



BELOTTI
MILANO

B S T - T S E R I E S S T A B I L I Z E R S

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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.

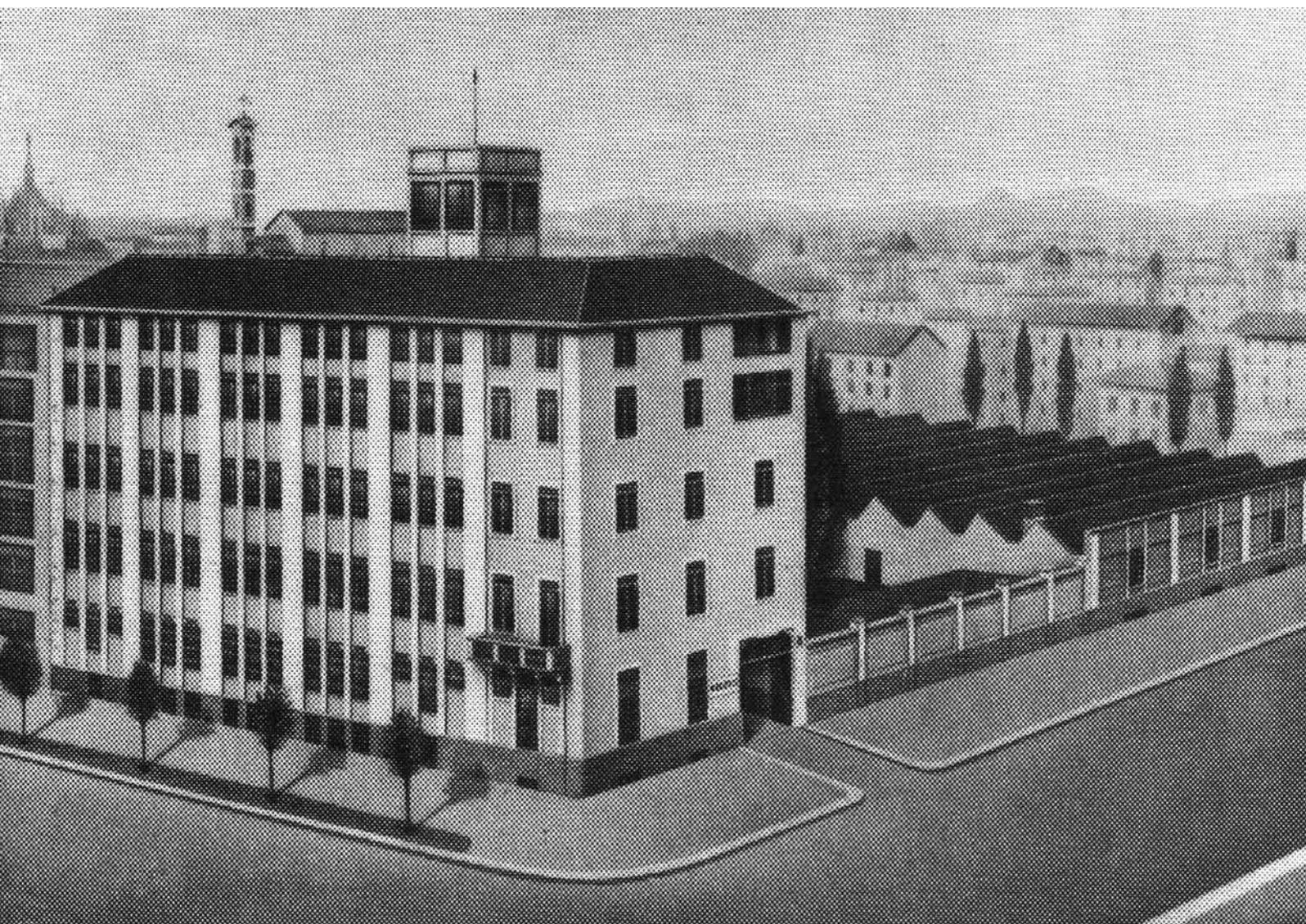
We are located in Milano with plants occupying 3.000 m² comprising office, factory and adjacent units.

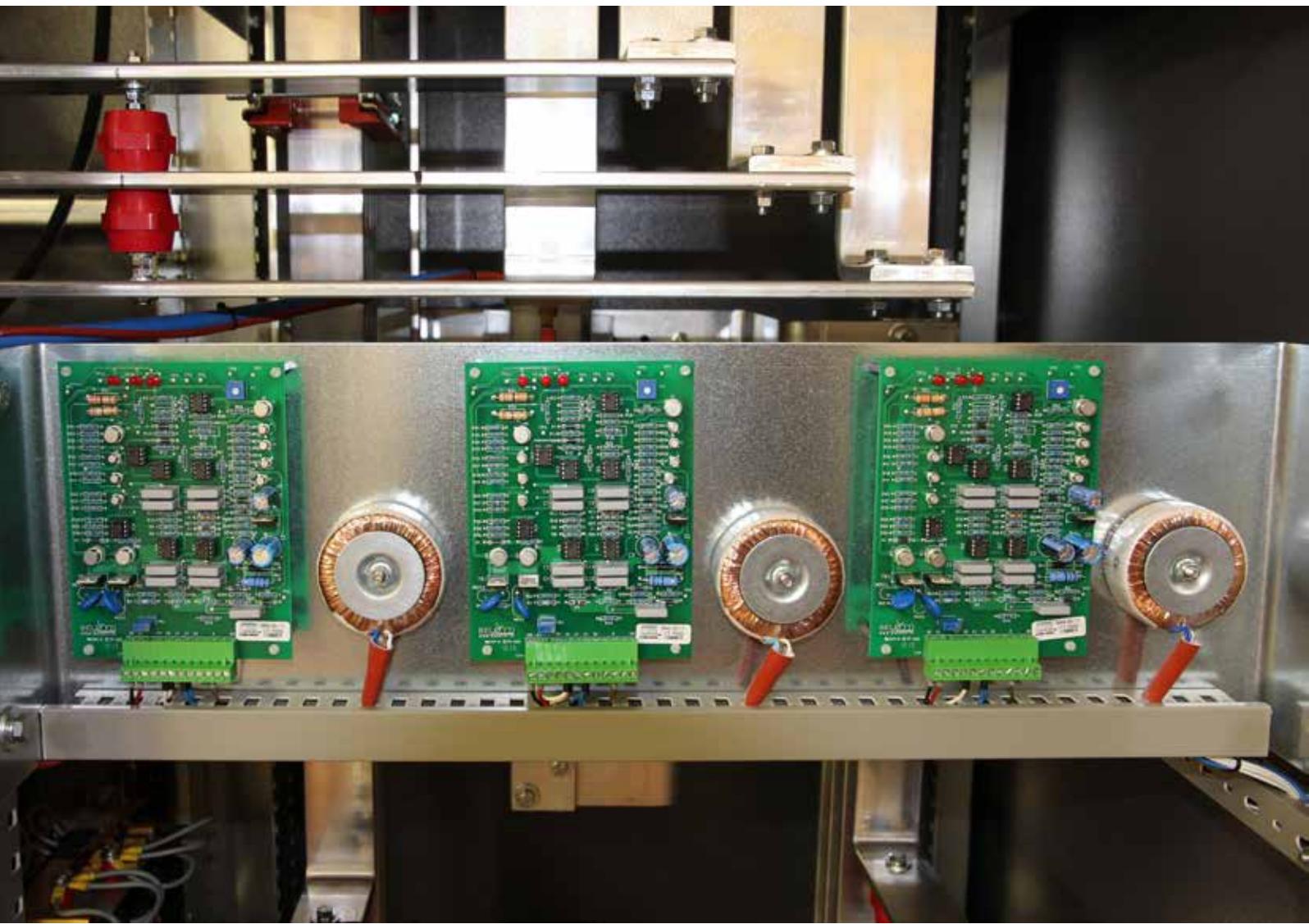
We are suppliers for most important groups all over Europe,

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.

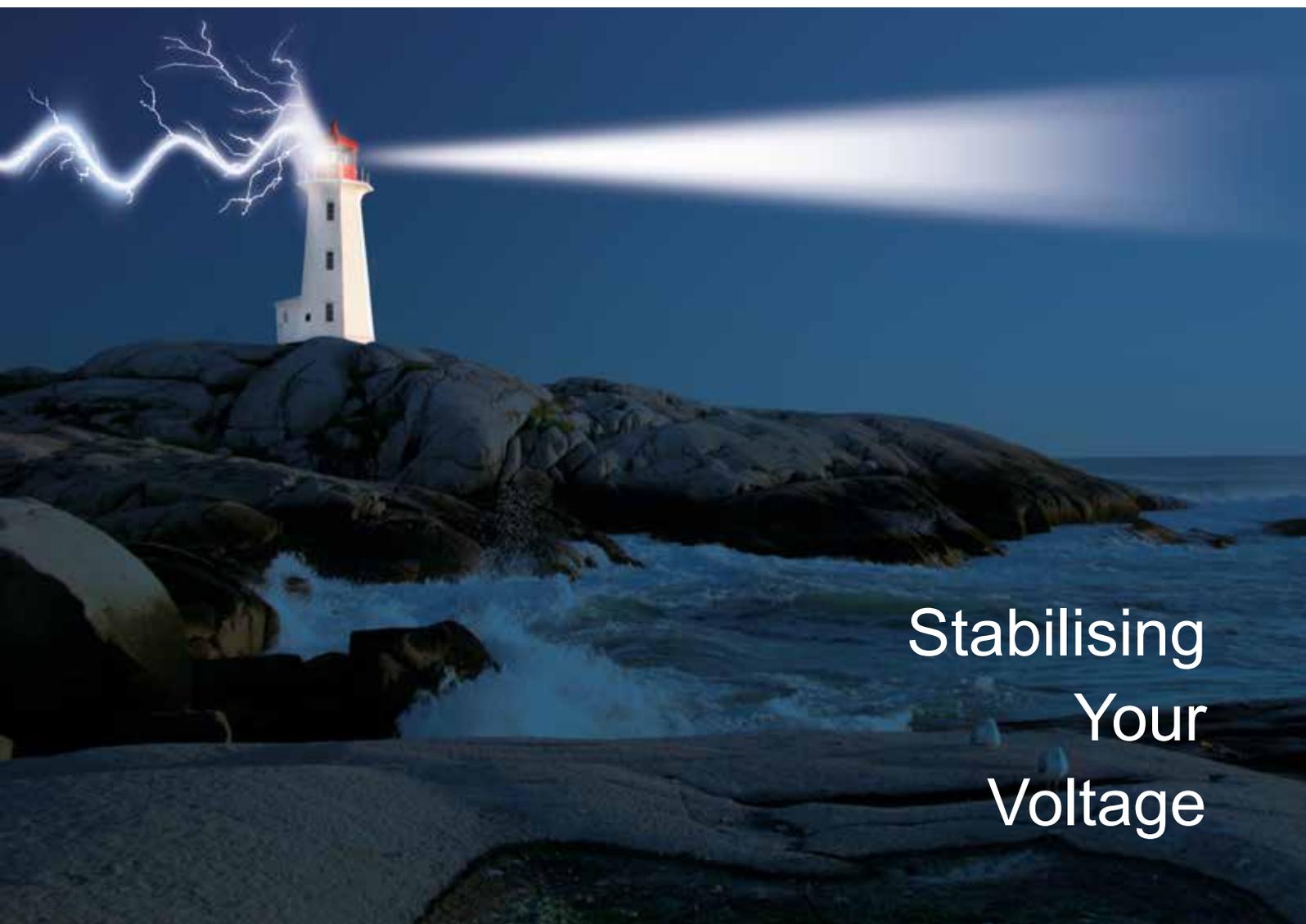
The R&D department ensures a progressive technical advancement through continuous experimentations and innovations to produce high quality and reliable products capable of adapting to different environmental conditions.





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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.

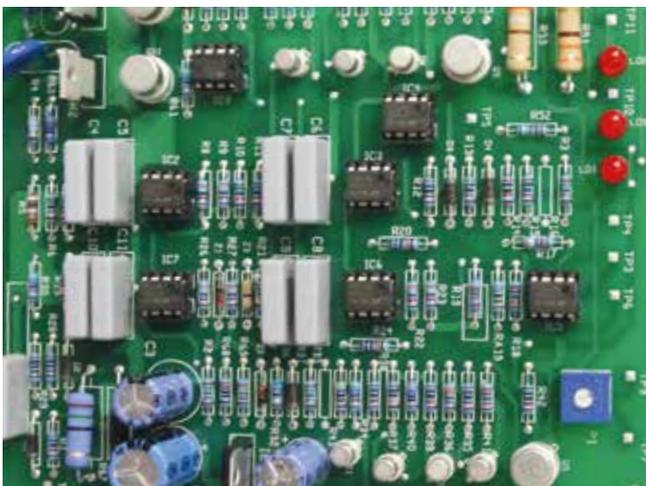
Our BST range of Automatic Voltage Stabilizers manufactured in Milan (Italy), meet the requirements of most applications where stable output is necessary.

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.



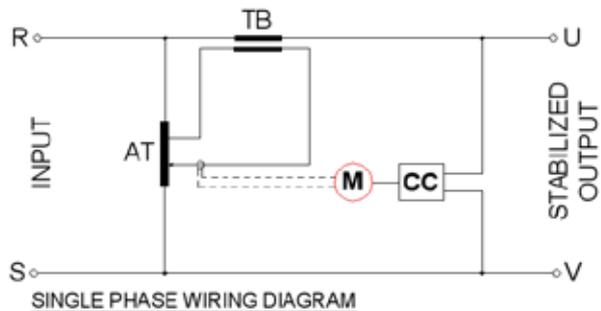
CONSTRUCTION AND CIRCUIT DESCRIPTION

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-T... IR)

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

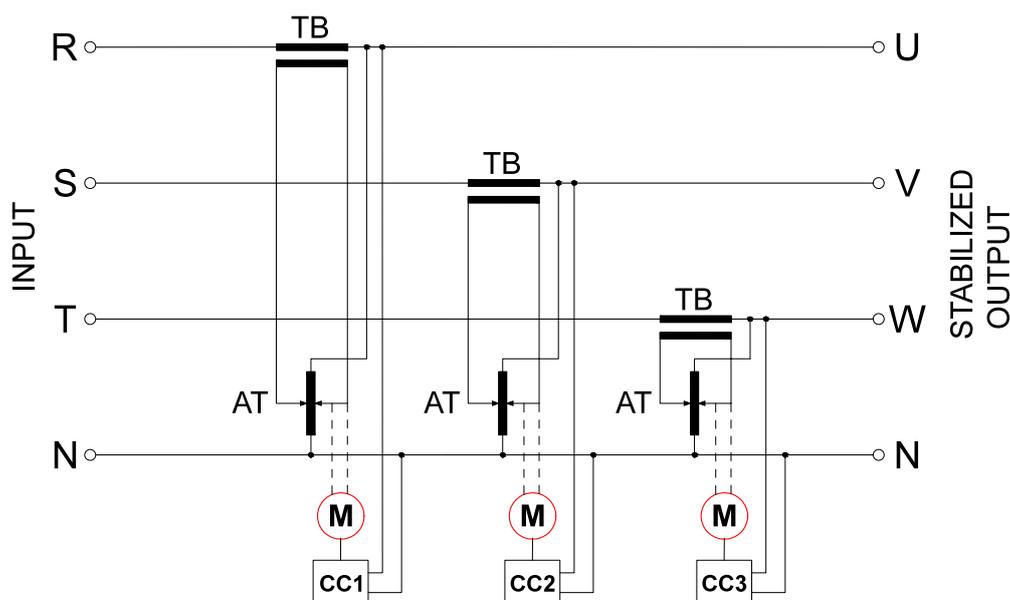
It is a combination of three single-phase units that are perfectly independent from one another. It can be connected to a 4-wire system (with neutral) or a 3-wire system.

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.

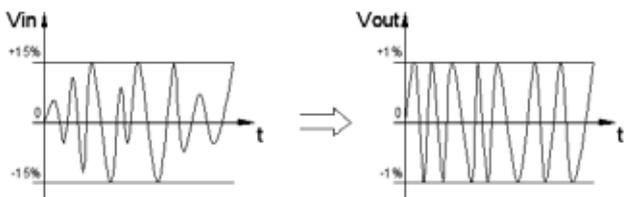
Example: 400V ±15% (min: 340V, max: 460V)
 400V ±20% (min: 320V, max: 480V)
 400V (-25 +15)% (min: 300V, max: 460V)

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)

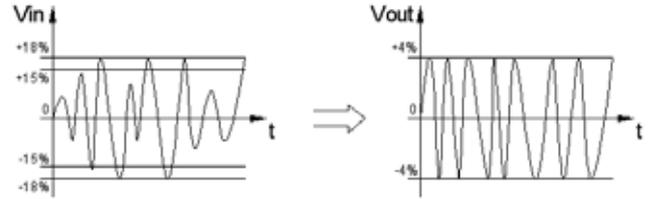
4) RATED OUTPUT VOLTAGE

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

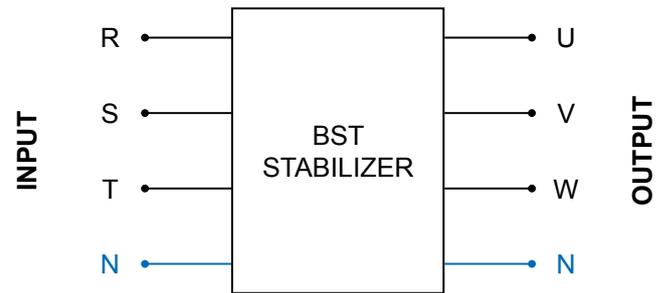
1) Normal variation of the mains: ±15% → correct variation in output: ±1%



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)

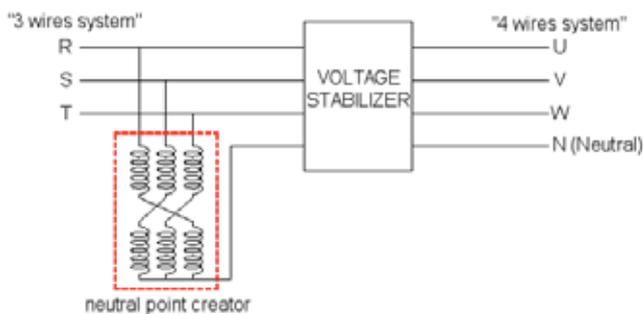


BST-T SERIES STABILIZER

The stabilizers BST-T series, range in power from 10 kVA to 300 kVA and consist of motorized toroidal type variable autotransformers which are contained in a stable built-in case disposed under the base to allow for easy material handling.

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 (Δ / Y) transformer or an autotransformer (neutral point creator) must be inserted.



The stabilizer can work even in an unbalanced loading condition provided the power rating of each phase is not exceeded.

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

The power supply network is checked automatically on the three (3) phases by three (3) 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 motorized variable autotransformers (one per phase)
- 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 (INPUT MCCB AUTOMATIC CIRCUIT BREAKER or INPUT SECTIONALISING SWITCH)
- N°1 group stabilized output signal lamps
- N°1 Input Surge Protector (type SLP CL.II (c) IEC 61643-1)
- N°1 Digital Multimeter EMM

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.

Surge arresters:

- 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.



BELOTTI DIGITAL MULTIMETER EMM

EMM series measure the main electrical parameters of the electrical energy distribution networks by 3 or 4 red led. It is used for local and remote visualisation of electrical parameters.

The digital multimeter replace in a unique way all the functions of voltmeters, ammeters, cosphi-meters, wattmeters, VARmeters and frequency meters.

Optionally, there are the availability of digital outputs (for pulse or alarm) a serial RS485 output with MODBUS-RTU, LONWORK, PROFIBUS/DP PROTOCOL) Several models, with various function and input/outputs option are available to satisfy all technical and economics needs.

BST-T SERIES STABILIZER

EMM-μD3-VA For AVR case 600x600x1200h mm



EMM-D4H For AVR case 600x600x1500h mm



EMM-4H For AVR cases 800x600x1600h, 1000x600x1800h, 1400x1000x2150h mm



INPUT SWITCH

Belotti AVR BST-T series standard execution are supplied with circuit breakers to protect the AVR. Based on the power of the AVR we offer two different switches:

- 1) Up until BST-T60-IR Model (60kVA),
INPUT MCCB AUTOMATIC CIRCUIT BREAKERS – DIN RAIL
Intervention curve Type C to avoid inrush current
 - Load range from 6Amps to 63Amps → interruption rate 6KA
 - Load range from 80Amps to 125Amps → interruption rate 10KA
- 2) From BST-T90-IR Model (90kVA),
INPUT SECTIONALISING SWITCH
 - Load range from 125Amps to 1000Amps 3 or 4 poles → interruption even under load

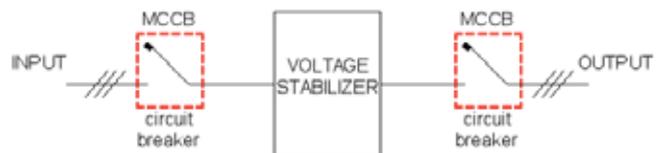
OPTIONAL ACCESSORIES

The fully protected series includes the following accessories:

- Contactors with over/under voltage
- Overcurrent relay

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

OPTIONS IN DETAILS

FULLY PROTECTED SERIES

- **Belotti voltage monitoring relay CP730**

The monitoring Relay CP730 is used to set & control at the time of construction of the Voltage Regulator (AVR) the input voltage range of tolerance within which the AVR must operated in order to meet nominal operational requirements.

For example: if the AVR is constructed for a fluctuation of 20%; it implies 400V +/-20% = at minimum 320V & at maximum 480V phase-phase (or for single phase 230V phase-neutral +/-20% = minimum 184V & maximum 276V).

These restrictions are set up on the frontal panel of instrument.

- U1 Lowest Tension
- U2 Maximum Tension

Light U1 and U2 RED it means that or the INPUT VOLTAGE is lower than the minimum required or the voltage is higher than the maximum limit.

In both case we have a break of the external contactor and as result, and the AVR stops.

YELLOW LIGHT (B) it means the voltage is back to standard measurement. The CP730 is in Soft Start mode 0,5/10 sec before restarting the AVR

GREEN LIGHT (U) it means that everything is working regularly: the input voltage is within the technical parameters of construction of the AVR.

BST-T SERIES STABILIZER

• OPTION: Overcurrent protection at output

In the single and three-phases stabilizers, current protection is achieved by inserting Hydraulic-Magnetic Circuit Breaker at the output. Single and multipole magnetic circuit breakers with trip-free mechanism and toggle actuation equipped with auxiliary changeover relay contacts which control a contactor that Opens or Closes the output load voltage supply.

In the three-phase system the device protects each phase. Reset is manual.



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.

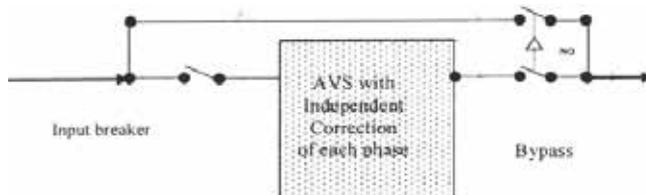
AVR Belotti BST-T series are supply with:



MANUAL CHANGEOVER SWITCHES



MOTORIZED BY-PASS is also possible for Belotti BST-T series AVR over 100Amps.



The motorized By-pass is constituted by a 3-position switch (I-0-II)

assembled at the output of the stabilizer that can work as follows:

- 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)

OUT OF STANDARD OPTIONS

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

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

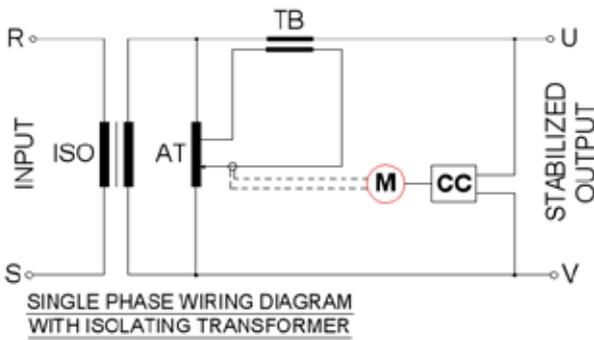
ISOLATING TRANSFORMER

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

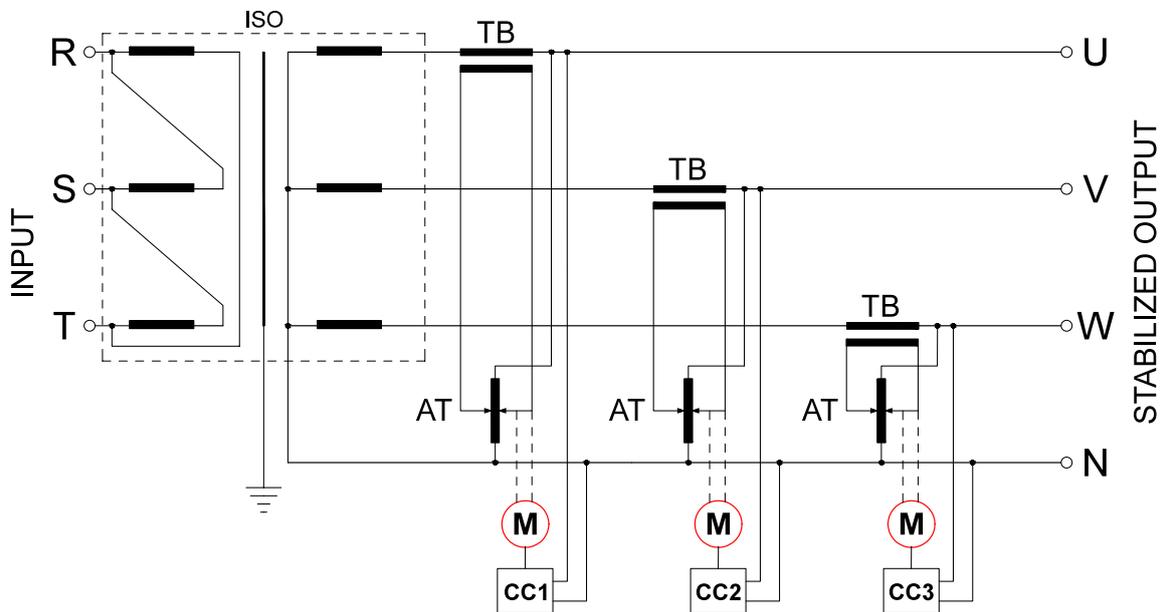
Features:

- Galvanic Isolation Primary/Secondary
- Isolating screen
- Δ / 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 STABILIZER WITH ISOLATING TRANSFORMER



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



3 PHASE WIRING DIAGRAM EACH PHASE REGULATED INDEPENDENTLY

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

TABLES AND DIAGRAMS

3-PHASE VOLTAGE STABILIZER BST-T 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-T16-IR/15	16	(340–460)	27	400	23	600 L 600 W 1200 H	160
BST-T25-IR/15	25	(340–460)	42	400	36	600 L 600 W 1200 H	195
BST-T45-IR/15	45	(340–460)	76	400	65	600 L 600 W 1200 H	210
BST-T60-IR/15	60	(340–460)	102	400	87	600 L 600 W 1500 H	265
BST-T90-IR/15	90	(340–460)	153	400	130	600 L 600 W 1500 H	290
BST-T110-IR/15	110	(340–460)	187	400	159	800 L 600 W 1600 H	460
BST-T150-IR/15	150	(340–460)	255	400	216	1000 L 600 W 1800 H	580
BST-T180-IR-15	180	(340–460)	306	400	260	1000 L 600 W 1800 H	600
BST-T220-IR/15	220	(340–460)	374	400	318	1400 L 1000 W 2150 H	900
BST-T250-IR/15	250	(340–460)	425	400	361	1400 L 1000 W 2150 H	940
BST-T270-IR/15	270	(340–460)	459	400	390	1400 L 1000 W 2150 H	970
BST-T300-IR/15	300	(340–460)	510	400	433	1400 L 1000 W 2150 H	1000

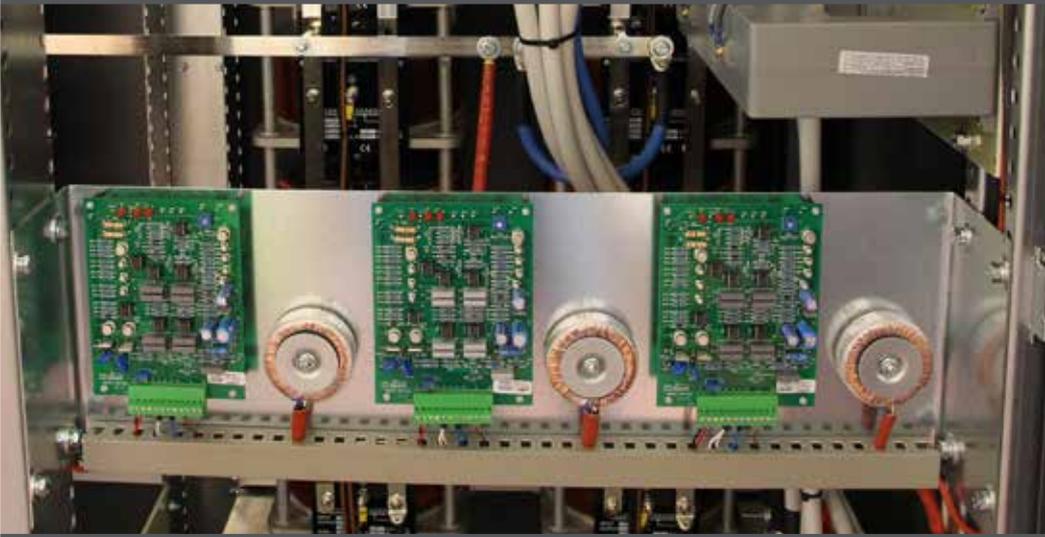
NOTE: The **dimensions** and the **weight** may be subject to change.

TABLES AND DIAGRAMS

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

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-T16-IR/20	12	(320 – 480)	21,6	400	17	600 L 600 W 1200 H	150
BST-T25-IR/20	20	(320 – 480)	36	400	29	600 L 600 W 1200 H	180
BST-T45-IR/20	35	(320 – 480)	63	400	51	600 L 600 W 1200 H	185
BST-T60-IR/20	50	(320 – 480)	90	400	72	600 L 600 W 1500 H	260
BST-T90-IR/20	70	(320 – 480)	126	400	101	600 L 600 W 1500 H	290
BST-T110-IR/20	85	(320 – 480)	154	400	122	800 L 600 W 1600 H	390
BST-T150-IR/20	120	(320 – 480)	217	400	173	1000 L 600 W 1800 H	578
BST-T180-IR/20	140	(320 – 480)	253	400	202	1000 L 600 W 1800 H	590
BST-T220-IR/20	170	(320 – 480)	307	400	245	1400 L 1000 W 2150 H	890
BST-T250-IR/20	200	(320 – 480)	369	400	289	1400 L 1000 W 2150 H	900
BST-T270-IR/20	220	(320 – 480)	397	400	318	1400 L 1000 W 2150 H	910
BST-T300-IR/20	250	(320 – 480)	452	400	361	1400 L 1000 W 2150 H	1000

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





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