Building a better future
Global Leader

Vacuum Interrupter

for Medium-Voltage from 7.2kV to 40.5kV

HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

Contents

Vacuum Interrupter is ...

HYUNDAI vacuum interrupters were developed in 1987 and mass production began in 1990. The best materials are used in the manufacturing of the vacuum interrupters, which can satisfy electrical and mechanical requirements at the same time.

A further and important step in the development of innovative vacuum interrupters is the brazing process developed by HYUNDAI for the permanent sealing of the vacuum chamber in the mechanically stable bonding of the metallic and ceramic parts or oxygen free copper and contact tips.

HYUNDAI's compact and light weight vacuum interrupters are constantly being improved to meet the demands of the global market.

Product Scope

Ratings				Model name	
Rated voltage	Rated lightning impulse voltage	Power frequency withstand voltage	Rated current	Short-circuit breaking current with at least 30-40% DC component and interrupter	
				4/4.3 kA	12/12.5 kA
7.2 kV	60 kV	20 kV	400 A	HVC 00703[1] HVC 00704[1] HVC 00709[2]	
			630 A		HVS 00706
			700/800 A	HVC 00710[2]	
			1200/1250 A	HVC 00712[2]	
			1600 A 2000 A		
			2500 A 3150 A		
12 kV	75 kV	28 kV	400 A	HVC 01204[1]	
			630 A 1200/1250 A 1600 A 2000 A		
			2500 A 3150 A		
			4000 A		
17.5 kV	95 kV	36 kV	630 A 1200/1250 A		
			1600 A 2000 A		
			2500 A		
			3150 A		
24/25 kV	125 kV	50 kV	630 A		HVC 02407[3] HVC 02408[3] HVC 02409[3] HVS 02414 HVS 02417
			1200/1250 A 1600 A 2000 A		
			3150 A		
36/38 kV	170 kV	70 kV	630 A 1200/1250 A 1600 A 2000 A		
			3150 A		
40/40.5 kV	185 kV	85 kV	630 A 1200/1250 A		
			1600 A 2000 A 2500 A 3150 A		

∗ All vacuum interrupters are basically applicable to vacuum circuit breaker.

1) for vacuum contactor
2) for oil tap changer
3) for vacuum switch
4) for C-GIS (cubicle type gas insulated switchgear)
5) for medium voltage GIS (gas insulated switchgear)

Model name				
Short-circuit breaking current with at least 30-40% DC component and interrupter				
20 kA	25 kA	31.5 kA	40 kA	50 kA
HVS 01225	HVS 01725			HVS 01750 (4.76 kV)
				HVS 10007
	HVS 02027[4] HVS 12015		HVS 01240	HVS 10027
				HVS 01753 HVS 01754
	HVS 01726		HVS 01745 HVS 01746	
		HVS 10005	HVS 01750 HVS 01752	
		HVS 10007	HVS 01747 HVS 01753 HVS 01754 HVS 10027	
	HVS 02028[4] HVS 02421 HCB 20005[5]		HVS 02440	
	HVS 02435	HVS 02430	HVS 03640	
	HVS 03627		HVS 03642 HVS 03644 HVS 03645	
		HVS 03640		
	HVS 02029[4]	HVS 02432[4]		
			HVS 04030	

Technical Information

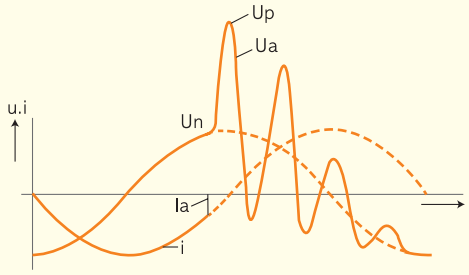
High Short-Circuit Breaking Capacity

HYUNDAI vacuum interrupters realize high short-circuit breaking capacity at compact size by appling two geometrically different contacts according to specification. Radial magnetic field contact flow higher current through a constricted arc, and axial magnetic field allows a diffuse arc even where the current intensity is high. Both the radial and axial magnetic fields are produced by special current paths provided in the contacts under the surface as shown in Fig.4 and Fig.5.

Low Chopping Current

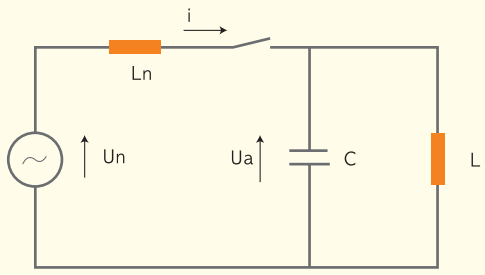
Below a certain minimum current, the metal vapour arc is interrupted prior to the natural current zero. When the current is interrupted by chopping phenomenon, the overvoltage shall appear just before the natural current zero point as shown in Fig.1. Therefore this chopping current must be as low as possible in order to prevent the build-up of impermissibly high overvoltage.

The magnitude of chopping current depends largely on the contact material used. The CrCu contact material keeps the chopping current below 5A.



Un : Power-frequency phase to earth voltage
Ua : Voltage at load-side breaker terminals
Up : Maximum overvoltage on the load side
i : Power-frequence current
Ia : Chopping current

Fig.1 Overvoltage due to current chopping when interrupting an inductive current



Un : Power-frequency phase to earth voltage
Ua : Voltage at load-side breaker terminals
i : Load current
Ln : Inductance of power system
L : Inductance of load
C : Capacitance of load

Fig.2 Single phase equivalent circuit for interrupting inductive current

High Dielectric Strength

On opening of the contact, the current to be interrupted produces a metal vapour arc discharge and continues flowing through the plasma until the next current is zero.
The arc is extinguished in the vicinity of the current zero, and the metal vapour loses its conductivity within a few microseconds. The dielectric strength of the break is thus re-established very quickly.

The steady state of pressure in a vacuum interrupter is less than $1x10^{-7}$ mbar. Contact clearances of 2mm to 20mm suffice and therefore produces a high dielectric strength as shown in Fig.3.

Minimal Contact Erosion

The metal vapour plasma of the vacuum arc is highly conductive. The arc voltage and the energy conversion in the break are likewise minimal. The high conductivity, in conjunction with the minimal energy conversion and short arcing times are the reasons for the minimal contact erosion and long electrical service life of our vacuum interrupters.

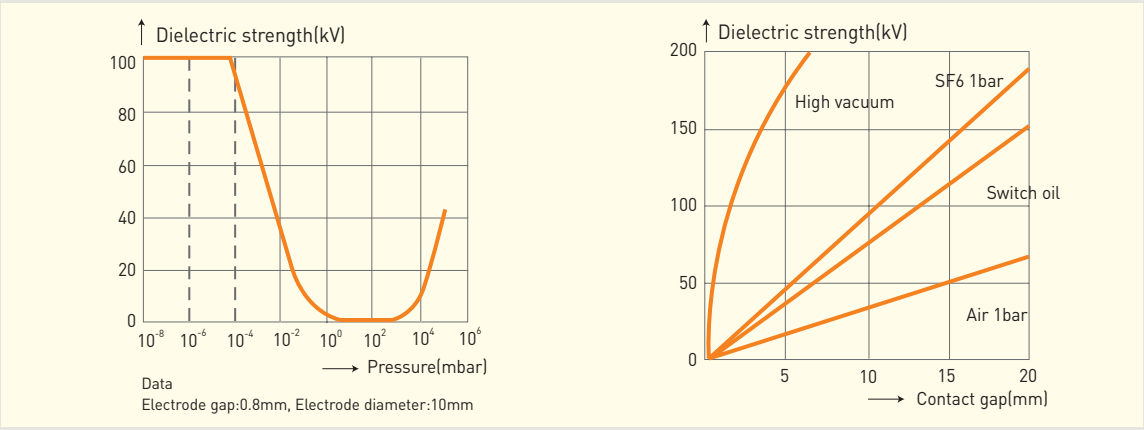


Fig.3 Dielectric strength in vacuum

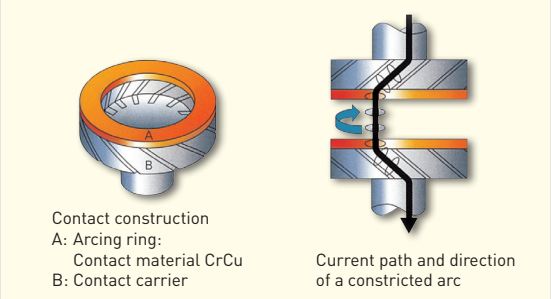


Fig.4 Radial magnetic field contact

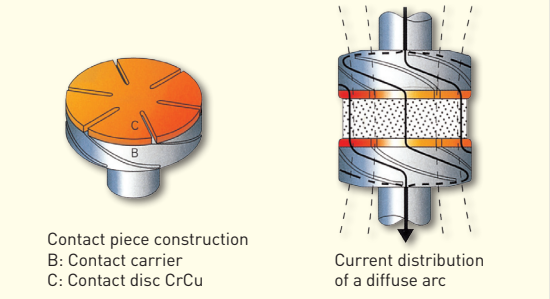


Fig.5 Axial magnetic field contact

Quality Assurance

Quality Assurance

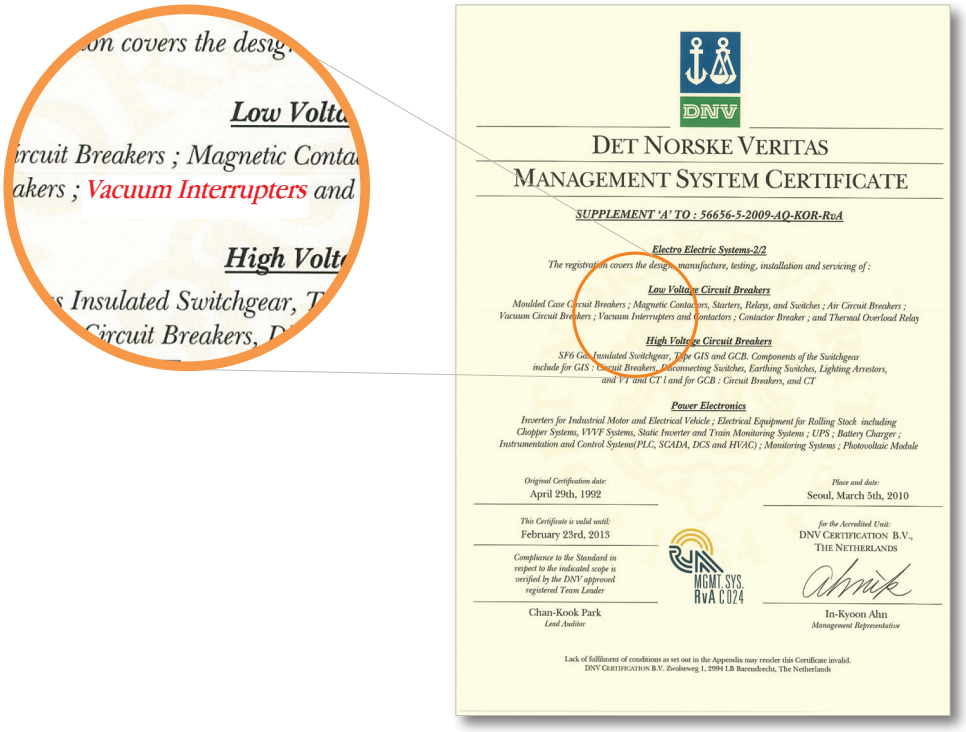
HYUNDAI vacuum interrupters have been verified by type tests at KEMA and KERI laboratories according to IEC and ANSI performance standards, and maintain its reliability based on a quality assurance program ISO9001.

KEMA KERI CESI

Material Testing

Material testing is of particular significance due to the special materials used. All materials of structural and operational components which can influence function and service life of a vacuum interrupter elements, are tested in our own testing laboratory.

The technical data of the materials are very tight tolerance ranges and are checked on every consignment delivered.



DNV

DET NORSKE VERITAS

MANAGEMENT SYSTEM CERTIFICATE

SUPPLEMENT 'A' TO : 56656-5-2009-AQ-KOR-RvA

Electro Electric Systems-2/2

The registration covers the design, manufacture, testing, installation and servicing of :

Low Voltage Circuit Breakers

Moulded Case Circuit Breakers ; Magnetic Contactors, Starters, Relays, and Switches ; Air Circuit Breakers ; Vacuum Circuit Breakers ; Vacuum Interrupters and Contactors ; Contactor Breaker ; and Thermal Overload Relay

High Voltage Circuit Breakers

SF6 Gas Insulated Switchgear, Type GIS and GCB. Components of the Switchgear include for GIS : Circuit Breakers, Disconnecting Switches, Earthing Switches, Lighting Arrestors, and VT and CT 1 and for GCB : Circuit Breakers, and CT

Power Electronics

Inverters for Industrial Motor and Electrical Vehicle ; Electrical Equipment for Rolling Stock including Chopper Systems, VVVF Systems, Static Inverter and Train Monitoring Systems ; UPS ; Battery Charger ; Instrumentation and Control Systems(PLC, SCADA, DCS and HVAC) ; Monitoring Systems ; Photovoltaic Module

Original Certification date: April 29th, 1992

Place and date: Seoul, March 5th, 2010

This Certificate is valid until: February 23rd, 2013

for the Accredited Unit: DNV CERTIFICATION B.V., THE NETHERLANDS

Compliance to the Standard in respect to the indicated scope is verified by the DNV approved registered Team Leader

MGMT.SYS. RvA C 024

Chan-Kook Park, Lead Auditor

In-Kyoon Ahn, Management Representative

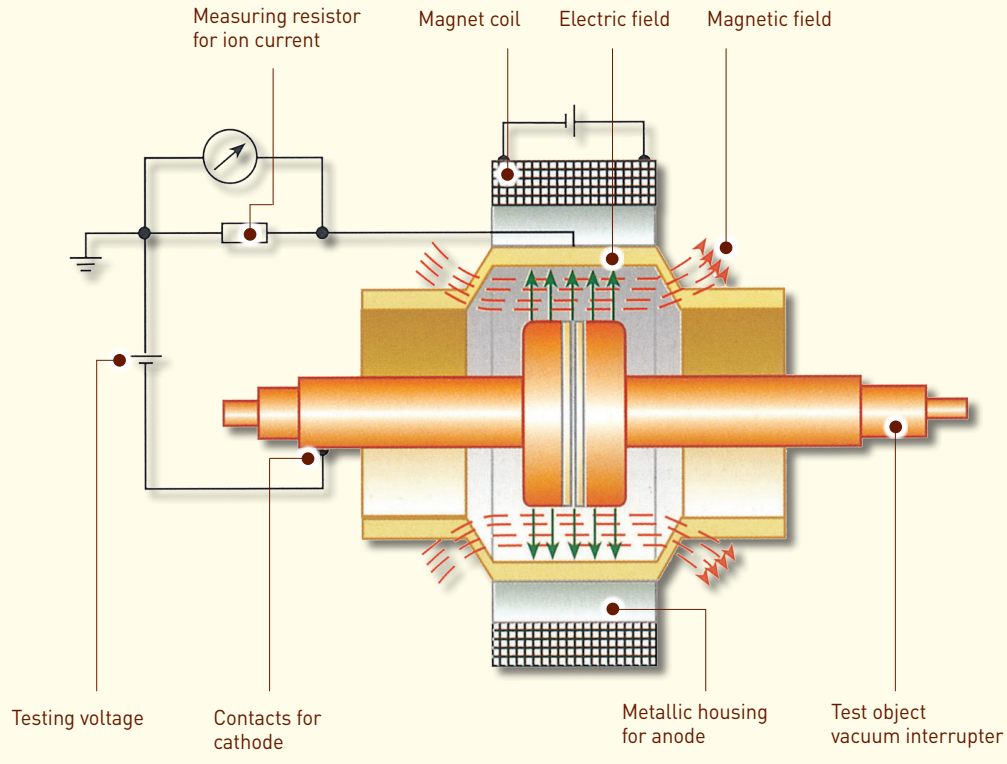
Lack of fulfilment of conditions as set out in the Appendix may render this Certificate invalid.
DNV CERTIFICATION B.V. Zwolseweg 1, 2994 LB Barendrecht, The Netherlands

Internal Pressure Testing

Completing the whole process, each vacuum interrupter is subject to its air tightness to determine the service life expectancy. A special internal pressure measuring process has been developed to test for leakage even after the interrupter has been sealed.

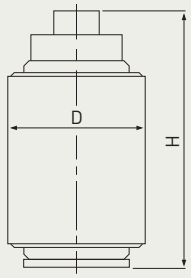
In a stationary facility, electrical and magnetic field are superimposed in a such way that free electrons ionize any residual gas molecules and produce a measuring current that varies as a function of the pressure. All interrupters are stored in argon and then tested by means of this process. They are released for shipment only if a leakage rate of up to $1x10^{-13}$ mbar x *l*/s is not exceeded.

This amounts to a storage time of 20 years without any loss in quality. The following figure shows the principle of inner pressure measuring for vacuum interrupters.



Dimensions

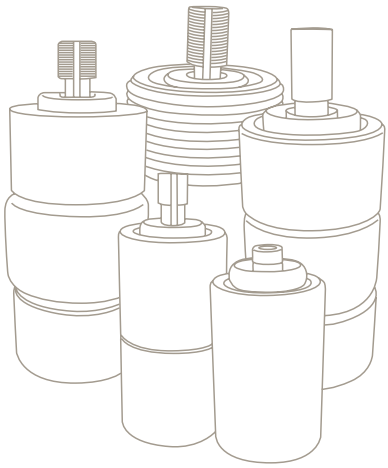
STYLE A



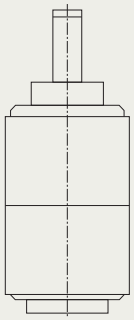
TYPE	H	D
HVC 00703	93	53
HVC 00704	113	60
HVC 00709	135	60
HVC 00710	135	70
HVC 00712	188	87
HVC 01204	126	79

STYLE B

TYPE	H	D
HVS 00706	155	60

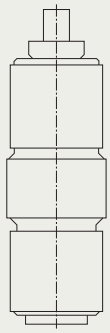


STYLE C



TYPE	H	D
HVC 02407	190	60
HVC 02408	190	60
HVC 02409	153	60
HVS 01225	167	81
HVS 01725	200	81
HVS 01726	203	104
HVS 01746(5)	277	104
HVS 02027	261	104
HVS 02028	270	104
HVS 02029	275	104
HVS 02414	277	81
HVS 02417	219	81
HVS 02421	277	104
HVS 02430	304	130
HVS 02432	324	130
HVS 02435	310	130
HVS 03640	483	130
HVS 12015	219	110

STYLE D



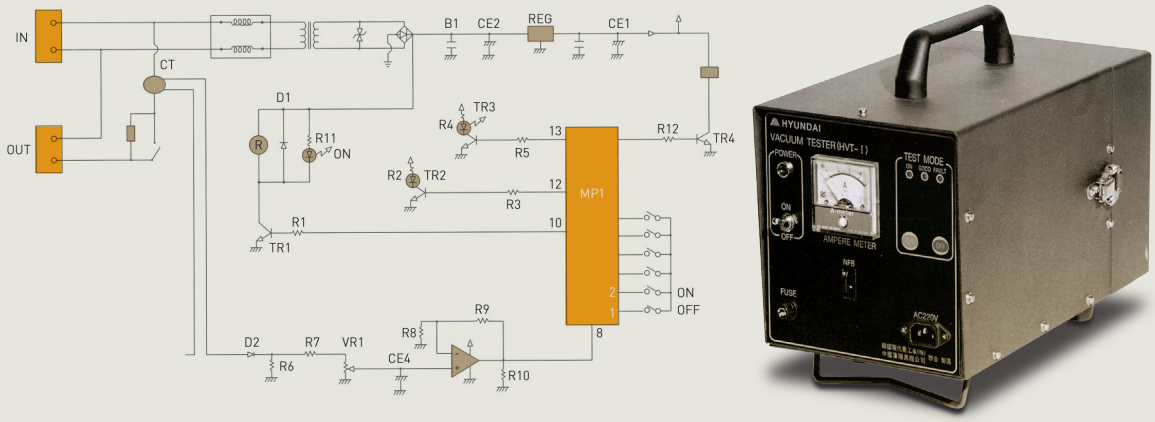
TYPE	H	D
HVS 01240	455	154
HVS 01747	313	110
HVS 01750	275	110
HVS 01752	313	125
HVS 01753	313	125
HVS 01754	312	140
HVS 02440	311	135
HVS 03627	371	110
HVS 03642	484	152
HVS 03644	483	135
HVS 03645	483	154
HVS 10005	345	152
HVS 10007	344	154
HVS 10027	368	152
HCB 20005	421	133

STYLE E

TYPE	H	D
HVS 04030	537	134

Vacuum Tester

HYUNDAI VACUUM TESTER (HVT-1)



Ordering Information

V1-V3 (Ordering Grouping)

HVS

MODEL	
HVC	For Vacuum Contactor
HVS	For Vacuum Circuit Breaker
HCB	For Medium Voltage GIS

1725

PART NO.
Refer to Product Scope (page 4-5)

Lightening impulse withstand voltage test for vacuum interrupters

HHIS-WC-RE-B68-01, 2011.11 Designed by JC Communication

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