HWDK On tank Reactive Vacuum Load Tap Changer

Shanghai Huaming Power Equipment Co., Ltd

HWDK On Tank Reactive Vacuum Load Tap Changer Introduction:

The HWDK is Huaming's latest offering for large current LTC application. The HWDK is an on-tank reactive-type vacuum LTC for 3-phases applications. Drawing on Huaming experience in LTC design the HWDK can accommodate currents and operating voltages up to 2000 A and 72.5 kV. It is suitable for 50 Hz and 60 Hz systems and wye or delta connection.

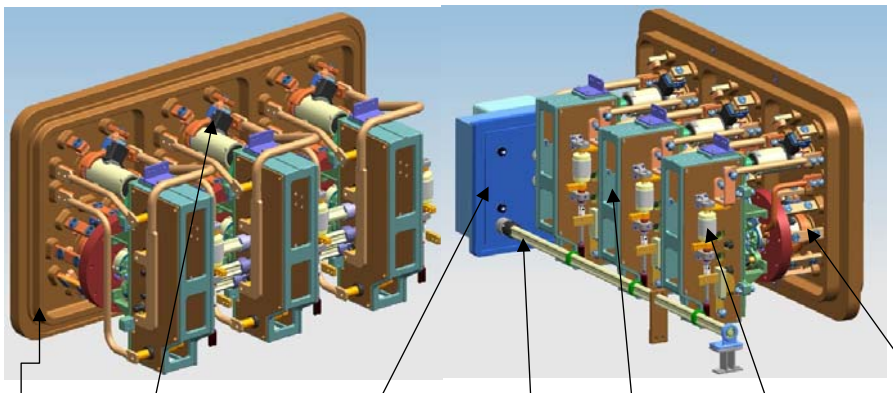
1. Introduction

HWDK is intended to be used for transformer application with voltage regulation done on the low voltage terminal. These are typically 3 phases DY transformers for secondary substations with low voltages of 13kV. However, the tap changer can be used for a variety of situation when up to 2000A current capacity is required.

2. Description

2.1 Structure

The HWDK's include a bypass switch a tap and change over tap selector both mounted in a separate and completely isolated oil compartment fixed externally on one side of the transformer's main tank. The tap changer is driven by an external motor drive mounted to the side.



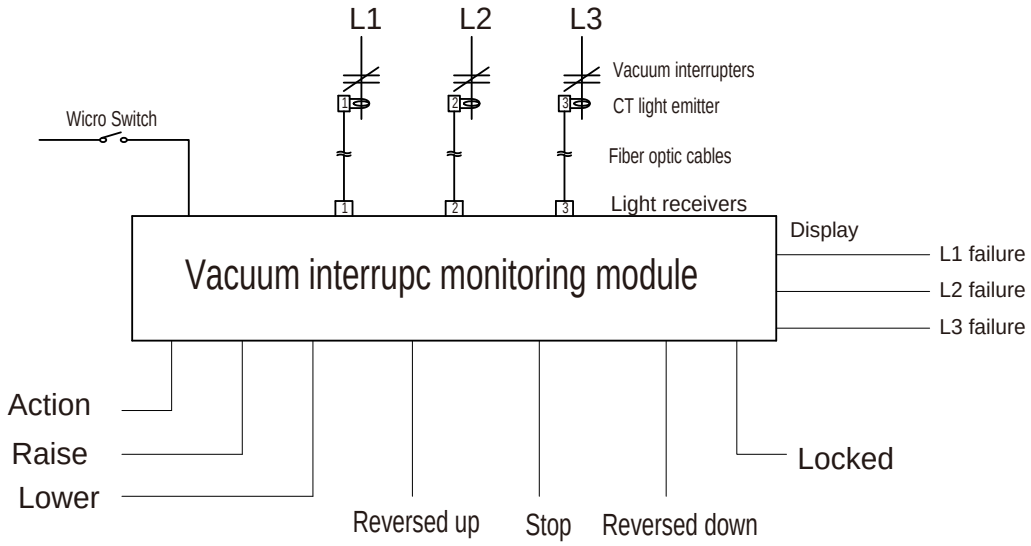
For accuracy, all switching elements are driven through one main driving shaft connected to the motor drive unit.

To prevent possible contamination the tap-changer's main body and its operating spring mechanism are located in separate compartments. This not only facilitates maintenance but also guarantees long-term oil purity and good electrical insulation within the compartment.

The change-over switch is fast-driven by its own transmission shaft with synchronization achieved within 3ms.

2.2 Vacuum Technology with fault detection:
Huaming opted for Vacuum interrupters (VI) technology for this design. The bypass switch benefit from Huaming field experience of vacuum LTC with more than 30,000 unit in operation. Eaton VI are therefore used as arcing contacts to extinguish arcs generated during LTC operation. This means the LTC is not subject to oil carbonization and therefore, an online oil-filter is not needed. This makes the operation nearly maintenance-free.

The HWDK is also fitted with a switching fault protective module to detect potential VI's failure and lock the tap-changer when critical conditions are detected. The protective module operates by monitoring the current flowing through the VI's after a switch. Should the monitored current exceed a set value, the module immediately sends a stop command to prevent the motor drive from running and avoid significant failures.



2.3 Superior short circuit performance with up to 30KA peak capacity.
Several features have been combined to reach high short circuit capacity. By design, Vacuum interrupters only transmits current during switching. They are bypassed during normal operation with the current flowing through a large stationary contact. Both moving and fixed contacts adopt a multi-point contact system to ensure good current transmission and the tap selector's moving contacts adopt bearing springs design.

2.4 Convenient maintenance

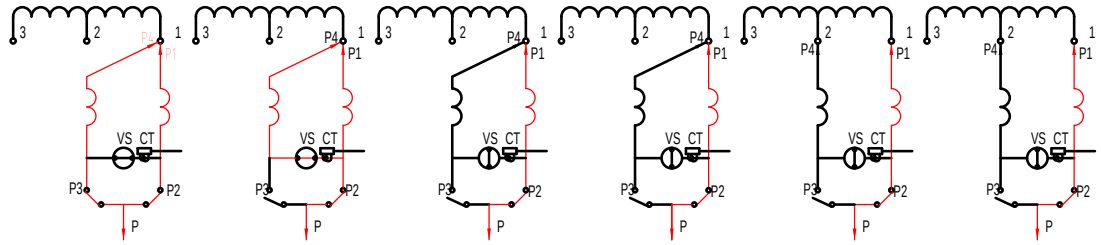
The HWDK adds to the traditional advantage of on tank LTC for which the transformer oil does not need to be drained when inspecting the LTC. With an internal layout that increases space inside the LTC compartment, it becomes possible to check or replace any LTC component without having to dismantle the LTC.

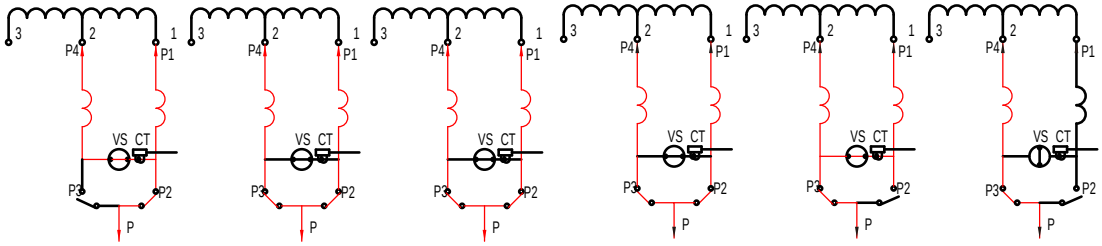
2.5 HWDK technical data

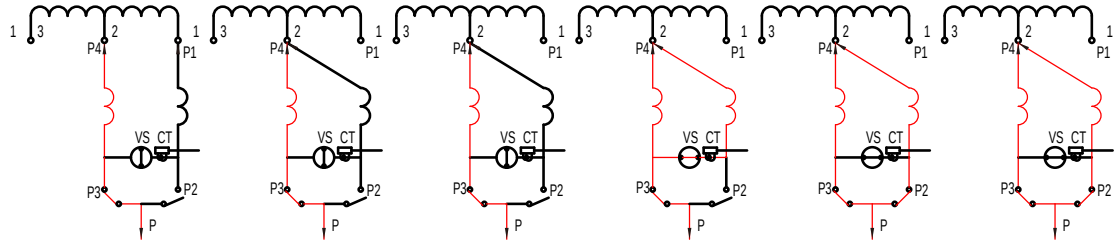
Table 1. HWDK technical data

Type		HWDK	
Max. rated through-current I_{um} (A)		1500	2000
Rated frequency (Hz)		50	60
Max. rated voltage tap-to-tap (V)		2000	
Max. rated voltage per step (V)		1000	
Rated step capacity (kVA)		3000	4000
Standard operating positions (with change-over selector)		33	33
Regulating winding section		9（8 effective）	
Short-circuit current test (kA)	Thermal (3s)	12	
	Dynamic (Peak)	30	
Insulation to ground（KV）	max. continuous voltage between circuits（IEEE/CSA）（KV）	72.5	
	Rated separate source AC withstand voltage (50Hz 1min)	140	
	Rated lightning impulse withstand voltage（1.2/50us）	400	
Maximum and minimum insulation level of switch (limit range) (kV)	Rated separate source AC withstand voltage (50Hz 1min)	70	
	Rated lightning impulse withstand voltage（1.2/50us）	250	
Insulation level between two taps stages (KV)	Rated separate source AC withstand voltage (50Hz 1min)	50	
	Rated lightning impulse withstand voltage（1.2/50us）	125	
Mechanical life		1,500,000 operations	
Vacuum contact life		600,000 operations	
Maintenance interval		500,000 operations	
Tap changer oil tank		Leakage test	No leakage under 0.08 MPa for 24 hrs
		Withstand full vacuum （±17psi）	
Dimension of tap changer oil tank (in)		L×W×H	68×33×46
Weight (lb.)		3009	
Filling volume of oil tank (us gal)		383	

HWDK LTC switching sequence:







0°	38～49°（P3 opens）	54.5～65.5°（VI opens）	66°（CT closes）	79～105°（P4 open to close）	132°（CT breaks）	152°～（VI closes）	164°（P3 closes）	180°
	7～9（P3 opens）	10～12（VI opens）	12.1（CT closes）	14.5～20（P4 open to close）	24.2（CT breaks）	28	30	33

Note:
VS: Vacuum interrupter
P1, P4: Tap selector contact
P2, P3: Main contact

External Configuration of HWDK LTC

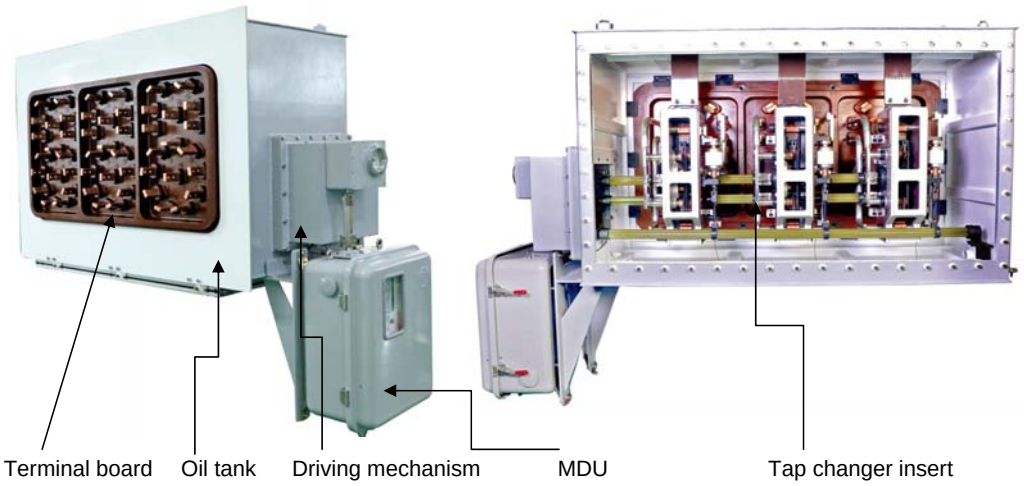


Figure 2. Structure of HWDK external reactance vacuum tap changer

Oil Tank Configuration

The oil tank is composed of transmission mechanism, oil tank, protection device, etc. It mainly realizes oil storage, the fixation of switching insert, the fixation of motor driving unit and the fault protection of tap changer. See Figure. 4

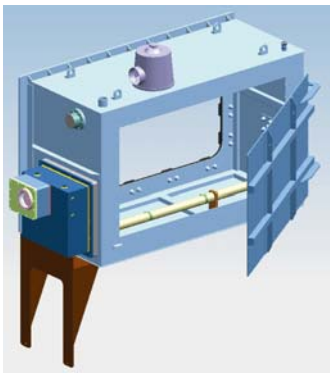


Figure. 4 Structure of oil tank

Figure. 5 Motor drive unit

Motor drive unit

HWDK is fitted with a digitally controlled step by step operating Motor Drive Unit customized to customer requirement. It is located in a dedicated enclosure See Figure. 5

Shanghai Huaming Power Equipment Co., Ltd.

Address: No 977 Tong Pu Road, Shanghai 200333, P.R.China
Tel: +86 21 5270 3965 (direct)
+86 21 5270 8966 Ext. 8688 / 8123 / 8698 / 8158 / 8110 / 8658
Fax: +86 21 5270 2715
Web: www.huaming.com E-mail: export@huaming.com