M16FA655A - Mark V

User Manual

Automatic Voltage Regulator for Three-phase Synchronous Generators

(Issued: 09.2010)

SIN.NT.002.8

MarelliGenerators®

INTRODUCTION

This Technical Note provides general installation and operating information exclusively concerning the Marelli Motori regulator code specified in the document, mounted on the Marelli Motori synchronous generators specified in the next paragraph “APPLICATION”.
Before the generator start and any types of regulation operation, read carefully and completely this Technical Note.

IMPORTANT NOTE: It is not the intention of this document to cover all the installation or connection diagram variations, nor does this manual provide information for every possible contingency. The connection drawings provided with the generator, the generator user manual and all the technical information provided by Marelli Motori Technical Personnel can integrate this Note.

In particular, the connection drawings into this document are provided only for explanation purposes. They do not cover all the application cases and not substitute the connection drawings usually provided with the generator.

Should further information be required, please contact After Sales Department (see the reference at the end of the page).

SAFETY PRECAUTIONS

WARNING: when the regulation device is energized (generator running), a lethal voltage is present at the top panel (connection side) and at all the parts electrically connected to it. Furthermore, there are components into the card that can reach high working temperatures, with high danger for the user in case of direct contact.

Every wiring and/or mechanical installation operation on the regulator must be performed only in generator stop conditions, and only by skilled personnel. Furthermore, pay attention to wait a time interval sufficient for the device cooling-down.

Every regulation setting operation must be performed with generator running in no load conditions, by skilled personnel, using tools suitable to assure the user safety (i.e. isolated screwdriver, protection glasses and gloves).

Marelli Motori is under no liability for any damages which may occur to the AVR, the plant or the persons, or for lost earnings, or financial loss, or system stoppages, due to missed out Technical Note reading (both safety and installation/operating instructions).

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APPLICATION

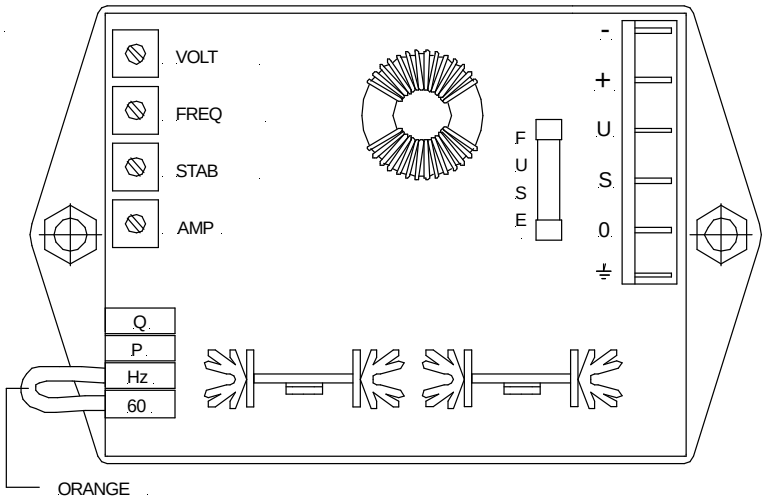
The voltage regulator type “MARK V”, is suitable for Synchronous Generators of MARELLI MOTORI make, MJB series, size range 160-250 frames. The regulator is fully insulated in order to maintain high reliability also with severe ambient conditions (high level of humidity, dust, salt atmosphere), and in case of high vibrations level. The regulator is proper both for single and 3-phase generators.

TECHNICAL SPECIFICATION

Power supply voltage (±10% of range tolerance, 50/60Hz)	170÷277 V
Voltage sensing (single-phase) (±10% of range tolerance, 50/60Hz)	170÷277 V
Maximum continuative field current	5 A
Maximum forcing field current (1 minute)	8 A
Maximum field voltage	100 V
Field resistance	8 Ω ÷ 20 Ω
Regulation accuracy (steady state conditions, rated, balanced and non deforming load, constant frequency)	±0.5 %
Thermal Drift (% voltage change for 50℃ change from T_{amb}, after 10 minutes)	±0.5 %
Response time	1 cycle
Operating temperature	-30℃ / +70℃
Weight	320 g

Functions

Protection	Under-frequency limiter
	Over-excitation limiter
	Internal fuse, replaceable
Control	With external potentiometer, 100 kΩ 1 W for ΔV = ±5 % of the rated voltage
	With external DC voltage signal (0-10 V)



TERMINALS

Connection terminals are performed through FAST-ON terminals. The terminals have to be connected according the applicable wiring diagram, in order to avoid any possible mistake in the wiring.

U **0**	*Power supply terminals*
S **0**	*Generator voltage sensing terminals*
+ **-**	*Output terminals (to the exciter field)*
⏚	*Terminal for connection to ground of internal EMI filter*
60 **Hz**	*60Hz mode selection terminals*
P **Q**	*Terminals for connection to external control device*

POTENTIOMETERS

- **VOLT** - potentiometer for adjusting the output voltage of the generator. Normally the internal potentiometer VOLT allows possibility of adjusting the voltage in a wide range; to obtain a finer possibility of voltage setting or to adjust the voltage from the control panel, or in order to limit the voltage range, an external potentiometer can connected to the terminal P and Q (resistance about 100 kΩ, 1 W, to obtain voltage regulation of ±5%).

VOLT ↻	Increases the voltage setpoint

- **FREQ** - potentiometer for changing the low speed protection corner frequency.
It is usually set at the factory in order to reduce the excitation when speed becomes lower than 90% of rated speed at 50 Hz (frequency lower than 45 Hz, or corner frequency). By removing the bridge which normally shorts the terminals Hz and 60, the speed protection acts properly for 60 Hz operation.

FREQ 	Increases the corner frequency

- **STAB** - stability potentiometer: clockwise rotation permits to increase the regulation stability (the response time becomes larger).

STAB 	Increases stability and response time

- **AMP** - potentiometer for changing the over excitation limiter; that limiter permits to protect the generator in case of over excitation due to load conditions that could cause the rotor damage.

Even if correctly set, this function does not substitute external systems protections, it is only a completing device.

AMP 	Increases the excitation current threshold

STABILITY SETTING

The voltage regulator is provided with internal adjustable stability circuits in order to allow stable operation in a wide range of applications.
The operation of the regulator can be set on field to adapt it to the characteristics of the plant and of the driving engine (diesel engine, water turbine, gas turbine) in order to obtain the best voltage response.

To change the stability characteristics of the regulator, it is necessary to act on the potentiometer STAB.

OVER-EXCITATION PROTECTION

in case of over-excitation due to load conditions that could cause the rotor damage.

The protection is delayed to avoid transitory conditions and operates by decreasing excitation and keeping it to a safety level.

To change the over-excitation threshold of the regulator, it is necessary to operate with the potentiometer AMP.

CONTROL BY MEANS OF EXTERNAL DEVICE

External potentiometer

An external potentiometer for fine setting of the voltage reference can be connected to the terminals P and Q.
This permits to:

- change the voltage set-point by means of remote control device;
- set the generator voltage reference with accuracy higher than the one of the internal regulator potentiometer VOLT.

External potentiometer specifications are the following:

Setting range	*Potentiometer specifications*
±5%	100 kΩ - 1 W minimum
±10%	200 kΩ - 1 W minimum

As soon as the external potentiometer is connected to P and Q, a change in the global voltage reference of the regulation system will occur; the internal trimmer VOLT must be set again to the rated generator voltage.
In detail: put the external potentiometer cursor in mid position, and after that, turn VOLT counterclockwise until to reach approximately the desired generator voltage.
It's now possible to operate the fine setting of the voltage by means of the external potentiometer.

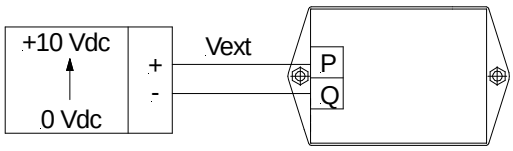
Special connections: external DC voltage signal

In particular cases, it is possible to connect to P and Q an external device capable to provide a DC voltage signal to the regulator for generator excitation control.

This signal must be within the range 0 to +10 V (with P positive terminal and Q negative terminal).

WARNING: the external device output connected to P and Q must be galvanically insulated.

<u>The setting procedure is the following:</u>
Generator in single operation, no load, must be run.
Set VOLT potentiometer in order to have approximately 50% of the rated generator voltage.
Connect the external device as per following figure



and provide a voltage V_{ext} = +5 V to P and Q terminals.
Set again VOLT in order to have approximately the rated generator voltage.

It is now possible to control the generator excitation by means of the voltage provided to P and Q; that control is approximately linear within the following range:

ΔV_{ext}	ΔV_{gen}
+3 V	-20%
-3 V	+20%

WARNING:
Always provide the voltage V_{ext} BEFORE every generator start.
Application of a negative voltage to P and Q is forbidden, in order to avoid dangerous over-excitation.

Should you have any doubts about the connection and/or use of P and Q terminals, please contact Marelli Service (see INTRODUCTION).

EMI SUPPRESSOR

The Voltage Regulator is provided with an internal Electromagnetic Interference filter: this interference suppression system permits to obtain compliance with relevant EMC standards on MARELLI MOTORI generators.

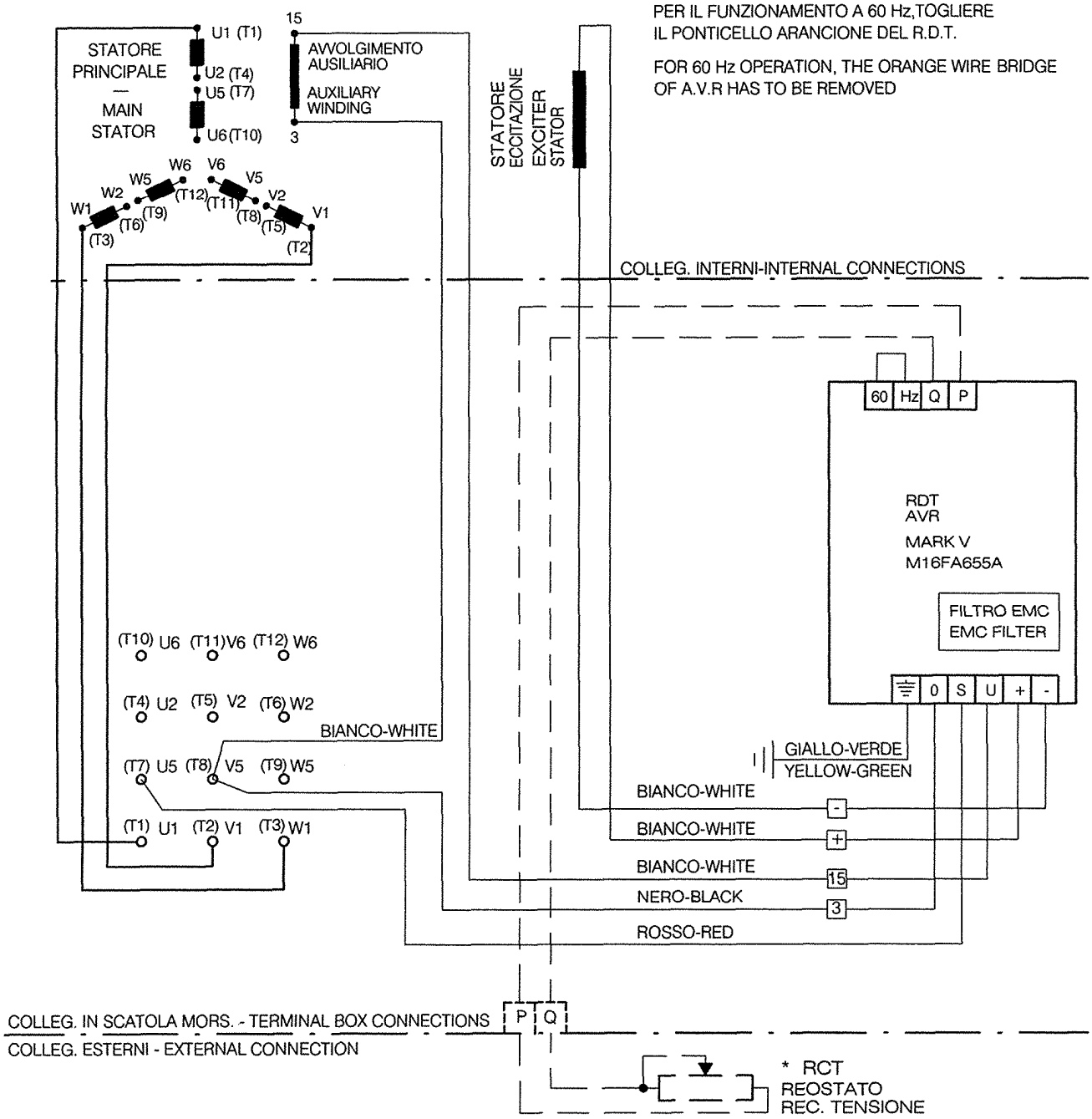
FUSE

The voltage regulator is provided with an internal protecting fuse (5 A, 500 V) (which acts in case of faults on the regulator or very large overloads on exciter circuit).

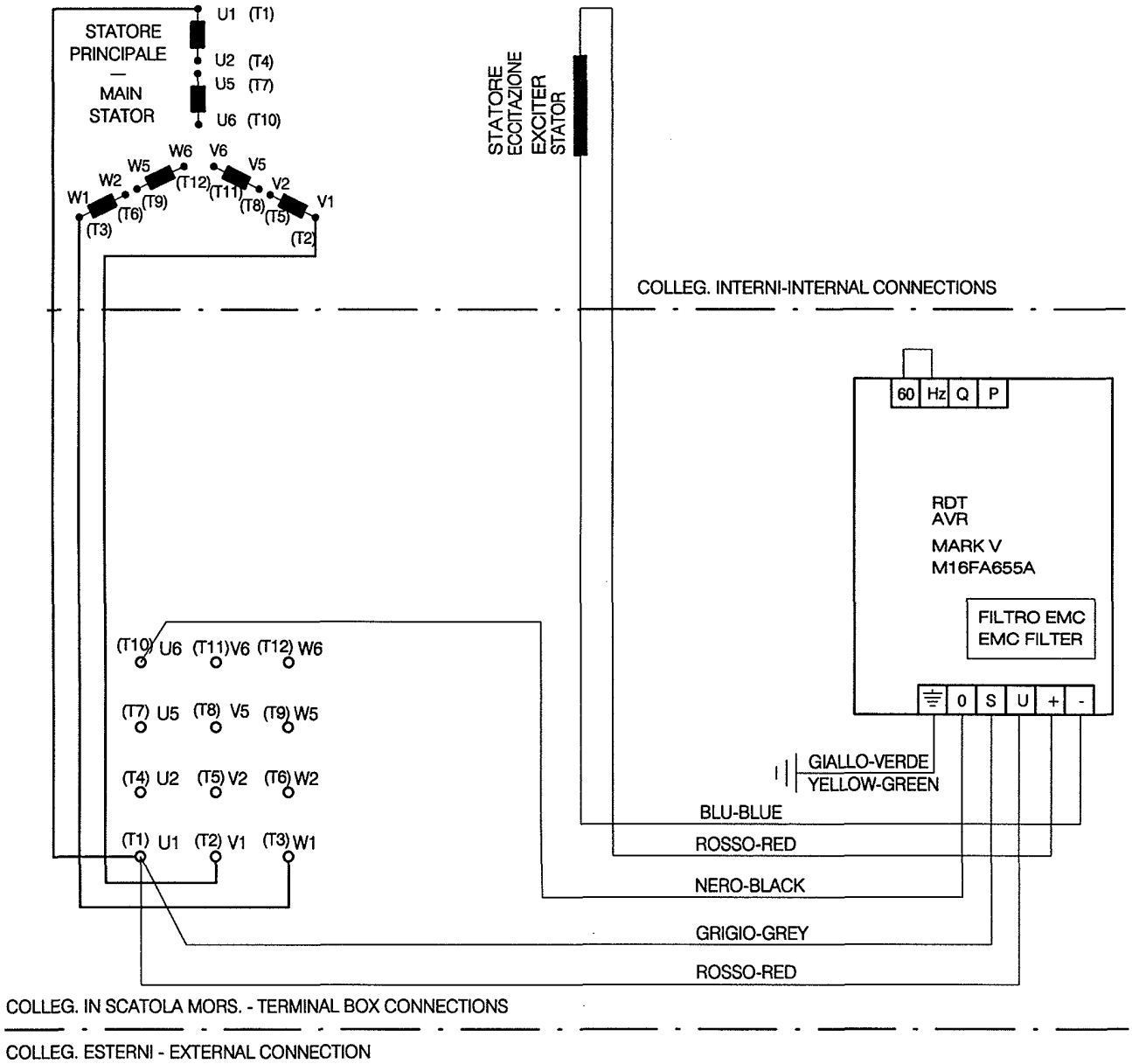
ACCESSORY

Description	Part number
Fuse Ultra rapid, ceramic, 5 A – 500 V	963823065
External potentiometer 100 kΩ - 1.5 W	963824430

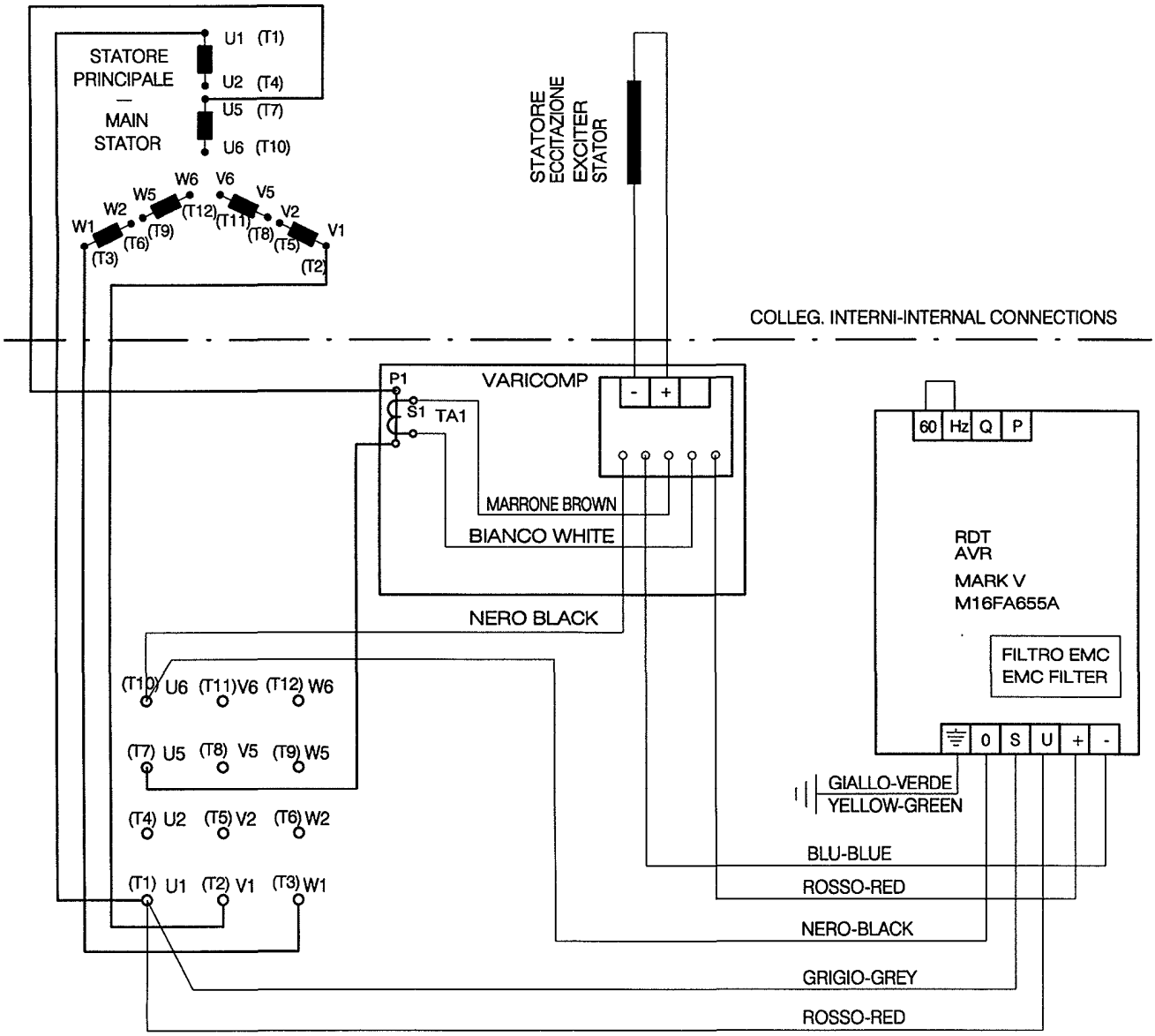
12 TERMINALS
SUPPLY BY AUXILIARY WINDING



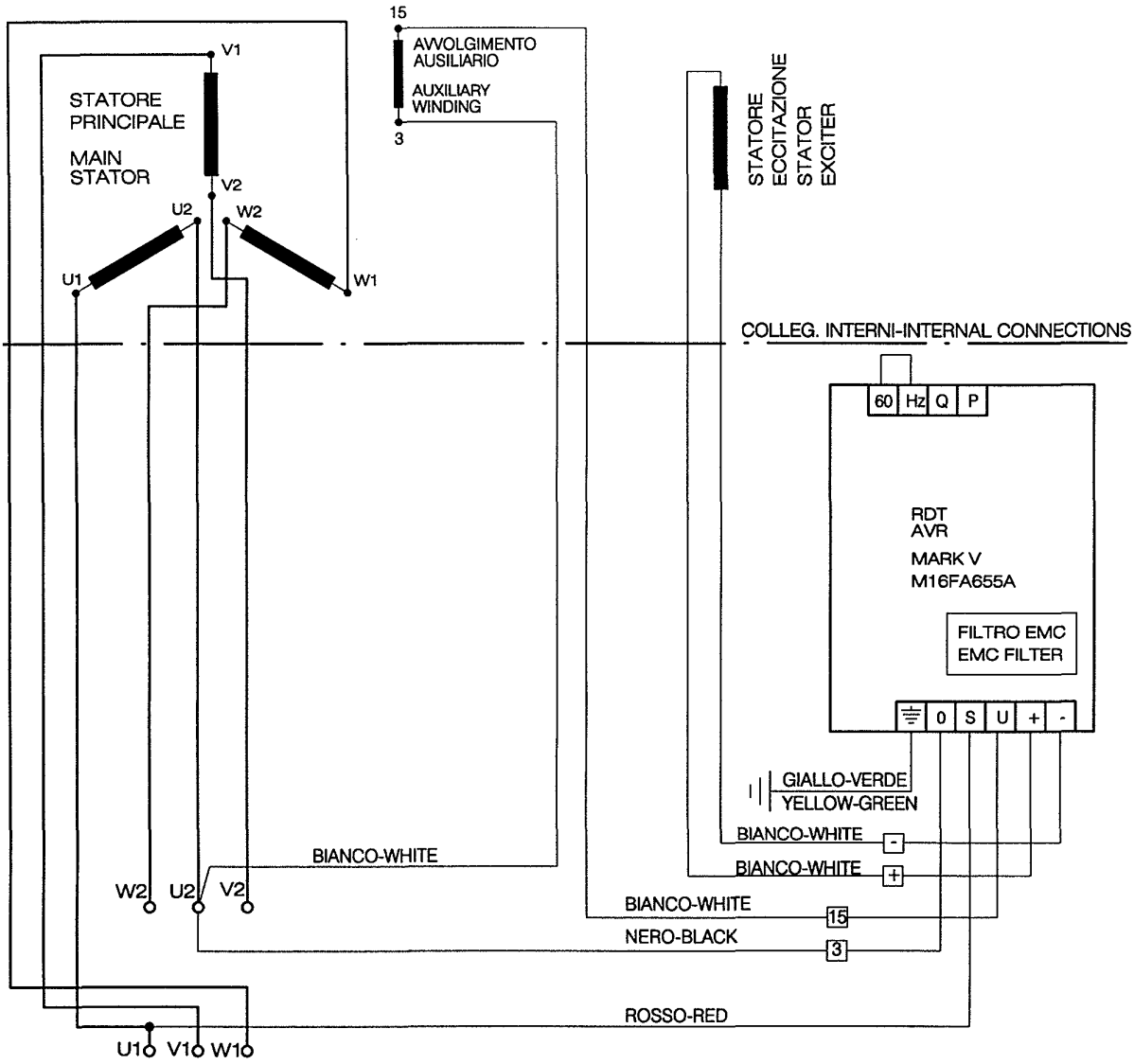
12 TERMINALS
SUPPLY BY THE MAINS TERMINALS



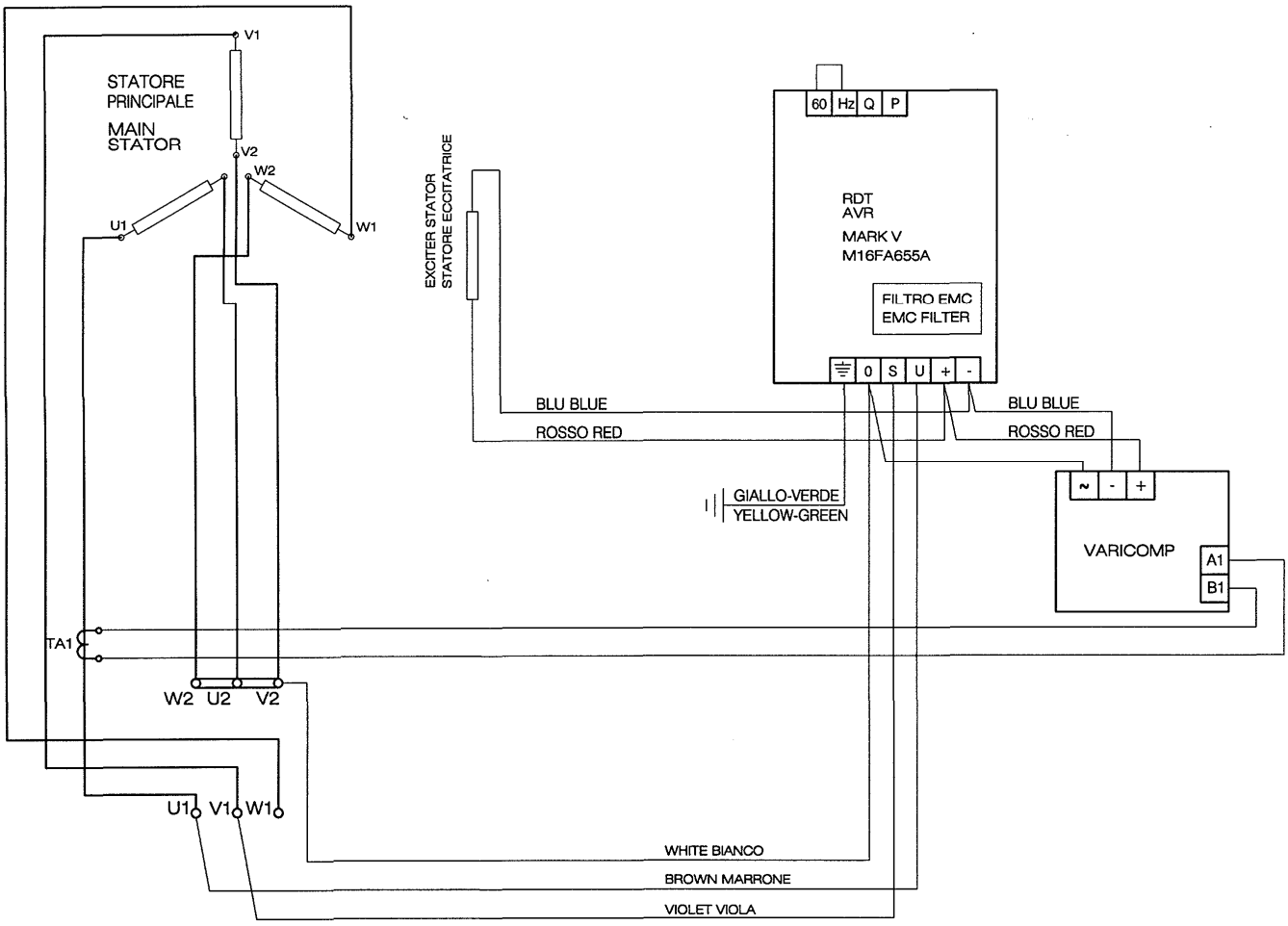
12 TERMINALS
SUPPLY BY MAINS – OVEREXCITATION DEVICE VARICOMP



6 TERMINALS
SUPPLY BY AUXILIARY WINDING



6 TERMINALS
SUPPLY BY MAINS – OVEREXCITATION DEVICE VARICOMP



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