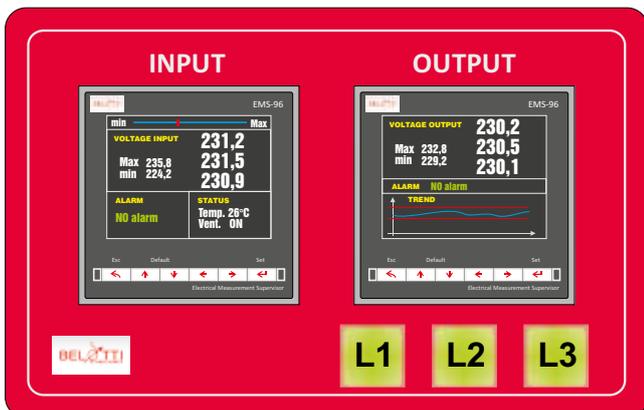
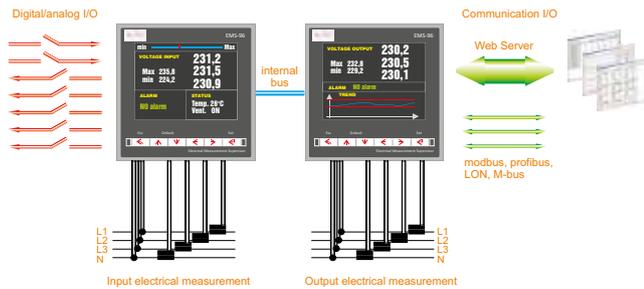
# BST-TH SERIES STABILIZER

## BELOTTI EMS-PANEL (LCD Colour Displays)

The EMS Panel enables users to completely monitor electrical parameters in the input and output of the voltage stabilizer.

The main features of the EMS Panels in high-power three-phase stabilizers include:

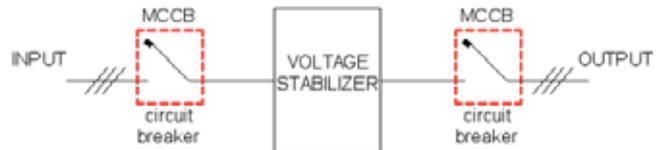
- The measured parameters in input and output, mainly: voltages, currents, powers, frequency, active energy
- Reports state outputs:
  - presence of the stabilized output voltage
  - increase/decrease adjustment phase voltage
  - upper/lower variac limits
- Alarm signalling:
  - max/min input phase voltage
  - max/min output phase current
  - phase failure
  - over-temperature (optional)
  - faulty ventilation (optional)
  - SLP failure (optional)
- Communication interfaces RS485 with Modbus protocol for remote transmission of all measured parameters.
  - Internal Web Server with RJ45 Ethernet Port HTTP, FTP client and server, SMTP, Modbus TCP/IP (optional)
  - Wi-Fi connection (optional)
  - Profibus DP/Vzero (optional)
  - GPRS Mode (optional)



## OPTIONAL ACCESSORIES

On request, Belotti equips machines with the following options:

- automatic INPUT circuit breakers MCCB (instead of the switch disconnecter) → (allow protection against overloads and short circuits)
- automatic OUTPUT circuit breakers MCCB



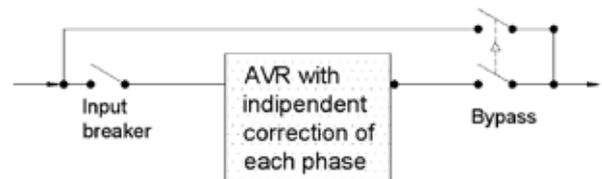
- manual BY-PASS

## BELOTTI MANUAL BY-PASS

Our manual BY-PASS allows for maintenance to be carried out on the stabilizer while providing power to the final load connected to the stabilizer itself without interrupting the supply of energy.

The operation to put in BY-PASS mode is easily made on the door panel of the stabilizer.

## BY-PASS SCHEME Series ATYS



The By-Pass is constituted by a motorized 3-position switch (I-0-II) assembled at the output of the stabilizer that can work as follow:

- Pos. I → By-Pass position (input breaker must be open)
- Pos. 0 → OFF position (all off)
- Pos. II → BST ON position (stabilizer on) (input breaker must be close)

**IMPORTANT:** in “BY-PASS ON” position, the output voltage is not stabilized!!!



# BST-TH SERIES STABILIZER

## OUT OF STANDARD EXECUTIONS

On request is possible to supply the stabilizer with some accessories assembled in the same case:

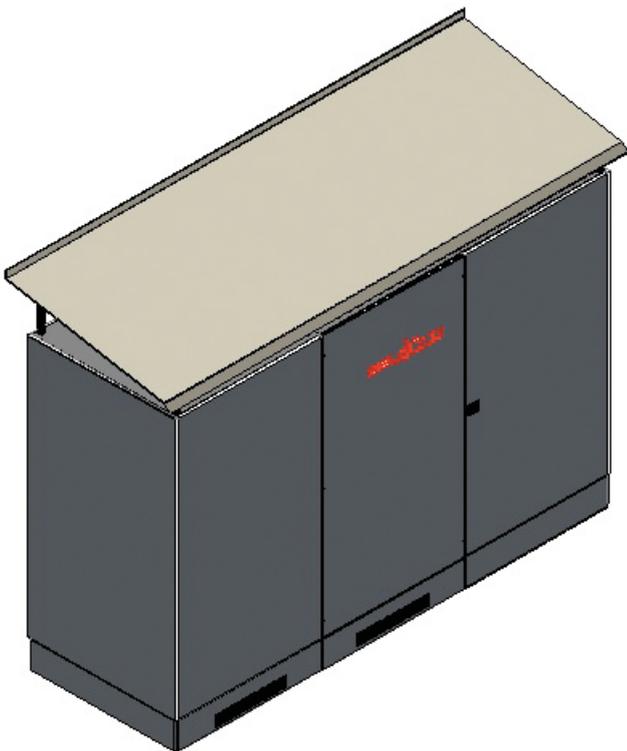
- Outdoor Construction IP54
- Isolating Transformer BST - (model) ISO

## OUTDOOR CONSTRUCTION

Belotti provides a different enclosure cabinet especially for outdoor installations.

The machine is equipped with a roof and specially designed extractor fans in order to surmount dire weather and/or temperature distress conditions.

Particular attention is given to the surface treatment of metal parts and painting of cabinets. High strength epoxy paints are, in fact, used to withstand extreme temperatures (-40°C to +60°C).



## ISOLATING TRANSFORMER

Belotti Isolation Transformer guarantee the best mains input protection and noise filtering at the BST Stabilizer input.

Suitably designed isolation transformers block interference caused by ground loops.

Isolation transformers with electrostatic shields are used for power supplies for sensitive equipment such as computers or laboratory instruments.

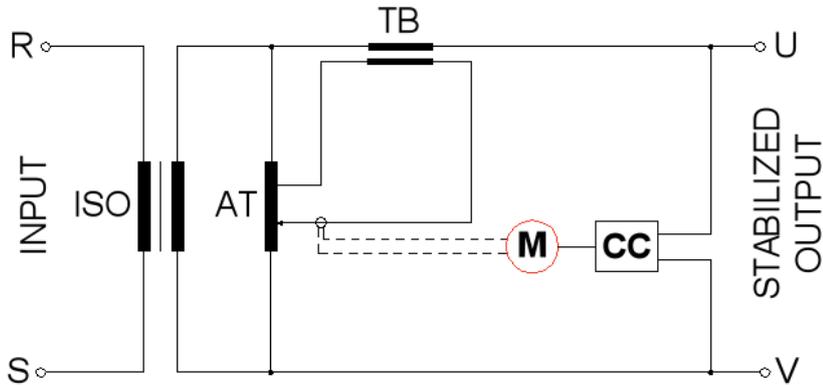
Features:

- Galvanic Isolation Primary/Secondary
- Isolating screen
- $\Delta/Y$  (DYN 11) connection gives phase equilibration and creation of a new and clean neutral at secondary, essential for the correct operation of single-phase loads
- Noise filtration



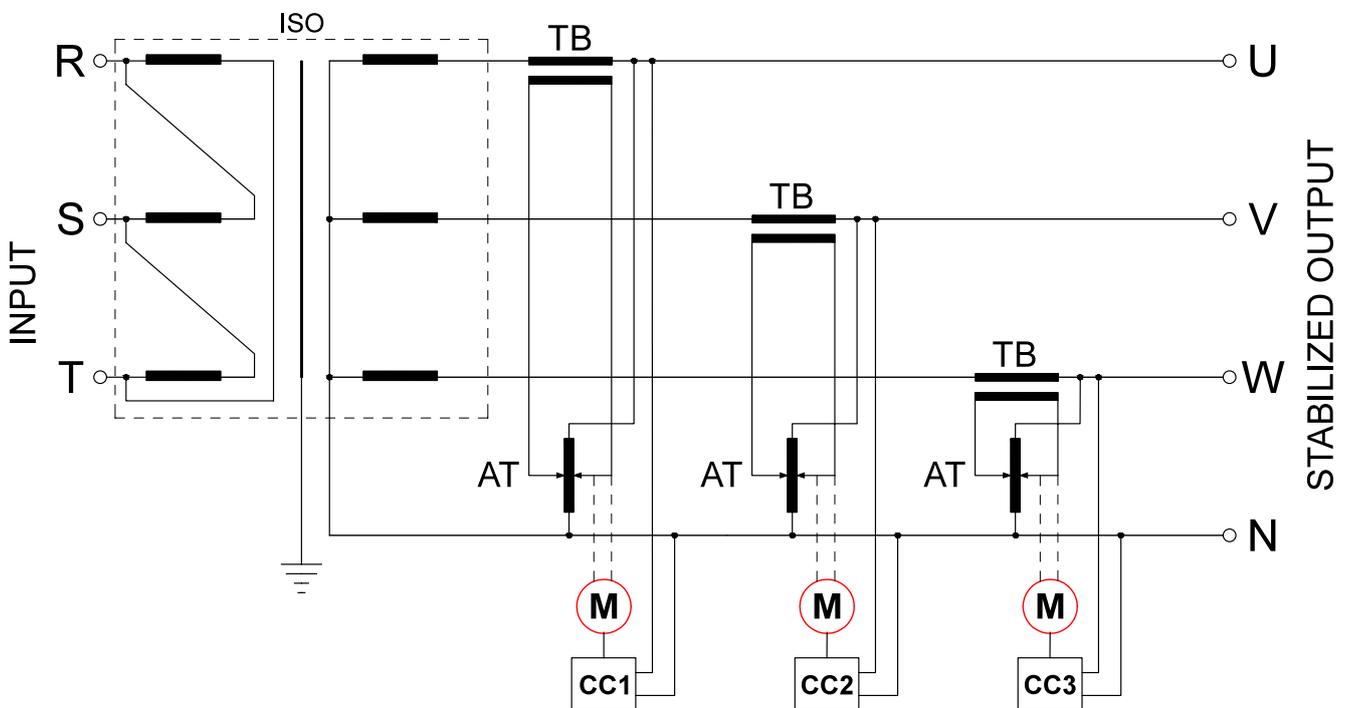
# BST-TH SERIES STABILIZER

## BST STABILIZER WITH ISOLATING TRANSFORMER



**SINGLE PHASE WIRING DIAGRAM  
WITH ISOLATING TRANSFORMER**

TB = BOOSTER TRANSFORMER
AT = VARIABLE AUTOTRANSFORMER
CC = SOLID STATE CONTROL CIRCUIT
M = SERVOMOTOR
ISO = INSULATION TRANSFORMER



**3 PHASE WIRING DIAGRAM  
EACH PHASE REGULATED INDEPENDENTLY**

TB = BOOSTER TRANSFORMER
AT = VARIABLE AUTOTRANSFORMER
CC = SOLID STATE CONTROL CIRCUIT
M = SERVOMOTOR
ISO = ISOLATING TRANSFORMER

# TABLES AND DIAGRAMS

## 3-PHASE VOLTAGE STABILIZER BST-TH SERIES $\pm 15\%$

TYPE	RATED POWER (kVA)	INPUT VOLTAGE 400V $\pm 15\%$	MAX INPUT CURRENT (A)	OUTPUT VOLTAGE 400V $\pm 1\%$	RATED OUTPUT CURRENT (A)	DIMENSIONS (mm)	WEIGHT (Kg)
BST-TH 400IR/15	400	(340 – 460)	680	400	578	2600 L 1000 W 2150 H	1200
BST-TH 500-IR/15	500	(340 – 460)	850	400	723		1400
BST-TH 630-IR/15	630	(340 – 460)	1071	400	910		1500
BST-TH 800-IR/15	800	(340 – 460)	1360	400	1156		2200
BST-TH 1000-IR/15	1000	(340 – 460)	1700	400	1445	3200 L 1200 W 2150 H	2800
BST-TH 1250-IR/15	1250	(340 – 460)	2125	400	1806		3300
BST-TH 1600-IR/15	1600	(340 – 460)	2720	400	2312		4000
BST-TH 2000-IR/15	2000	(340 – 460)	3400	400	2890	3600 L 1400 W 2150 H	4800
BST-TH 2500-IR/15	2500	(340 – 460)	4250	400	3613		5800
BST-TH 3000-IR/15	3000	(340 – 460)	5100	400	4335		6500
BST-TH4000--IR/15	4000	(340 – 460)	6800	400	5780	4800 L 1500 W 2150 H	8500

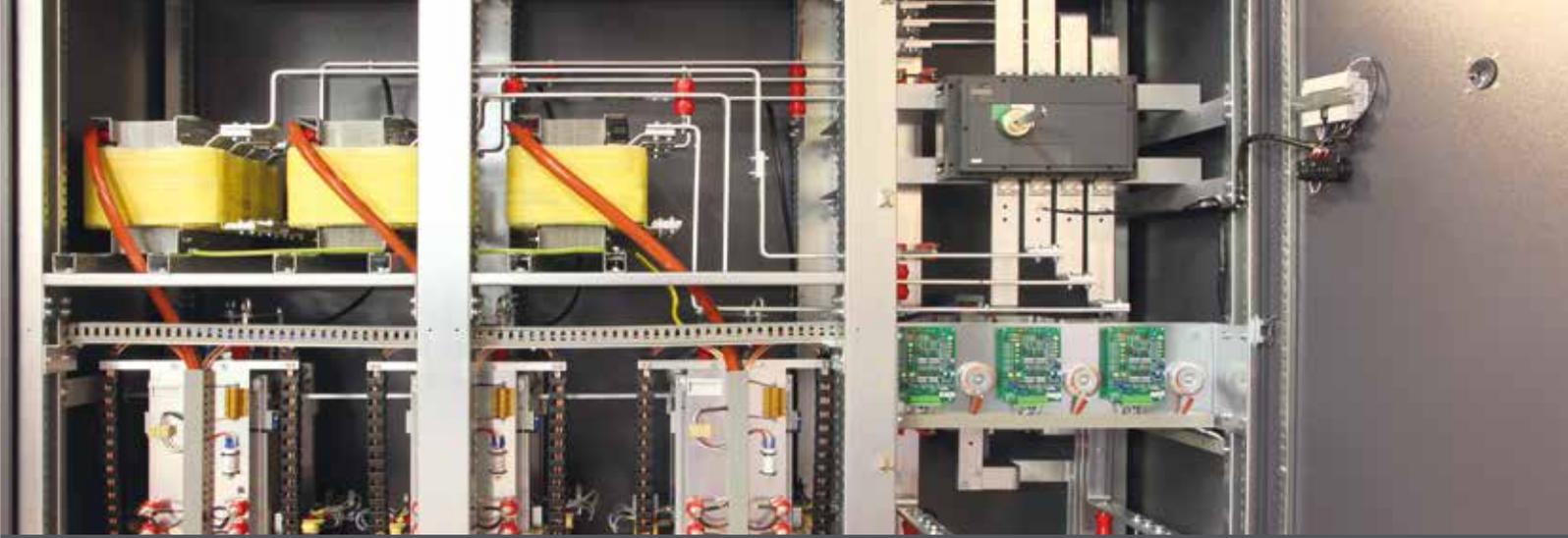
NOTE: The **dimensions** and the **weight** may be subject to change.

# TABLES AND DIAGRAMS

## 3-PHASE VOLTAGE STABILIZER BST-TH SERIES $\pm 20\%$

TYPE	RATED POWER (kVA)	INPUT VOLTAGE 400V $\pm 20\%$	MAX INPUT CURRENT (A)	OUTPUT VOLTAGE 400V $\pm 1\%$	RATED OUTPUT CURRENT (A)	DIMENSIONS (mm)	WEIGHT (Kg)
BST-TH 500-400-IR/20	400	(320 – 480)	723	400	578	2600 L 1000 W 2150 H	1400
BST-TH 630-500-IR/20	500	(320 – 480)	903	400	723		1500
BST-TH 800-630-IR/20	630	(320 – 480)	1138	400	910		2200
BST-TH 1000-800-IR/20	800	(320 – 480)	1445	400	1156	3200 L 1200 W 2150 H	2800
BST-TH 1250-1000-IR/20	1000	(320 – 480)	1806	400	1445		3200
BST-TH 1600-1250-IR/20	1250	(320 – 480)	2258	400	1806		4000
BST-TH 2000-1600-IR/20	1600	(320 – 480)	2890	400	2312	3600 L 1400 W 2150 H	4800
BST-TH 2500-2000-IR/20	2000	(320 – 480)	3613	400	2890		5800
BST-TH 3000-2500-IR/20	2500	(320 – 480)	4516	400	3613		6600
BST-TH 4000-3000-IR/20	3000	(320 – 480)	5419	400	4335	4800 L 1400 W 2150 H	8000

NOTE: The **dimensions** and the **weight** may be subject to change.





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