



## **On-Site OLTC Retrofit Solutions**

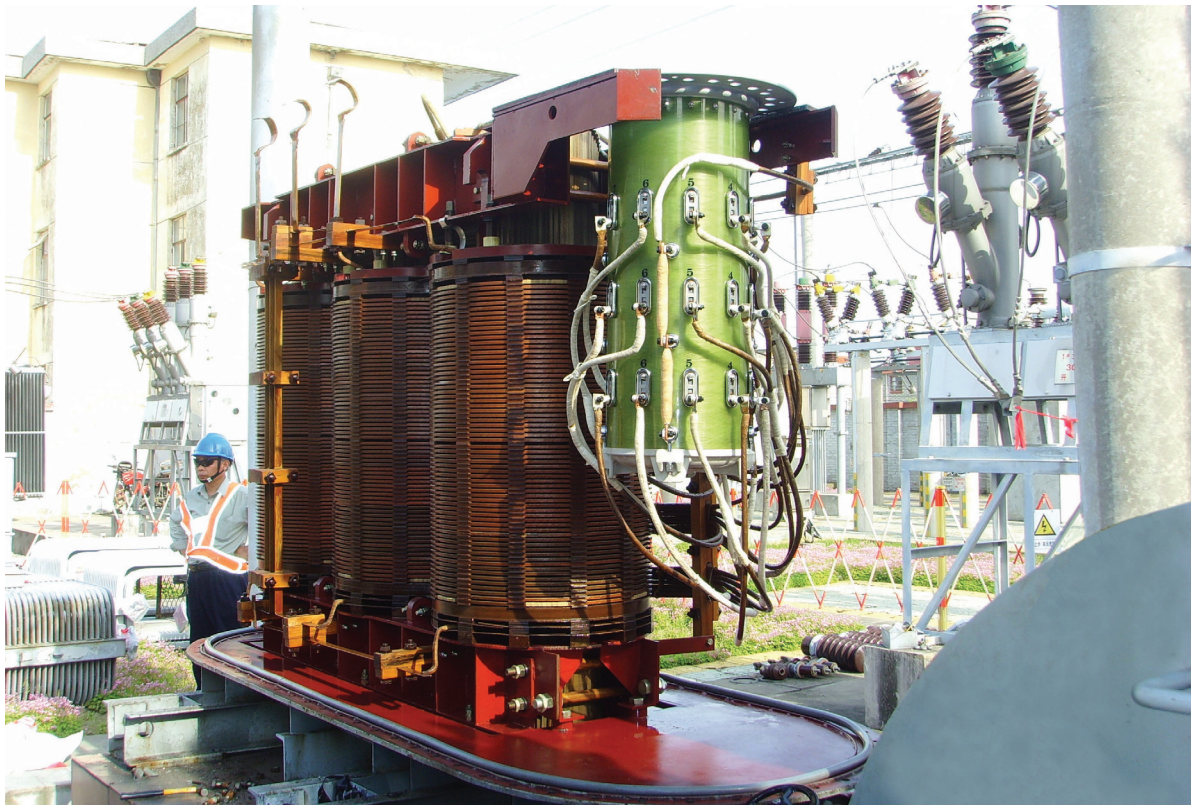
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**Shanghai Huaming Power Equipment Co.Ltd.**



# Summary

*As on-load tap changers are widely used in power transmission & distribution these days, it plays an important role on energy saving and electricity quality improvement. However, users are facing a tricky choice on existing transformers that cannot regulate voltage on-load: whether to replace the whole transformer or maintain the current situation. Some of these transformers originally installed OCTC. And some although installed OLTCs at first, these tap changers failed to operate due to poor quality, bad maintenance or lack of after sales service. The malfunctions of these OLTCs include serious oil leakage, motor drive unit dysfunction or missing signal output; some may even cause severe failures on transformers.*





# Our solutions

**W**e offer the optimal solution to balance the performance and investment. Based on tap changer manufacture experience over two decades, Huaming offers several OLTC retrofit solutions for users. Since Huaming launched CV type OLTC in the early 1990s, it is widely used in the retrofit of 66kv and 110kv transformers with star bridge connection in the middle of winding in China. For the overseas market, vacuum retrofit of OLTC and smart network retrofit make great contribution to business. All these OLTC retrofits by Huaming greatly enhance tap changers operation performance.

There are five main OLTC retrofit solutions:

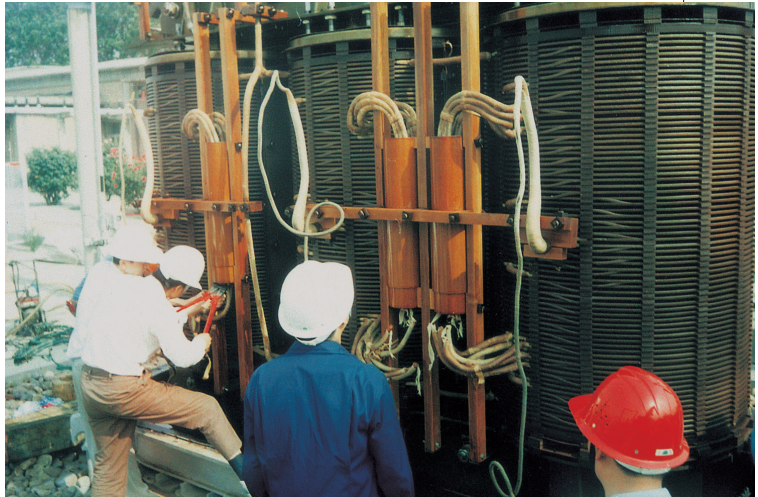
- 1, Retrofit off-circuit tap changer to on-load tap changer
- 2, Retrofit old OLTC to new OLTC
3. Vacuum retrofit of OLTC
- 4, Retrofit motor drive unit of OLTC
- 5 Installation of online oil filter in retrofit project





# Solution I-Retrofit OCTC to OLTC

*T*here are several plans for retrofitting OCTC to OLTC. If it does not require extending the regulation range, the on-site retrofit saves both time and money. It includes adding an oil tank for tap changer at one side of transformer's oil tank, dismantling leads from OCTC's tap terminal and connecting it with the OLTC's tap selector. Connection conductors is fixed on the support; insulation distance between lead and tank wall and between different phase's lead should be secured.



Before the retrofit



Leads connection during the retrofit of OCTC to OLTC

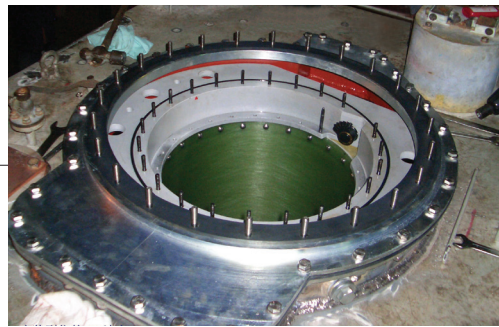
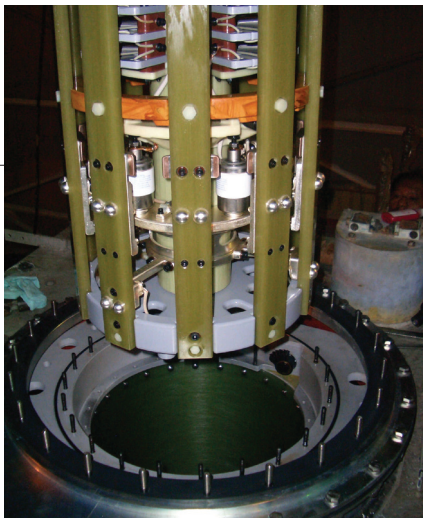
# Solution II-Retrofit old OLTC to new OLTC

**C**hoose the new type OLTC according to the mode, regulation method, voltage level and rated operating current of the old OLTC on the transformer. If the new OLTC's mounting flange is different from the old ones, we should remove the old OLTC's mounting flange and weld the connection flange of the new one on the transformer. Besides this, the supports for oil tank, intermediary transmission bevel gearbox shall also be newly welded in consideration of oil tank's location and driving shaft's horizontal direction and vertical angle. If there is some difference on tap selector's terminal location between the old OLTC and the new one, we will extend the lead to the new tap selector's terminal by cold pressing. All these works shall be completed within eight to ten hours to avoid tap changer's longtime exposure to air.

*Project reference*

*Old OLTC type: HIII-D400/126-10193W + MA9*

*New OLTC type: CV2III-500D/126-10193W + CMA7*





## Preparations before retrofit:

*Equipments and tools (prepared by the end user)*

- 1. Two sets of motor crane and four sleepers*
- 2. Two sets of electrical welders above 400A, four bags of Ø5 electrode and two electric welder's helmets*
- 3. Two oxygen containers, one ethane container and two burning torch of large size*
- 4. One hand grinder*
- 5. Drop hammer, level, tape measure, ruler, fine steel wire, carpenter pencil, 2' nail, double planning wood, ect.*
- 6. One electrical terminal of 220 to 380 voltage*
- 7. Oil filter and transformer oil*
- 8. Scaffold and ladder used in the project*
- 9. Hydraulic crimping pliers*
- 10. Drying process of the tap changer and insulation material*
- 11. Cable's layout and drilling installation holes on indicator*
- 12. Oil tank*

## Material and machined parts used in the retrofit:

- 1. One set of tap changer, including: Motor drive unit, indicator, cable for remote controller (users specify its length) and other accessories.*
- 2. Oil tank and auxiliary oil tank for tap changer*
- 3. Crepe paper, white tape and paper-covered copper stranded wire (whose sectional area is determined by the operating current)*
- 4. Connection pipes and terminals used in cold press*
- 5. 5mm steel plate*





## Solution III-Vacuum retrofit of specific type OLTC

In recent years, a lot of end users wish to make partial retrofit on the OLTCs in service so as to change the oil-immersed tap changer to vacuum tap changer. To meet customer's requirement, Huaming developed the CM2 vacuum type insert after more than ten million electrical switching tests within five years. CM2 has the same size and structure of CM. So you can just replace the old CM insert with a new CM2 insert to realize the vacuum retrofit on CM type OLTC. It is convenient and economic for end user. The vacuum interrupter used in CM2 is provided by US company EATON. After thousands of electrical switching tests, it proves the electrical life of CM2's diverter switch can reach 600,000 times.



Comparison between CM2 and CM

### Preparations before retrofit:

1. Cut the transformer off network and check safety precaution
2. Do pretests on transformer
3. Adjust the tap changer to the set position, take the shaft down, drain oil, remove the head cover and lift out the insert; clean the oil compartment, oil tank, protective relay and pipe; check the new CM2 insert
4. Install the CM2 insert, fill new transformer oil, put on the head cover and add more oil.
5. Connect the tap changer and MDU and adjust the equipment
6. Test and inspect
7. Clean the operation site

### Customer's preparations before retrofit

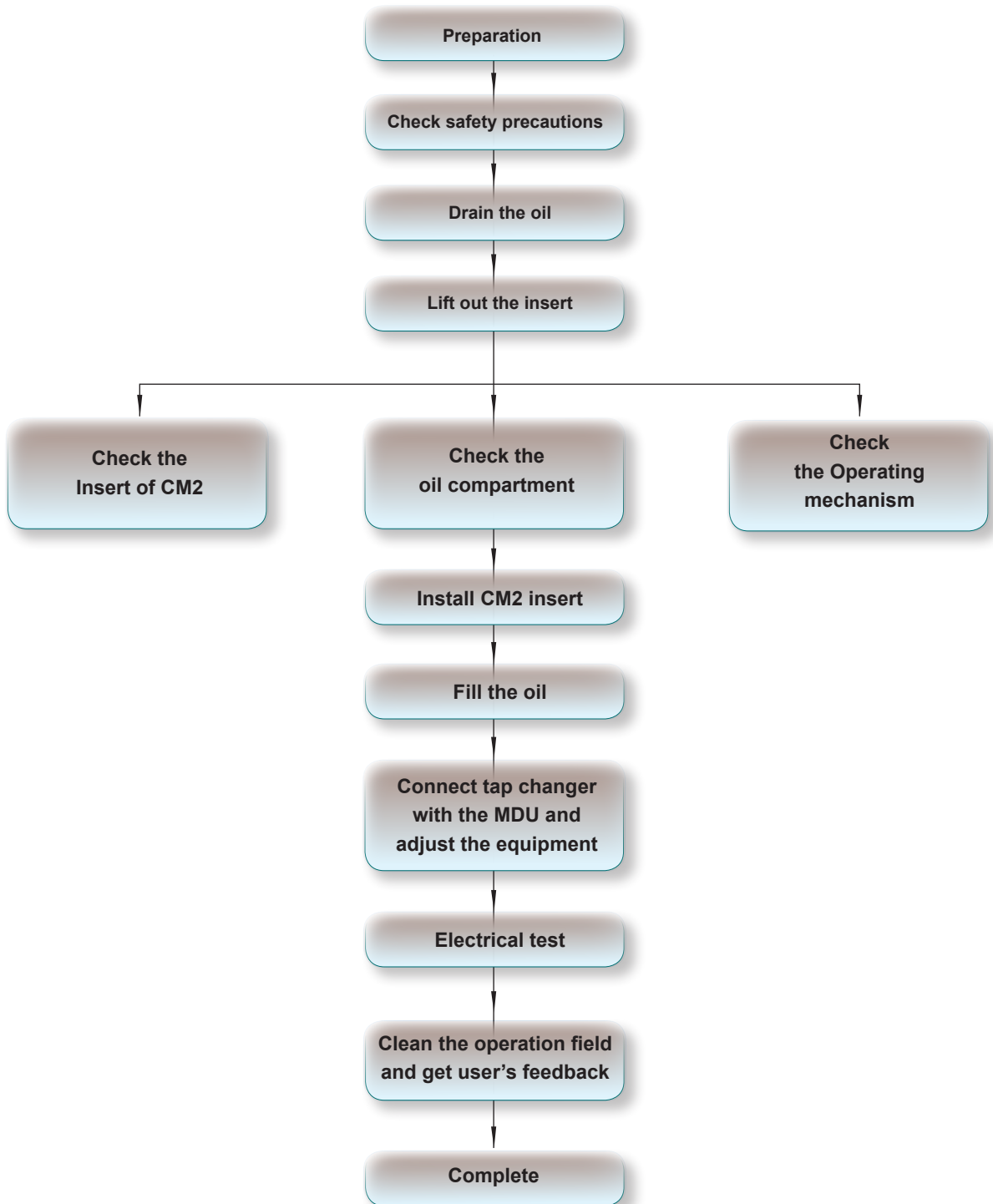
1. Lifting crane used in CM2 insert replacement
2. One set of vacuum oil filter and some transformer oil
3. Safety precaution and tests before replacing CM2 insert

### Huaming's preparations before retrofit

1. All the tools and raw materials needed for replacing CM2 insert should be delivered at arranged time.
2. Engineers from Huaming will be responsible for lifting out the insert and installing the new CM2 insert.



# Procedure





## Solution IV - Retrofit motor drive unit of OLTC

Motor drive unit is used for driving tap changer to realize tap change operation. There are various types of MDU for different types of tap changers. After long time operation, many old motor drive units will have problems which may jeopardize the stability of network. So we should carry out proper retrofits on old MDUs.

### Preparations before retrofit:

1. *Inspect the equipment's condition*
2. *Inspect the environment*
3. *Check the safety distance (when the transformer is operating)*
4. *Check the equipment operation record(when the transformer is operating)*
5. *Check the equipment indicator(when the transformer is operating)*
6. *Make the retrofit*
7. *Do the field test after retrofit*
8. *Regenerate the equipment*
9. *Duty transmission*
10. *Clean the field*

### Note:

1. *Keep safe distance from on-load equipment*
2. *Mind safety while working at high place*
3. *Mind fire and electricity*
4. *Mind tool displacement*
5. *Mind uniform and protection*



MDU retrofit by Huaming in Cuba in 2006. Since then it has been working properly.



## Solutions V Installation of online oil filter in retrofit project

*T*ype ZXJY series online oil filter plant for on-load tap changer is designed by Huaming's R&D team with patented technology. This device is mainly used for circulating and filtering of on-load tap changer insulating oil. It can remove free carbon and metal particles, as well as reduce water content in the tap changer oil during normal operation of transformer system ensuring the breakdown voltage and service life of the oil, improving the safety and reliability of on-load tap changer, which consequently extends the maintenance intervals.

*Special note: During on-site installation of oil filter plant, make sure that the transformer is de-energized. Otherwise, it is considered to violate the operation safety regulation and will not be able to completely release the gas inside the pipes which will jeopardize the normal safe operation.*



On-line oil filter



# Retrofit Projects accomplished by Huaming

OLTC after retrofit	Transformer	Users
CV III -200Y/63-1007	20000/63	Jilin Changchun power bureau
CV III -200Y/63-1008	20000/110	Anhui Tongling power bureau
CV III -350 Δ /63-1007	31500/110	Niingxia Tongchuan power bureau
CV III -350Y/63-1007	31500/110	Wuhu power bureau
CV III -350Y/60-10193W	20000/110	Inner mongolia Simeng power bureau
CV III -500Y/60-1007	50000/110	Hebei Handan power bureau
CV III -500Y/60-10193W	31500/110	Jiangsu Yizheng power bureau
CV III -500Y/60-10193W	31500/110	Jiangsu Gaoyou power bureau
CV III -500 Δ /35-1007	20000/35	Beijing power bureau
CV III -350Y/63-1007	31500/110	Anhui Liuan power bureau
CV III -350Y/110-1405	16000/110	Hubei Yichang power bureau
CV III -350Y/110-1405	31500/110	Shannxi regional electric power group co. ltd.
CV III -350Y/110-1405	25000/110	Jiangxi Ganzhou power bureau
CV III -350Y/110-1405	31500/110	Hebei Handan power bureau
CV III -350 Δ /110-1007	20000/110	Shannxi Baoji power bureau
CV III -350Y/60-1007	31500/110	Sichuan Dezhou Power bureau
CV III -350 Δ /35-14271W	8400/10	Shannxi Hanzhong bayisan company
CV III -350 Δ /35-14271W	4000/10	Shanxi electrical equipment co. ltd.
CM III 500Y/60B-10193W	31500/110	Shanxi Hanzhong power bureau
CM III 500Y/35B-1007	12500/35	Zhaoyuan power Bureau
CM III 600Y/63C-18351G	13000/35	Lin Zhou Hongxin Factory
SHZVIII-600Y/72.5B-10193W	63000/110	Shanxi Hanzhong power bureau
CM III 500Y/40.5B-10070	10000/35	Beijing power company
CM III 500Y/40.5B-10070	20000/35	Beijing power Company
SHZV III -400Y/72.5B-10193W	20000/110	Coking Coal Group
WSLV-600D/110-3*2(B)	180000/110	Qingtongxia Aluminum Company
SYJZZ-35/200-7	4000/35	Qinhuangdao Power Company
SYJZZ-35/200-5	6300/35	Jinan Jibian power equipment company
WSL II -600Y/63-6*5(A)	31500/110	Shanxi Hanzhong transformer company
WSL II -800Y/63-6*5(B)	40000/38.5	Shandong Luneng Taishan Power Equipment Co., Ltd.
SYJZZ-35/200-7	8000/35	Yunnan Tongbian Electric Co., Ltd.
CV III -350Y/110-1405	40000/110	Henan Rongyang power bureau
CV III -350Y/110-1405	50000/110	Jinan Zhiyou group
CV III -200 Δ /63-1405	16000/63	Yaside Power Equipment Co. ltd.
CV III -350 Δ /110-1405	10000/110	Wuhan transformer manufacture Co.ltd.
CM2 III -500Y/72.5C-10193W	63000/110	Guangdong Foshan Municipal Power Bureau
CM2 III -500Y/72.5B-10193W	50000/110	Kunming Municipal Power Bureau
CM2 III -350Y/72.5B-10193W	35000/110	Shanxi Provincial Electricity Company Jinzhong branch
CM2 I -1500/63 switching insert(63kV)	6000/27.5	Nanning Power Supply Section of Nanning Railway Bureau
CM2 III -500Y/63C-10193W	50000/110	Guiyang Municipal Power Bureau

