

TVR-Line voltage regulator/voltage booster

---Three phase

---TVR series



Product brochure

2009/4

Zhejiang Farady Electric Co., Ltd.

ISO9001&ISO14001 certificated enterprise



Company Profile:

We Zhejiang Farady Electric Co.,Ltd establish at year 2006,is a professional manufacturer of line voltage regulators, focus on the comprehensive management of power quality and power equipment, production and marketing. Our company located in Wenzhou , an important base for the development of technology industry——Yueqing economic development Zone, nearby state road 104 with convenient transportation.。 After 8 years development . FARADY insist those concepts are Seiko production, innovation, fast rise. Our products Single & Three phase voltage regulator are leading technology in domestic market such as Xinjiang province, Shandong province, Neimenggu province and also export to Iran, Ecuador, Nicaragua...We are also leading manufacturer of line voltage regulator in China.

Farady have a good business relationship with US Intelligent device supplier SEL,ICMI, we can follow the newest technology of transformer design and intelligent device. We have established a long-term personnel training and technical cooperation, also get lots of national patents.



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1、 General:

Ideally the distribution lines should be able to keep the whole line of constant voltage, but in actual, the impedance of the distribution line will result in that the voltage of end and terminal is not same (Figure 1). The actual voltage from the rated voltage of the circuit size is an important measure of power quality, also is a important guarantee of power supply reliability and voltage quality.

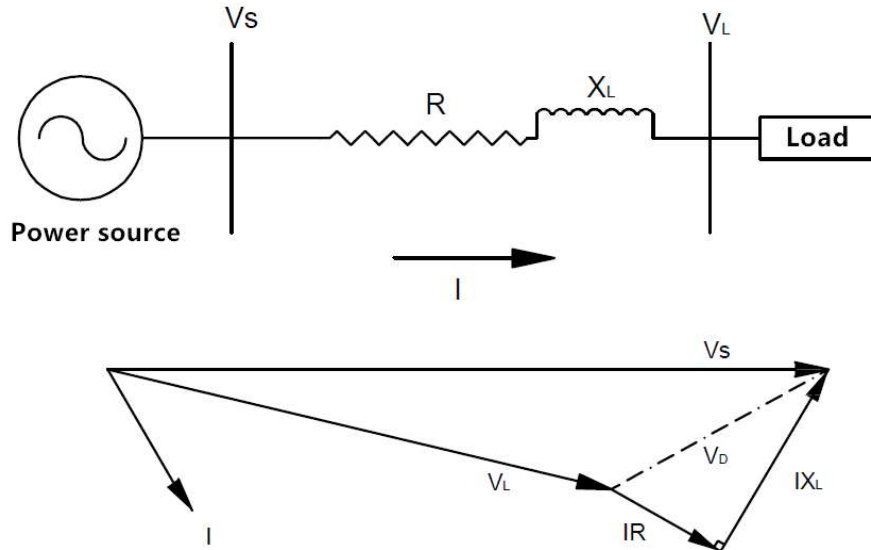


Figure 1

Since the line voltage can not be kept constant, when the actual voltage levels exceed the normal range of fluctuation of voltage allowed, it will seriously affect the normal use of the system and electrical equipment.

- **Electric power system:** Low voltage will affect the power supply equipment output, reducing supply reliability, but also affect their own economic power, voltage drops particularly severe, even voltage collapse may occur, the frequency of loss and blackouts and other incidents
- **Electric equipment:** Voltage quality have an impact on safe and economic operation of various types of equipment such as the asynchronous motor, for example, if the voltage decreases, the voltage will reduce torque so that the slip is increased, so that the stator and rotor current significantly increases, resulting in motor temperature liter rise, possibly even burning motor; on the contrary, when the voltage is too high, due to the excitation current and iron loss greatly increased, resulting in motor overheating, efficiency is reduced.。
- Low voltage will affect the use of incandescent lamps. Voltage 10% lower than the rated voltage, incandescent light flux is reduced by 30% higher voltage than the rated voltage of 10%, the lamp life is reduced by half. Low voltage will also affect the air conditioning running, cell phone charger, TV signal reception and other problems.
- **Power system losses:** In conveying power certain time, the square of system losses and operating voltage, if the voltage decreases, the current increases and the loss, the loss will become larger system

1.2 Line voltage fluctuation range

In order to ensure the level of actual voltage distribution lines within the permissible range of electrical equipment, line length is generally maintained at a reasonable distance (18KM, at least no more than 25KM), and the line load is not too large.

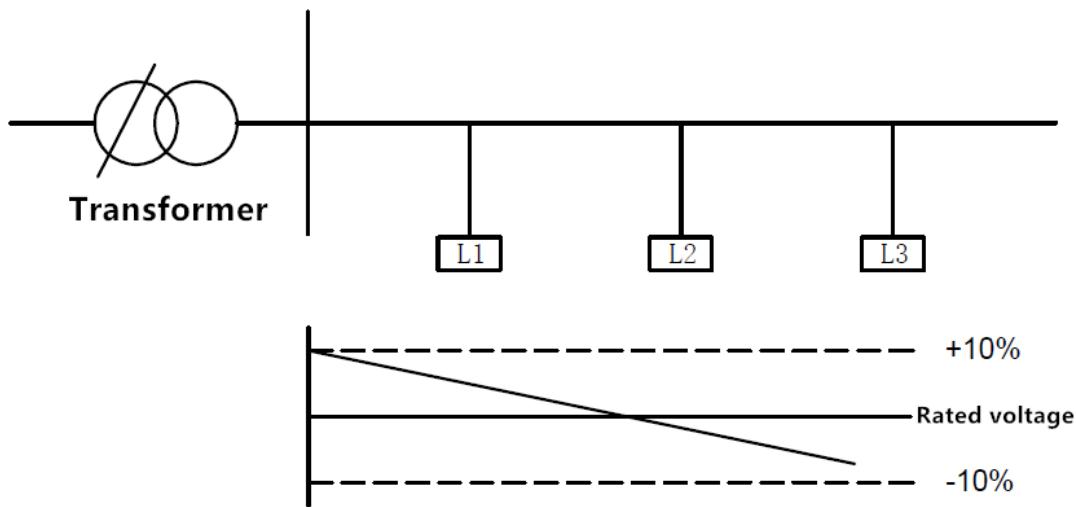


Figure 2: Ideally the distribution lines

The reality is that with the increase of electricity load, a lot of lines because of various conditions, transmission lines extending only response, which causes the voltage level of the terminal voltage exceeds the actual operating voltage range of electrical equipment, the situation is particularly common in rural electric system.

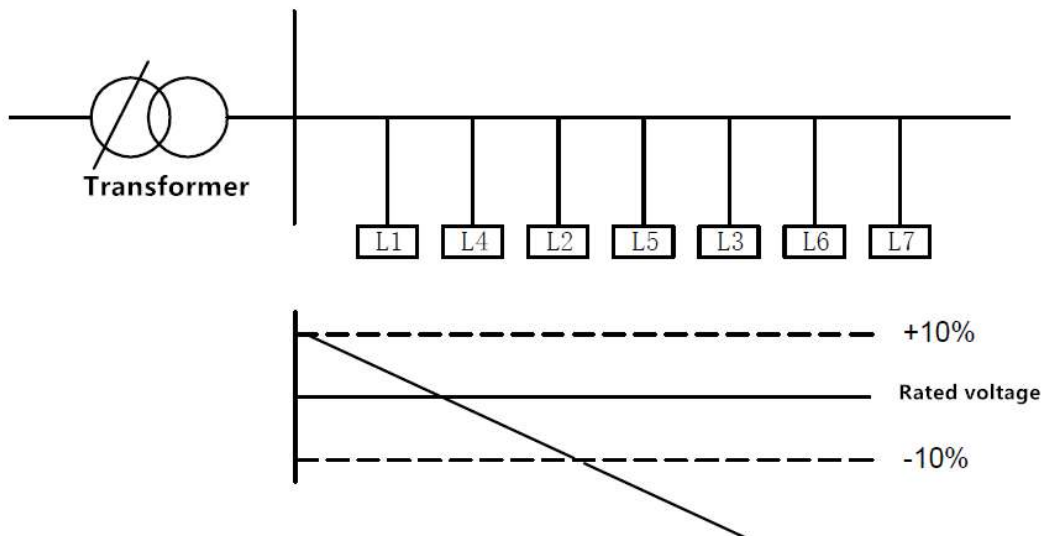


Figure 3: in fact

The way to improve voltage regulation:

- 1、 Build a small electric substation (shortcoming: large investment, long time)
- 2、 Change the transmission line (shortcoming: large investment, long time)
- 3、 Change the taps in transformer (shortcoming: small regulation range, only $\pm 5\%$ range, need to add a on load tap changer)
- 4、 Install compensation capacitor (shortcoming: small regulation range, only $\pm 2-3\%$ range)
- 5、 Install line voltage regulator (Advantage: Low cost, quick improvement)

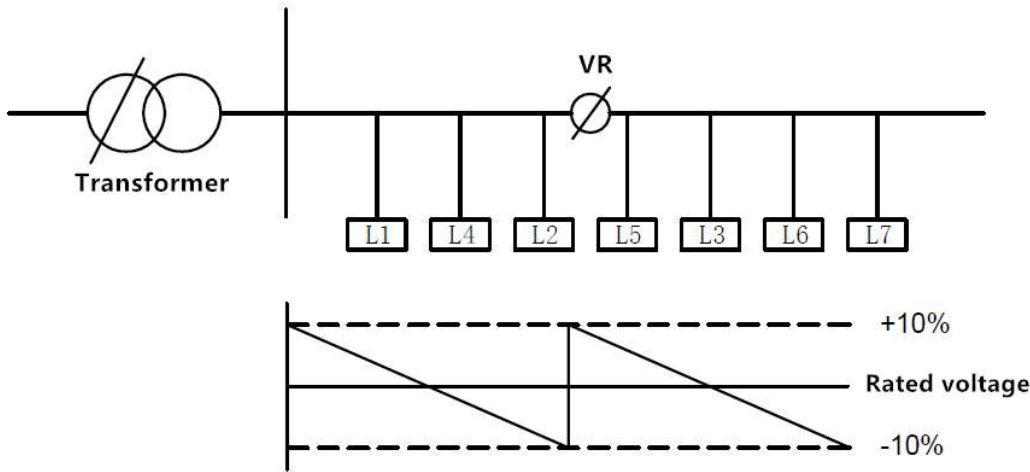


Figure 4: The installation of voltage regulator(2/3 of transmission line), will regulate the voltage to rated voltage , let the electric equipment at rated work condition

2、Applications:

2.1 Serious voltage line drop

Some transmission line have a serious voltage drop since the load is too large or the transmission distance is too long, the solution such as the construction of the substation, the cost is too expensive. In this situation, we can install a voltage regulator in the place that the voltage drop is too large than normal range, to ensure the electric equipment working ordinarily. See Figure 8

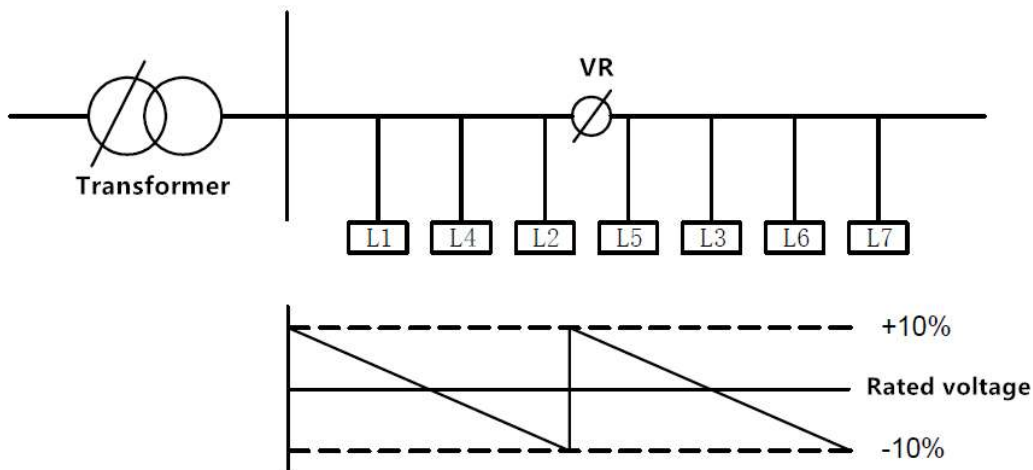
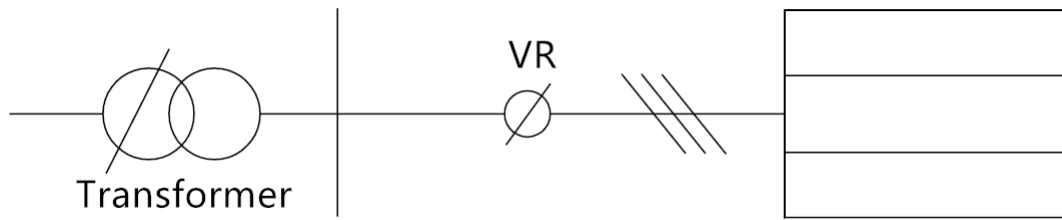


Figure 8

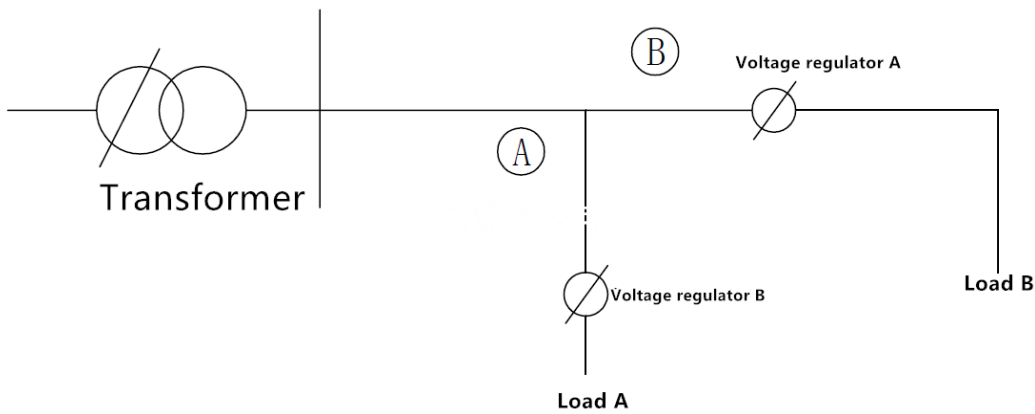
2.2 Transformer output side

The tap changer and coil of transformer use one same tank, the operation of tap changer will result in cracking of insulation oil, increase the amount of maintenance and induce a variety of potential problems. In this situation, if we install a voltage regulator replace of transformer, we can decrease the maintenance of transformer , reduce security risk.



2.3 At important electric transmission line branch:

If transmission branch A is too long also with too large load, but transmission branch B is short, in this situation , if use a transformer with tap changer, it can not meet all the regulation need in every branch, but if you use a voltage regulator, all problems will be solved.



3、 Work Principle:

TVR-line voltage regulator is a special design autotransformer with on-load tap changer, it can automatically "monitoring" and smoothly adjusts the output voltage, and also guarantee the output voltage within the voltage requirement. 27 taps regulation can meet every step 0.75% regulation accuracy. See blow figure 5

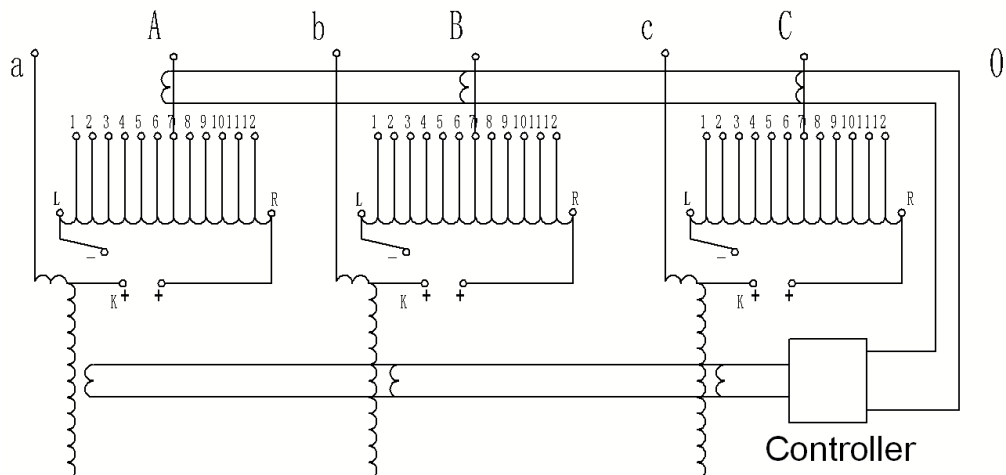


Figure 5: work principle

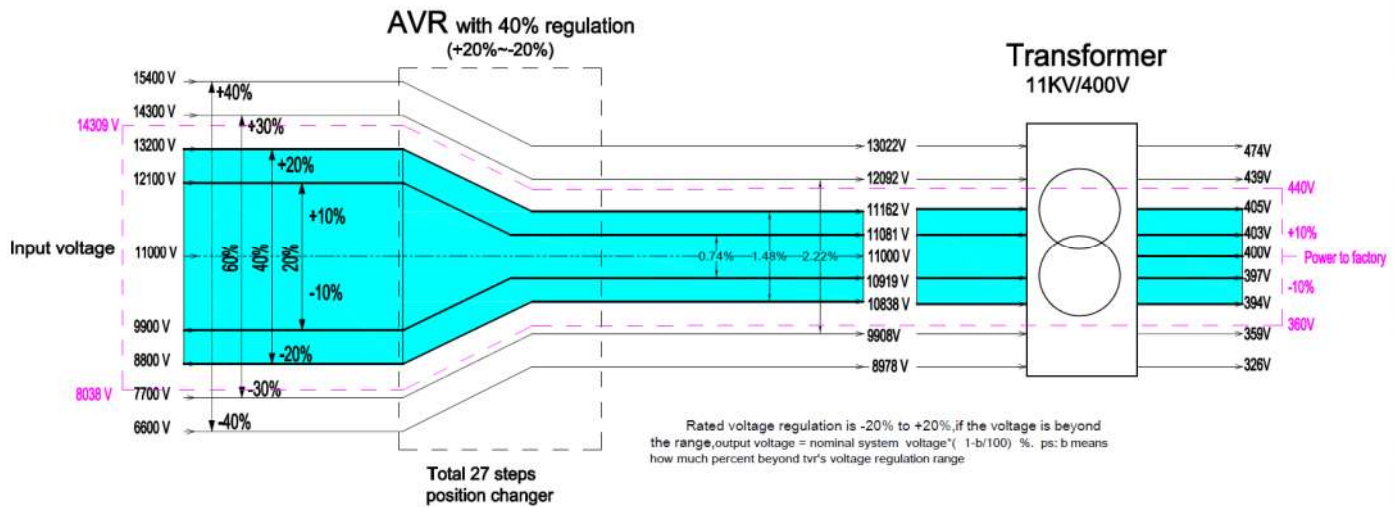


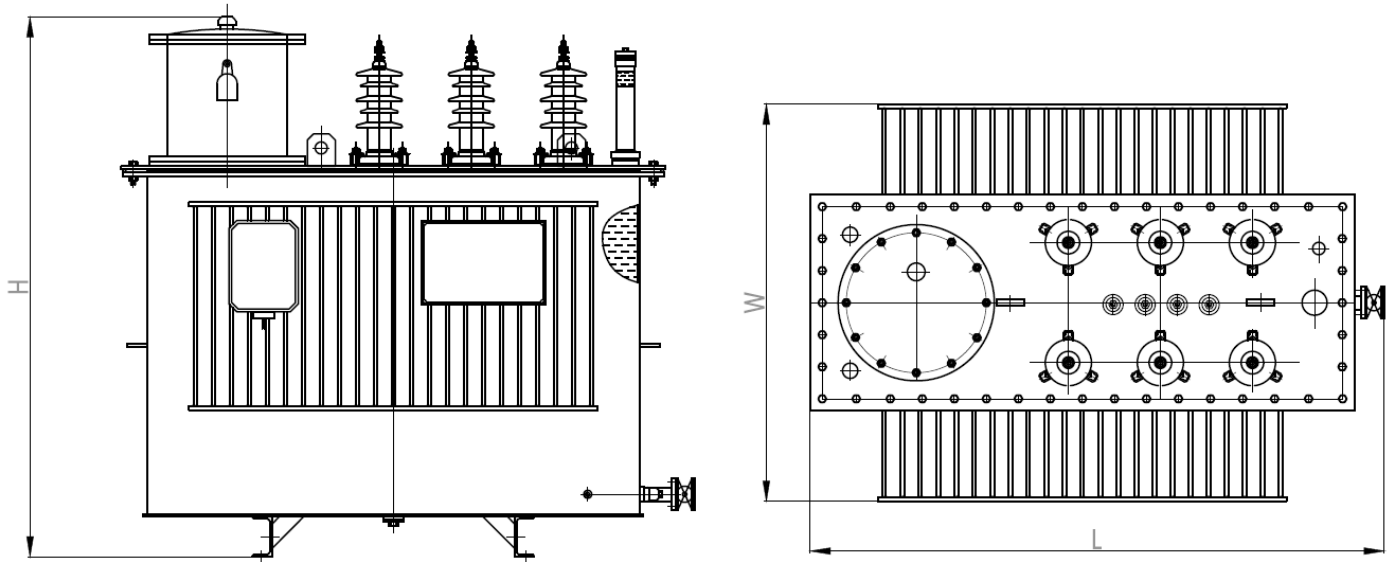
Figure 6. AVR Utility sample

In Figure 6, is an utility sample for a factory which require 400V electric power, but the power line is not stably in the summer because the load is 120% of rated capacity, so the power to the factory is lower than 360V, all the electric equipments in the factory can not use. After install Farady auto voltage regulator, it can adjust the power line voltage from 8038V to 11000V and keep it stable with 2% accuracy , so the power to factory can be keep at 400V(± 8V accuracy).

4、Work condition

- (1) Below 3000 meter; (special altitude can be customized)
- (2) Work temperature: -25℃-65℃(special temperature can be customized)
- (3) Monthly humidity less than (25℃) 90% in 25℃
- (4) Pollution class: III class
- (5) Rating voltage : 11/22/33kV or customized
- (6) Rating capacity: 500kVA~6300kVA
- (7) Frequency: 50/60Hz
- (8) Vector group: 3phase 3 wire single winding star/delta
- (9) tap change selector: 9/11/13/17/27/32 position
- (10) Cooling method: ONAN
- (11) PT: 10000/100V 50VA;
- (12) CT: XXX/1A, 2 meter method;
- (13) third winding rating voltage: 220V;
- (14) regulator range: (-10%~+10%), (-5%~+15%), (0~+20%) (0~+30%) or customized

5、 Technical specification



○ Weights and dimensions are for reference only, and not for construction purposes. For exact dimensions, please contact Farady Electric co.,Ltd

Technical Chart (50Hz/60Hz)

Line voltage kV	Power line capacity kVA	Dimensions			Total weight kGs
		Length (mm)	Width (mm)	Height (mm)	
10~15kV (0%~±20% Regulation range)	1000	1760	960	1350	810
	2000	2050	1150	1350	1340
	3000	2200	1200	1400	1830
	4000	2350	1400	1450	2250
	5000	2455	1450	1490	2555
	6300	2485	1500	1490	3150
20~24kV (0%~±20% Regulation range)	1000	1910	1152	1450	920
	2000	2200	1380	1500	1550
	3000	2350	1440	1550	2150
	4000	2500	1500	1600	2600
	5000	2605	1500	1640	2950
	6300	2635	1550	1640	3465
30~35kV (0%~±20% Regulation range)	1000	2060	1302	1070	1070
	2000	2350	1530	1770	1770
	3000	2500	1590	2415	2415
	4000	2650	1650	2970	2970
	5000	2755	1650	3375	3375
	6300	2785	1700	4160	4160

○ Special design for custom please contact FARADY technical department.

6、 Voltage regulator structure



6.1 、 On load tap changer



Vacuum type on load tap changer

Regulator Vacuum type On load tap changer is of selector switch structure, which combines the functions of diverter and selector. The tap changer is mounted to the transformer tank cover by its head. When the tap changer is used without a change-over selector, the maximum operating positions available is 12, and it is up to 23 positions if with a change-over selector.

- Maintenance-free up to 100,000 tap-change operations with no time component.
- Exchange of the diverter switch insert after 1.2 million tap-change operations
- Intended for selected alternative insulating fluids
- Intended for operation in earthquake-prone areas
- Max current up to 600A
- Max voltage up to 145kV
- Max positions up to 23



Oil immersed type on load tap changer

Oil immersed type Changer is a typical combined-structure tap changer applicable in oil-immersed transformer, comprising of two major parts: diverter switch and tap selector. The OLTC is put in transformer oil tank and its diverter switch has a separate oil compartment from transformer tank, while tap selector, together with transformer windings, is completely laid inside the tank. OLTC's installation is divided into two types - standard tank flange and bell-type flange.

- Electrical life arrives 50000 times.
- Mechanical life arrives 500000 times.
- Max current up to 400A
- Max voltage up to 35kV
- Max positions up to 23
- The contact resistance between joins not bigger than 500 $\mu\Omega$.
- Cheaper than Vacuum type tap changer

7、 Intelligent controller



7.1 High accuracy: 27 taps regulation in rated range

7.2 Long work life: Unique tap changer designed to avoid arcing ,the regulator can ensure the operating life of nearly a million times.

7.3 Maintenance-free: All sealing design, high IP protection degree, whole life maintenance-free

7.4 Flexible: Flexible mounting within the lines and substations, exit the operation and the opening and closing function when necessary.

7.5 Good function: Through RS232 adapter of controller, SCADA distribution automation

7.6 Low loss: Design to maximize the reduction of iron loss , reduce load loss.

7.7 Economic: Economically effective voltage regulation circuit, a significant reduction in line losses and extended equipment life.

8、 FK function features

8.1 Friendly user interface, can easily modify the settings and browse online data

8.2 Easy to set the voltage ,bandwidth, delay and offset voltage

8.3 Measurement of various data: load voltage, load current, apparent power, reactive power, power factor and so on.

8.4 Can be realized according to power flow direction, forward and reverse automatic voltage regulator (for ring network



power supply), the completion of all the feature

8.5 Provide user RS232,RS485 data interface , can be long range remote control, telemetry, automation of distribution network

8.6 With a variety of communication protocols, it can be directly and master communication, no need to add RTU (FTU) devices.

9、Project



Ethiopia



Vietnam



Cote D'voire



Iran

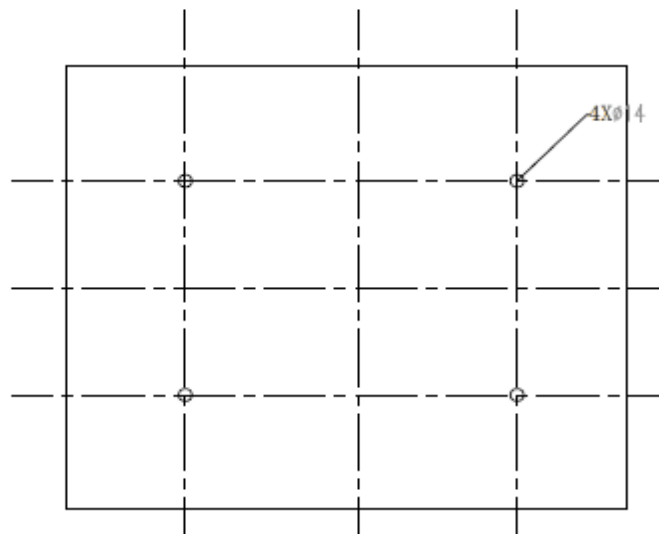
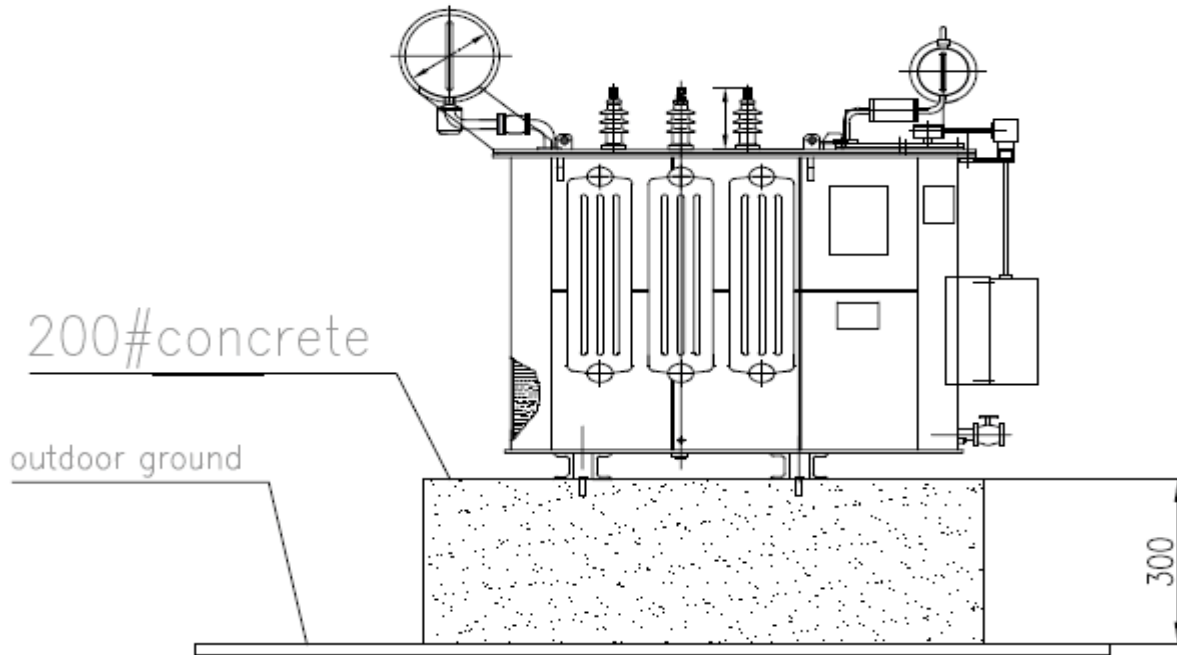


Albania



China

10、 Install sketch





11、FAQ:

Q: Dose voltage regulator need human intervention?

A: The controller of voltage regulator have two modes : auto & Manual. The default setting is auto when clients get it, so no need for the human intervention.。

Q: When the line drop is too serious, can the voltage regulator regulate the voltage line to normal level?

A: Just within the scope of product design range , it is ok. You need to request your voltage range when order our products, the maximum is 30%

Q: Where is the installation place of voltage regulator?

A: It is generally 2/3 of the load line to be installed ,also can be installed on the user own transformer primary。

Q: Does voltage regulator will increase the line losses?

A: It depends on the line load.

Q: How is the voltage regulator application of foreign market?

A: The line voltage regulator is used in USA, CANADA, JAPAN for long history. Our company's single phase voltage regulator with WYE or DELTA connection group are design to export foreign market.

Q: FARADY single phase voltage regulator have 32 taps position with high regulation accuracy, can we order that?

A: Such as 10KV, if we use 32 taps tap changer , every tap will only have 60 volts. This equipment is not suable for domestic market because if it use in rural power line ,it will operate every seconds. We comment you to use three phase voltage regulator if client have not a high requirement of regulation accuracy.

Q: Does the voltage regulator can be apply to two power line?

A: Yes. FARADY voltage regulator can automatically identify the power of direction and automatically determine which side to use the regulator voltage transformer as the adjustment object, timely adjustment of lifting gear action.

Q: What if the power line is off when VR tap position on a raise position, after the power is on, will it cause a too high voltage?

A: Our company can according to customer requirements production line automatic voltage regulator with a small uninterruptible power supply in the power lines can be automatically transferred back to the regulator gear straight profile, in order to avoid the problem of ultra-high voltage power is restored.

Q: Dose the voltage regulator need maintain in use?

A: Use oil interrupter load tap-line automatic voltage regulator requires regular maintenance, according to on-load tap-specification indicated number of operations to replace the transformer load tap-tap within the oil while handling contacts. Maintenance cycle is determined by the frequency of operation of the regulator, the general oil-load tap-interrupter requires action 3000-5000 times maintenance.

Vacuum-load tap-line automatic voltage regulator does not require regular maintenance, such vacuum-load tap-action more than 100,000 times have maintenance-free features, no maintenance during this operation cycle

Q: Can your VR meet our requirement that maintenance without power or not in use when we do not need that?

A: Yes, our product can be equipped with bypass switch , can be cut off that no need to cut whole power line



Ordering Information: Depending on the application to provide installation position line surge voltage fluctuation range, the line current, and please provide the length of the entire line, and determine the reason of voltage fluctuations.

Other special requirement, such as single or three phase ,oil tap changer or vacuum tap changer, or any other requirement.

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