An Introduction to
High –Voltage Engineering Center Laboratory Set Products

High-Voltage Engineering Center

Contents

Preface

Today, the High-Voltage engineering science has covered various aspects of technical details related to production, transfer, distribution and consumption of electricity. Since offering effective strategies to optimize High -Voltage equipment production and resolving problems in grids, power plants and stations required scientific dominance over the subject and practical experimentation, thus High -Voltage lab project and establishment is of importance. The High -Voltage lab set is a necessary facility for research, industry and higher education centers that helps to understand principles of High -Voltage physics like electric discharge in non-conducting environment (air, gas, and solid) and investigating electrical appliances' function under high direct/alternating voltage and impulse wave.

Advanced countries have leapt forward in application of High -Voltage engineering science and achieved great success. But in our country, for a number of reasons, a wide gap divides us from industrial countries. Since 1986, the JDEVS sensed the gap and based on scientific capabilities and experienced personnel, decided to step into this expert work field. Research began and by The Assistance of God, after 7 years of implementing various research projects in lab stage or semi-industrial stage , the JDEVS High-Voltage Engineering Center succeeded in manufacturing High -Voltage lab sets up to 400 kV.

1- Access to know-how of manufacturing High -Voltage lab set up to mega volt.

2- Helping High -Voltage industry to improve quality of goods /services by providing QC test facility.

3- Contribution in equipping universities and research centers to upgrade HR training and quality/quantity of research.

4-Economic savings in High -Voltage lab equipping cost by domestic production and preventing foreign currency drain out of country.

1-Introducing High -Voltage engineering center products

1-1Modular High -Voltage lab set

1-1-1Scope

Modular High -Voltage lab set is designed and produced by Elmosanat JDEVS to be used in training electric engineering students, and High -Voltage industry plants' QC & research lab set. Using High -Voltage lab set has been praised not only for basic high-voltage university research, but for applied research in industry and research centers. The set components can be carried with ease. Since it is modular, the parts are fastened by stands and suspended metal distributor boxes as a whole. The set can be easily adjusted to represent various circuits described below. Main High -Voltage lab set applications are utilized in training, research and industrial centers summarized below.

1-1-1-1Training center

In universities and higher education centers offering electricity field with inclination towards power, the classic High -Voltage test is used to teach High -Voltage science principles to students and show them how to work with High -Voltage equipments under high voltage, what are safety measures and High -Voltage work area problems. The High -Voltage sets like those produced in JDEVS are in fact the main equipments required in any High -Voltage lab.

1-1-1-2 Research center

High -Voltage technology has spread in various areas of modern life like energy, communication, transportation, medicine, environment, and defense sectors and importance of research in these fields to improve quality of production /service, many research centers like fundamental/applied /development research facilities require fine High -Voltage labs to perform experimental / scientific tests on new systems and equipments with High -Voltage units or where other High -Voltage systems affect them.

1-1-1-3 Industrial/production center

There are 2 major issues in High -Voltage, one is about safety of people that directly/indirectly work with High -Voltage equipment and the other is achieving high reliability index for systems that use High -Voltage equipments or their electric power is supplied through public grid. So, the producers of High -Voltage equipments and even low-tension equipments, must observe mandatory QC standards. QC tests include routine test and type test. Most of times, in addition to mandatory standard control by the producer, the users of High -Voltage equipments or semi-manufactured parts used in other equipments , or repair & maintenance centers require High -Voltage equipments tests. Diversity of High -Voltage parts like insulator, disconnectable/non-disconnectable switch under load, transformer, cable, post, panel, etc. and dispersion of various producers in the is industrial field all around the country, requires equipping all related plants with QC labs assisted by High -Voltage lab sets.

1-1-2 Introducing the components

High -Voltage lab set general specifications is designed in modules and by connecting parts within a circuit scheme, the set can be used as AC High -Voltage circuit with 1 to 3 stages. Therefore, the parts must have identical general specifications:

- Uniform length of elements to facilitate installation and forming the circuit
- Oil insulator to isolate part from external influence
- operating range: -5 to +40 C°
- Part nominal value is printed on insulation

High -Voltage lab set is made from many parts such as below:

- Diode
- High VoltageTransformer
- Pressure/vacuum vessle
- Corona vessle
- Connection rod
- Insulator rod
- Connection cup
- Peak impulse digital voltmeter
- AC peak digital voltmeter
- Discharge rod
- Paschen Sphere
- Connection cable
- Power supply
- Control panel
- Divider capacitor with matching
- Load capacitor
- Impulse capacitor
- Load resistor
- Measuring resistor
- Wave front resistor
- Wave rear resistor
- Vertical variable distance Sphere with servomotor
- Horizontal variable distance Sphere with servomotor

The details of elements are described next.

1-1 Measuring resistor (RM)

AC/DCapplication:voltage dividing resistor to measure circuit voltage .

Specifications:

AC Voltage = 100 [kV]
DC Voltage = 140 [kV]
Max curent = 500 [mA]
W= 5.5 [Kg]

1-2High Voltage 100kV/AC-single phase transformer (T)

This unit is equipped with coupling (cascade) wiring.

Specifications:

U1 = 220 [V]
U2 = 100 [kVrms]
P = 5 [kVA]
F = 50 [Hz]
W= 200 [Kg]

1-3 Wave tail resistor (RD)

Application: used in standard impulse wave producing circuit (lightning or switching).

Specifications:

Impulse Voltage = 140 [kV]
R = 6100 [Ω]
W = 4.8 [Kg]

1-4 Wave front resistor (RD)

Application: used in standard impulse wave producing circuit (lightning or switching).

Specifications:

Impulse Voltage = 140 [kV]
R = 260 [Ω]
W = 4.5 [Kg]

1-5 Load resistor (RL)

Application in DC circuit: limiting current, and in AC: limiting charge.

Specifications:

DC &Impulse Voltage = 140 [kV]
R = 10 [MΩ]
W = 5.4 [Kg]
P = 60 [W]

1-6 Measuring capacitor(CM)

AC application: as capacitor voltage-divider, and in DC: as impulse.

Specifications:

AC Voltage = 100 [kV]

C = 100 [PF]
W = 10.5 [kg]

1-7 Load capacitor (CB)

Application: As load capacitor and capacitor voltage-divider to measure voltage in impulse wave

Specifications:

Impulse Voltage = 140 [kV]
C = 1200 [PF]
W= 10.5 [Kg]

1-8Charging capacitor (CS)

DC application: in voltage impulse wave producing circuit and also can be used as filter capacitor in voltage production

Specifications:

Impulse Voltage = 140 [kV]
C = 10000 [PF]
W = 11 [Kg]

1-9 Insulating rod(IS)

To hold up the set.

Specifications:

AC Voltage = 100 [kV]
W = 1 [Kg]
L = 63 [cm]
D = 6 [cm]

1-10 Horizontal variable distance Sphere(KF)

To produce impulse voltage and adjusting voltage amplitude.

Specifications:

Impulse Voltage = 140 [kV]
D = 100 [mm]
Max gap setting = 80 [mm]
= 8.6 [Kg]

1-11 Diode (D)

To use in Impulse voltage and DC Voltage generation.

Specifications:

Inverse peak voltage = 140 [kV]
Protective resistor = 500 [kΩ]
I= 20 [mA]
W= 5 [Kg]

1-12 Connection cup (K)

To connect parts.

Specifications:

W = 2.8 [Kg]
Made of = Aluminum
H = 9 [cm]
D = 15 [cm]

1-13 HV conection (HSV)

To create electric connection between transformer and parts in multi-stage setting.
Specifications:

Length = 0.7 [m]
Made of = Aluminum
W = 1.3 [kg]
D = 5.5 [cm]

1-14 Connection rod (V)

To connect parts electrically.

Specifications:

W = 1.8 [Kg]
Made of = Aluminum
Lenght = 63 [cm]
D = 6 [cm]

1-15 Paschen Sphere (KK)

Used with vacuum/pressure vessle to check dielectric yield voltage stability controlling for pressure multiplied by electrode gap.

Specifications:

Ub = P.d
AC Voltage = 100 [kV]
W= 2 [kg]وزن

1-16 Vacuum/pressure vessle (DKU)

Determining impact of vacuum/pressure on various electrode sparks and observing corona.

Specifications:

AC Voltage = 100 [kV]
DC Voltage = 140 [kV]
Max operating = 0-3 [bar] pressure
W= 12 [kg]وزن

1-17 Vertical variable distance Sphere (MF)To measure impulse voltage amplitude and adjusting voltage amplitude by electrodes:

- Spherical electrode

- Plane electrode

Specifications:

AC Voltage = 100 [kV]
DC Voltage = 140 [kV]
Impulse Voltage = 140 [kV]
D = 100 [mm]
Max gap setting = 80 [mm]
W = 10 [Kg]

1-1-3 One to three stages assembly circuit

-AC circuit

-AC resistive divider single stage and AC capacitive divider single stage

Un=100[kVrms]
Pn=5[kVA]
In=50[mA]
f=50[Hz]
Uk% ≅ 4

Two- stages

Un =200[kVrms]

Pn =5[kVA]

In=25[mA]

f = 50[Hz]

Uk% ≅ 10

Three- stages

Un =300[kVrms]

Pn =5[kVA]

In=16[mA]

f =50[Hz]

Uk% ≅ 14

-DC Voltage

Single- stage

Un=140 [kV]
In= 13[mA]
f =50 [Hz]

Two- stages

Un= 280[kV]
In =10[mA]
f= 50[Hz]

Three- stages

Un =400[kV]
In =7.5[mA]
f =50[Hz]

-Low energy impulse circuit

single- stage

Us = 140[kV]
Ws = 100[J]
C_s = 10[nF]
Voltage efficiency (Cs = 10) approx. 90%

Two- stages

Us = 280 [kV]
Ws = 200[J]
C_s = 10[nF]
Voltage efficiency (Cs = 10) approx. 90%

Three- stages

Us = 420[kV]
Ws = 290[J]
C_s = 10[nF]
Voltage efficiency (Cs = 10) approx. 90%

1-1-4 Components tables used in 1,2 & 3 stage circuits

No	Heading	AC Circuit				DC Circuit				Impulse Circuit			
		Stages	**1**	**2**	**3**	**Stages**	**1**	**2**	**3**	**Stages**	**1**	**2**	**3**
1	Control Panel		1	1	1		1	1	1		1	1	1
2	Supply		1	2	3		1	1	1		1	1	1
3	RL		---	---	---		---	---	---		1	1	2
4	Diode		---	---	---		2	4	6		2	2	2
5	CS		---	---	---		1	3	5		1	2	3
6	RM		1	2	3		1	2	3		--	--	---
7	CM		1	2	3		--	--	--		--	--	---
8	Horizontal Sphere		---	---	---		--	--	--		1	2	3
9	RD		---	---	---		--	--	--		1	2	3
10	RE		---	---	---		--	--	--		1	2	3
11	CB		--	--	--		--	--	--		1	2	3
12	Connection rod		1	1	1		2	9	1		2	9	14
13	Insulation rod		1	1	1		2	8	1		4	5	14
14	Connection cup		1	2	4		6	12	2		14	16	30
15	Discharge Rod		1	1	1		1	1	1		1	1	1
16	DIV		--	--	--		--	--	--		1	1	1
17	DPV		1	1	1		--	--	--		---	---	---

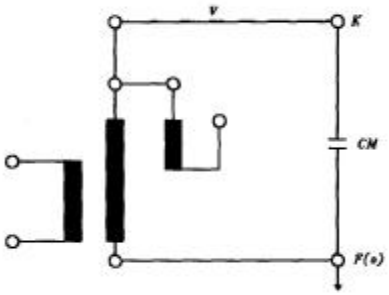
Note1: 75 Ohms coaxial cable for resistive/capacitive dividers

Note2: vacuum & pressure vessle and vertical& Paschen Spheres are used in training test bay.

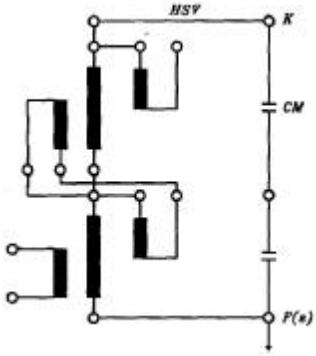
1-1-5 Schematic circuits

1-1-5-1 AC Schematic circuits

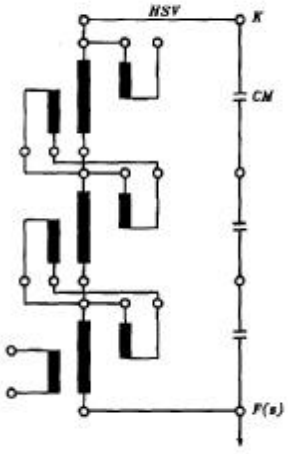
Single- stage



Two- stages



Three- stages

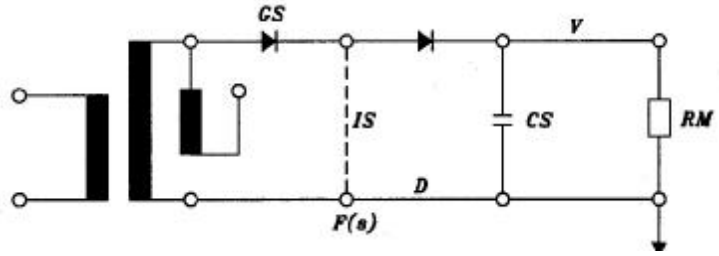


K=F(S)

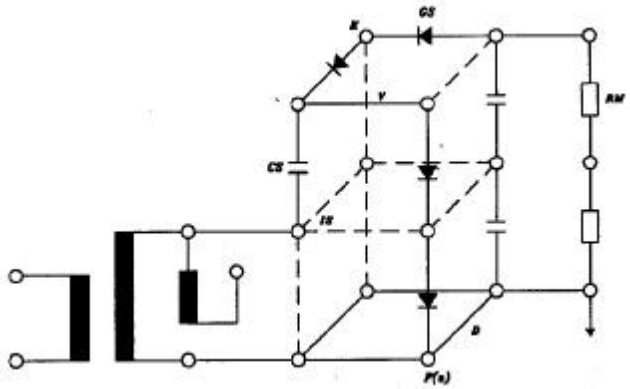
V=HSV

1-1-5-1 DC Schematic circuits

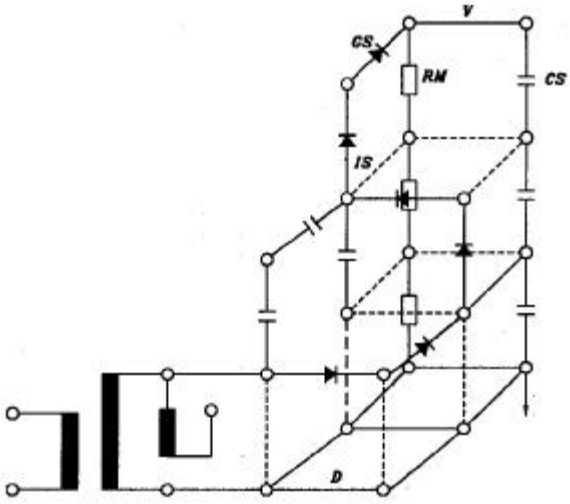
Single- stage



Two- stages



Three- stages



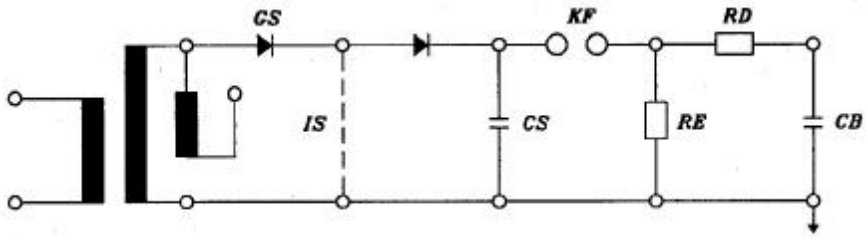
S= insulator rod

D=V conducting rod

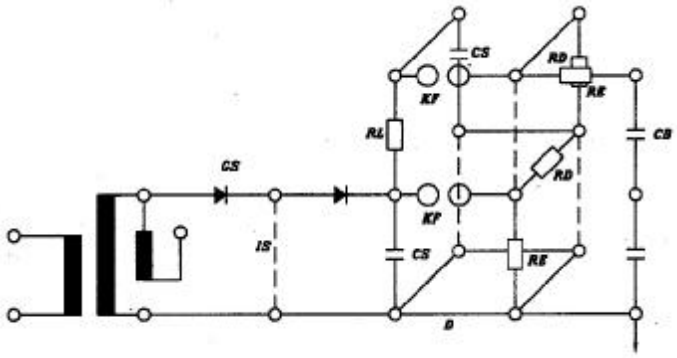
(S)F= Aluminum divider

1-1-5-3Impulse schematic circuit

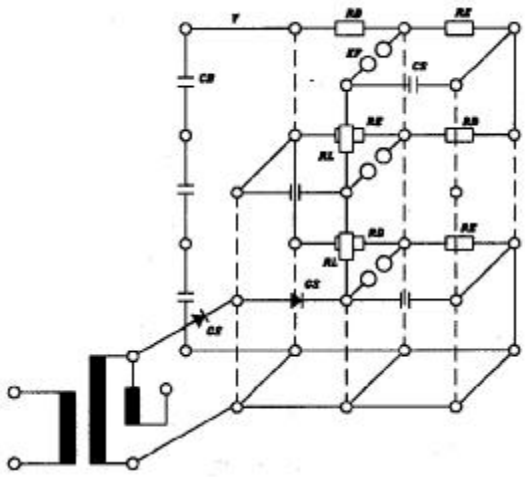
Single- stage



Two- stages

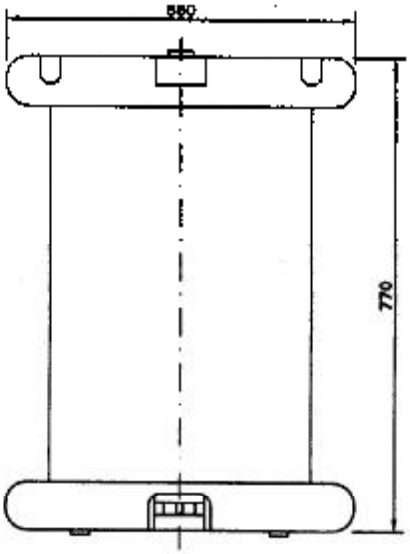


Three- stages

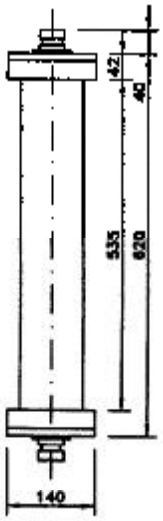


1-1-6 Dimensions of elements (mm)

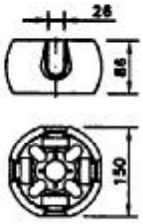
RM



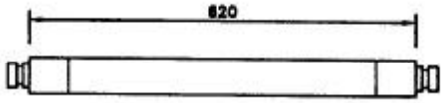
T



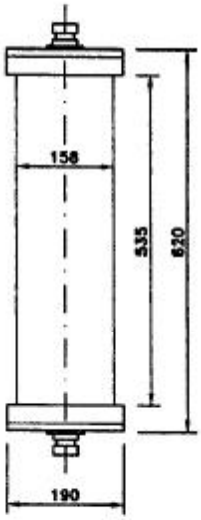
RL/RD/
RE/GS



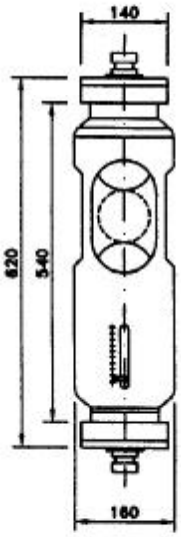
K



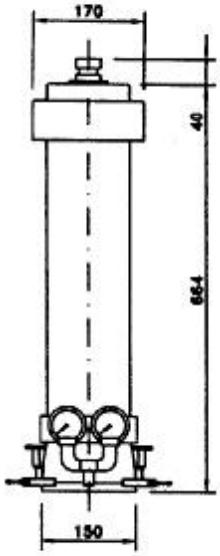
IS



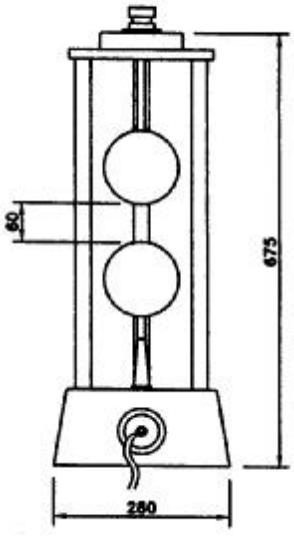
CB/CS/CM



KF



DKU



MF

1-1-7 Hipot 75 kV (portable)

Duty: 1 hour ON 1 hour OFF
Un = 75 [kVrms]
P = 1 [kVA]
I = 13 [mA]
f = 50[Hz]
Uk% ≅ 5

1-2 High power AC circuit

-AC 200 kV circuit

Un = 200 [kV]
P = 100 [kVA]
In = 500 [mA]
f = 50 [Hz]
Uk% ≅ 12

-AC 300 kV circuit

Un = 300 [kV]
P = 200 [kVA]
In = 660 [mA]
f = 50 [Hz]
Uk% ≅ 13

-AC 800 kV circuit in 2 stages

Un = 400 [kV]

P = 800 [kVA]

In = 2000 [mA]

f = 50 [Hz]

Uk% ≅ 13

-AC 600 kV circuit in 2 stages

Un = 600 [kV]

P = 200 [kVA]

In = 333 [mA]

f = 50 [Hz]

-AC 800 kV circuit in 2 stages

Un = 800 [kV]
P = 800 [kVA]
In = 1 [A]
f = 50 [Hz]

1-3 Resonance circuit

Un = 100 [kV]
P = 800 [kVA]
f = 50 [Hz]

1-4 High energy impulse circuit

-300 kV impulse circuit

Un = 300 [kV]

Ws = 15 [kJ]

Cs = 1 [µF]

-400 kV impulse circuit

Un = 400 [kV]

Ws = 20 [kJ]

Cs = 1 [μF]

1-5 measurement instruments

DIV

-1.2/50 Microseconds, application: measurement of standard impulse voltage amplitude.

Specifications:

-3.5-digit display

-Positive/negative impulse voltage measurement

-Accuracy: +/-1.5 % full scale(up to 40 C°)

-Used with resistive/capacitive divider

-Efficiency checker mode switch

-Impulse voltage reading for impulse circuits with 1 ,2&3 stages

-Measurement method: Sampler-holder

-0-125 kV 1 stage circuit

-0-250 kV 2 stage circuit

-0-375 kV 3 stage circuit

-Power Supply voltage: 220V/50Hz

-Earthing input

-Can be connected to scope

DPV Peak-meter digital voltmeter

-Application: Measuring peak voltage

Specifications:

-3.5-digit display

-Positive/negative peak voltage measurement

-Accuracy: +/- 1.5 % full scales (up to 40 C°)

-Peak measurement divided into √2 for effective peak

-Efficiency checker mode switch

-Peak voltage reading for AC circuits with 1, 2&3 stages

-Measurement method: Sampler-holder

-0-140 kV 1 stage circuit

-0-280 kV 2 stage circuit

-0-420 kV 3 stage circuit

-Power Supply voltage: 220V/50Hz

-Earth input

-Can be connected to scope

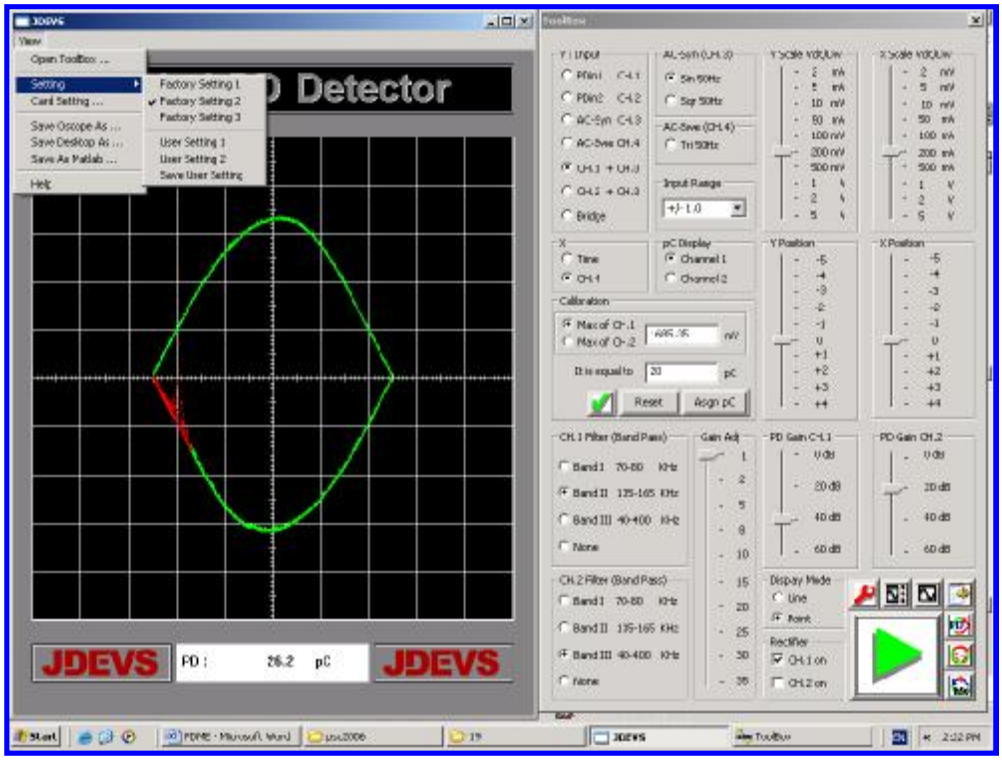
Computer system for partial discharge detection and processing

- Partial discharge measurement is a major non-destructive tests for insulator defect detection in High -Voltage equipments. Using IEC computer system one of the main devices that conforms to PD making standards , processing and measuring of partial discharge, it is possible to measure partial discharge or various devices like capacitor, transformer, insulator, cable and electric machinery. High frequency impulse is filtered by a quadripole and sent by measurement cable to PD card .The detection and measurement computer set and calibrator and synchronizer are external. The university PD is provided for signal processing and window-making capability for better measurement. PD software has capabilities like signal rectifier and filter.

2-2 Expert services in High -Voltage filed

Many industries in the country that are active in High -Voltage equipments production make use of JDEVS for standard testing of equipments or semi-prepared materials.

The QC test is performed exactly according to national/international standards based on employer order.



HIGH VOLTAGE TEST EQUIPMENT

JDEVS Reference List

Item	Equipment	Specification	Customer	Year
1	High Voltage Test Equipment	100kVAC, 420kVDC, 380kV Impulse	Tehran Electric Co.	1999
2	High Voltage Test Equipment	100 kV AC	Iran Nirou Co.	1996
3	High Voltage Test Equipment	140 kV DC	Jabon Co.	1997
4	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Electrokavir Co.	1997
5	High Voltage Test Equipment	100 kV AC	Elkan Co.	1996
6	High Voltage Test Equipment	100 kV AC	Barghgir Pars Co.	2000
7	High Voltage Test Equipment	125 kV Impulse	Ferdousi University	1994
8	High Voltage Test Equipment	125 kV Impulse	Mahmood Abad University	1994
9	High Voltage Test Equipment	100 kV AC	Shahid Abbas Poor University	1998
10	High Voltage Test Equipment	100kVAC, 140kVDC, 125 kV Impulse	Tabriz Manufacturing & Graduating organization	1998
11	High Voltage Test Equipment	100kVAC, 140kVDC, 125 kV Impulse	Ashtian Tablo Co.	1997
12	High Voltage Test Equipment	100 kVAC	Tamin Tablo Co.	1999
13	High Voltage Test Equipment	100 kV AC	Matrice Co.	1999
14	High Voltage Test Equipment	100 kV AC	Sadaf Gostar Co.	2000
15	High Voltage Test Equipment	100 kV AC/250 kV Impulse	Sanati Mehrabad Co.	2000
16	High Voltage Test Equipment	100kVAC, 280 kVDC, 375kV Impulse	Khajeh Nasiroddin University	2000
17	Designing Laboratory & Repairing	100 kV AC	Ajineh Co.	2001
18	High Voltage Test Equipment	100 kV AC	Fan Generator Co.	2001

19	High Voltage Test Equipment	100 kV AC/250 kV Impulse	Yam Co.	2000
20	High Voltage Test Equipment	200 kV AC, 375 kV Impulse	Tarbyat Moallem University	2001
21	High Voltage Test Equipment	600 kV AC, 200 kVA	Iran Switch Co.	2001
22	High Voltage Test Equipment	125 kV Impulse	Khorasan Manu. Co.	2001
23	High Voltage Test Equipment	125 kV Impulse	Kerman Tablo Co.	2001
24	High Voltage Test Equipment	100 kV AC	ABB Co.	2001
25	High Voltage Test Equipment	Accessories	Semnan University	2001
26	High Voltage Test Equipment	600kVAC, 200 kVA	Tavanir Org.	2002
27	High Voltage Test Equipment	100kVAC, 140kVDC, 125 kV Impulse	Taban Tablou Co.	2002
28	High Voltage Test Equipment	100kVAC	Maneh Partoe	2002
29	High Voltage Test Equipment	100kVAC / 200kVAC	Iran Insulator Co.	2001
30	High Voltage Test Equipment	100kVAC, 140kVDC, 250kV Impulse	shahin mafsal	2002
31	High Voltage Test Equipment	100 kVAC ,PD detector	Reza Transe Verk	2002
32	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Sakht Nirou Co.	2002
33	High Voltage Test Equipment	100 kVAC ,140kVDC	Pichaz Electric Co.	2002

Continued on the next page

HIGH VOLTAGE TEST EQUIPMENT

JDEVS Reference List

Item	Equipment	Specification	Customer	Year
34	High Voltage Test Equipment	100kVAC, 140kVDC, 125 kV Impulse	E.P.I.L. Co.	2002
35	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Fars Manu. Co.	2002
36	Designing Laboratory & Earting Sys.	100 kVAC, 140kVDC, 125kV Impulse	Electro Kavir Co.	2002
37	High Voltage Test Equipment	100 kVAC	Aras International Elec. Ind.	2002
38	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Kazeroon Azad University	2002
39	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Bojnoord Azad University	2002
40	High Voltage Test Equipment	Accessories	Iran Transfo Co.	2003
41	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Khoram Abad Azad University	2003
42	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Tolid Malzomat Bargh Co.	2003
43	High Voltage Test Equipment	100kVAC	SATHA Co.	2003
44	High Voltage Test Equipment	400kVDC	Tavanir Organization	2003
45	Impulse Generator	200 kV/ 10kj	Iran Transfo Co.	2003
46	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Azar Fonun Tablow Co.	2003
47	High Voltage Test Equipment	170 kV Impulse	Khouzestan Elec. Distribution Co.	2003
48	Voltage Measuring System & Capacitor	100 PF	Kerman Cable Ind.	2003
49	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Khouzestan w & Elec. Org.	2003
50	High Voltage Test Equipment	100kVAC	Kerman Voltage Co.	2003
51	Voltage Measuring Systems & Control Cubicles		Tabesh Tablo Co.	2003

52	Resonance High Voltage Test Equipment	1000 kVA / 125 kV	Tavanir Co.	2003
53	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Tarbyat Dabir University.	2003
54	High Voltage Test Equipment	100kVAC, 250 kV Impulse	Nirou Tablo Co.	2004
55	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Aran Energy Co.	2004
56	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Brojerd Azad University	2004
57	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Boshehr Azad University	2004
58	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Mazandaran Switch board Co.	2004
59	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Vana Sheed Co.	2004
60	High Voltage Test Equipment	100kVAC	Faramin Tablou Co.	2004
61	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Dezfoul Azad University	2004
62	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Sabzevar Azad University	2004
63	High Voltage Test Equipment	100kVAC	Asia Behin Barq Co.	2004
64	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Iran Seabock Co.	2004

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Item	Equipment	Specification	Customer	Year
65	High Voltage Test Equipment	100kVAC, 250 kV Impulse	Modern Electric Ind.	2004
66	High Voltage Test Equipment	100kVAC	Pars Industrial control & Electric Co.	2004
67	High Voltage Test Equipment	100kVAC	Taliran Engineering PJS Co.	2005
68	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Shahr Majlessi Azad University	2005
69	High Voltage Test Equipment	100kVAC	Doroud Kelid Barq Co.	2005
70	Resonance High Voltage Test Equipment	800kVA / 100 kV	Pars Generator Co.	2005
71	High Voltage Test Equipment	100kVAC	Barg Asan Tabriz Co.	2005
72	High Voltage Test Equipment	100kVAC	Phase Kar Eng.	2005
73	High Voltage Test Equipment	100kVAC	Pars Switch Co.	2005
74	Digital Peak Voltmeter (DPV)		Garb Manu. Co.	2005
75	High Voltage Test Equipment	100kVAC, 250 kV Impulse & pd	Tamin Tablo Co.	2005
76	High Voltage Test Equipment	100kVAC,250 KV Impulse	Dalman Co.	2005
77	High Voltage Test Equipment	240 kV Impulse & Monitoring System	Taban Tablou Co.	2005
78	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Rasel Tableau	2005
79	High Voltage Test Equipment	100kVA, 200 kV	Barghe Shokoh Co.	2005
80	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Gonabad Azad University	2005
81	High Voltage Test Equipment	100kVA	Panjtash Co.	2006
82	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Turbo Generator Co.	2006
83	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Tavan Sanat Co.	2006
84	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Nekanovin Co.	2006

85	High Voltage Test Equipment	100kVA, 200 kV	Zanjan Sadaf Gostar Insulator	2006
86	Digital Peak Voltmeter (DPV)		Commercial Co. Iran Transfo	2006
87	High Voltage Test Equipment	100kVAC	Rasan Co.	2006
88	High Voltage Test Equipment	Accessories	Mazandaran University	2006
89	High Voltage Test Equipment	100kVAC, 140kVDC, 240kV Impulse	Zangan Pars electrical Ind.	2006
90	High Voltage Test Equipment	200kVA2, 100kVA	I.T.S.D. Co.	2006
91	High Voltage Test Equipment	100KV AC	Tehran Tablo Co.	2006
92	High Voltage Test Equipment	100KV AC	Tabande Gostar Co.	2006
93	High Voltage Test Equipment	100KV AC	Pars Tableau Co.	2006
94	High Voltage Test Equipment	100KV AC	Azar Tavan Tablou Tabriz Co.	2006
95	High Voltage Test Equipment	100KV AC	Pars Sanat Parand Co.	2006
96	High Voltage Test Equipment	100KV AC	Azar Tablou Co.	2006
97	High Voltage Test Equipment	200KV/ 100 kVA	Iran Transfo After Sales Service Co.	2006
98	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	lavan tablo co	2007
99	High Voltage Test Equipment	100KV AC	Tavan tableau co	2007
100	High Voltage Test Equipment	100KV AC	Sepahan tablo co	2007

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Item	Equipment	Specification	Customer	Year
101	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Electric Faze co	2007
102	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Tablo Dena co	2007
103	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Tak saz tablo co	2007
104	High Voltage Test Equipment	100KV AC	Electrotavansaz co	2007
105	High Voltage Test Equipment	100KV AC	Azaran sanat tabriz co	2007
106	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	N.B.A co	2007
107	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Sharfan tablo co	2007
108	High Voltage Test Equipment	300KV/15KJ& 200KV/100KVAC	NTBPco	2007
109	High Voltage Test Equipment	100KV AC	Fars niroo co	2007
110	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Karoniroo co	2007
111	High Voltage Test Equipment	200kVAC, 140kVDC, 350kV Impulse	Khomeini Shahr Azad University	2007
112	High Voltage Test Equipment	100kVAC	Bargh khazar Ind co	2007
113	High Voltage Test Equipment	100kVAC , 140kVDC, 125kV Impulse	abesh tablo shargh co	2007
114	High Voltage Test Equipment	100kVAC	ATEN	2007
115	High Voltage Test Equipment	100kVAC & 240KV Impulse	Sane shargh co	2007
116	High Voltage Test Equipment	200KV/ 100 kVA	pars maghareh Co.	2007
117	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	niroosahel co	2008
118	High Voltage Test Equipment	200KV/ 100 kVA	tozie irantransfo zangan Co.	2008
119	High Voltage Test Equipment	100KV AC	Alfa Bargh co	2008
120	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	gital co	2008

121	High Voltage Test Equipment	100KV AC	pooya tarh tabloco	2008
122	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Hamedan Azad University	2008
123	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	mazharnour	2008
124	High Voltage Test Equipment	100KV AC	Abgin madar hegmataneh	2008
125	High Voltage Test Equipment	800 kV AC, 200 kVA	Pajoheshgahe Niro	2008
126	High Voltage Test Equipment	100kVAC, 140kVDC, 240kV Impulse	Electro Tabesh co	2009
127	High Voltage Test Equipment	100KV AC	SAHAND TAVAN TABRIZ.co	2009
128	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Gharb Tablo co	2009
129	High Voltage Test Equipment	100KV AC	Arta Tavan Ardabill co	2009
130	High Voltage Test Equipment	100KV AC	Barghgir Pars Co.	2009
131	High Voltage Test Equipment	100kVAC, 140kVDC, 240 kV Impulse	Pars Switch Co.	2009
132	High Voltage Test Equipment	200KV AC	Lajvar co	2009
133	Synthetic High Voltage Test Equipment		Tavanir Co.	2010
134	High Voltage Test Equipment	100KV AC	Tehran Padena Co.	2010
135	High Voltage Test Equipment	100KV AC	Novin Tarh Niro Pars Co.	2010
136	High Voltage Test Equipment	100KV AC	gsg dena Co.	2010
137	High Voltage Test Equipment	75 KV AC portable	Kar Neeroo Co.	2010
138	High Voltage Test Equipment	350KV Impulse	Araniroo Sepahan Co.	2010
139	High Voltage Test Equipment	100KV AC	Parsun Co.	2010
140	High Voltage Test Equipment	100KV AC	Fanavaran Vafa Co.	2010
141	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Shoshtar Azad University	2010
142	High Voltage Test Equipment	75 KV AC portable	Tabesh Electronic Co.	2010
143	High Voltage Test Equipment	100kVAC, 140kVDC, 125kV Impulse	Shabestar Azad University	2010

144 High Voltage Test Equipment	100kVAC / 200kVAC	KIAN Transfo Co.	2011
145 High Voltage Test Equipment	75 KV AC portable	IRAN BARQ Co.	2011
146-High Voltage Test Equipment	100KV AC	ELECTRORAAD Co.	2011

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