بسم الله الرحمن الرحيم

MODULATOR & POWER SUPPLY

FOR

HIGH POWER MICROWAVE TUBE

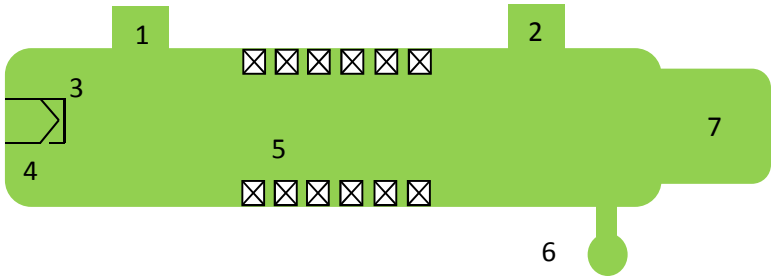
IN

LINAC ACCELERATOR

PULSENIRU

INDUSTRIAL

TWYSTRON TUBE



- 1 RF Input
- 2 RF output
- 3 Cathode
- 4 filament
- 5 Focus Coil
- 6 Ion vacuum pump
- 7 collector

Specification:

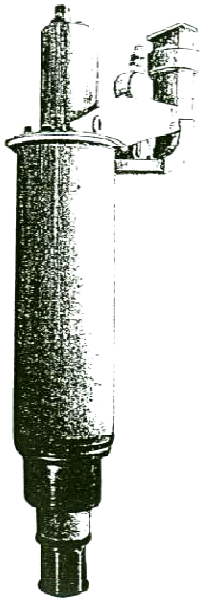
- S-band (2950-3050 MHz)
- Input RF power : 2kW
- Out put RF Power : 2MW
- PRF: 100Hz

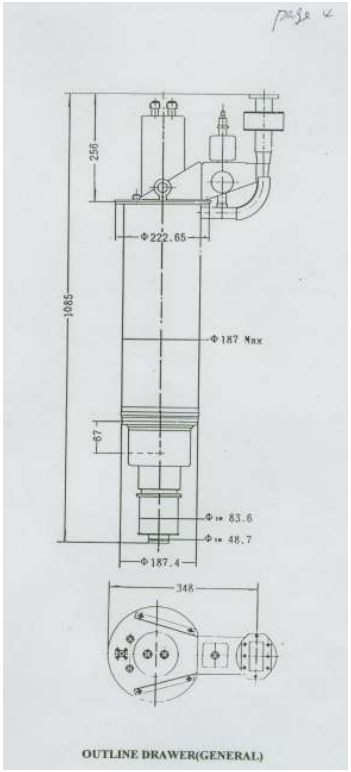
TUBE

KS-37
PULSED TWY'STRON
AMPLIFIER
2.9-3.1 GHz

TECHNICALITY

DESCRIPTION:
KS-37 Twy'stron tube consists of a broadband klystron driver section and an extended interaction traveling wave output section. It is a high pulsed power amplifier which delivers peak output power 1-3 megawatts. High power output, high gain, high efficiency, low noise, broadband performance are this tube's characteristics. When twy'stron is tuned for a 200-Megahertz bandwidth, both gain variation and power output variation are less than 1.5dB.





OUTLINE DRAWER(GENERAL)

TUBE

GENERAL CHARACTERISTICS

OPERATING CONDITIONS AND RATINGS

SPECIFICATION:

-Frequency range	2.9-3.1	GHz
-Output power, peak	2.5	MW
-Output power, average	5	KW
-Gain, at saturation	37	dB
-Bandwidth, 1.5dB	8	%
-Efficiency	35	%

OPERATING:

-Beam voltage, peak	117	KV
-Beam current, peak	80	A
-Pulse duration, beam	7	μs
-Duty cycle, beam	0.002	
-Drive power, peak	450	W
-Heater current	31	A
-Heater warm-up time, minimum	15	Min
-Load VSWR	1.2:1	
-Interelectrode capacitance		
cathode-anode, approximate	40	pf

PHYSICAL:

-Dimensions	See outline drawing	
-Weight,approximate	60	Kg
-Mounting position	Vertical, Cathode down	
-X-Ray shielding	Required	
-RF Connectors	See outline drawing	
-Coolant of collector	Water	
Flow, minimum	31	L/min
Pressure drop, at 39 L/min, Maximum	4	Kgf/cm^2
-Coolant of body	Water	

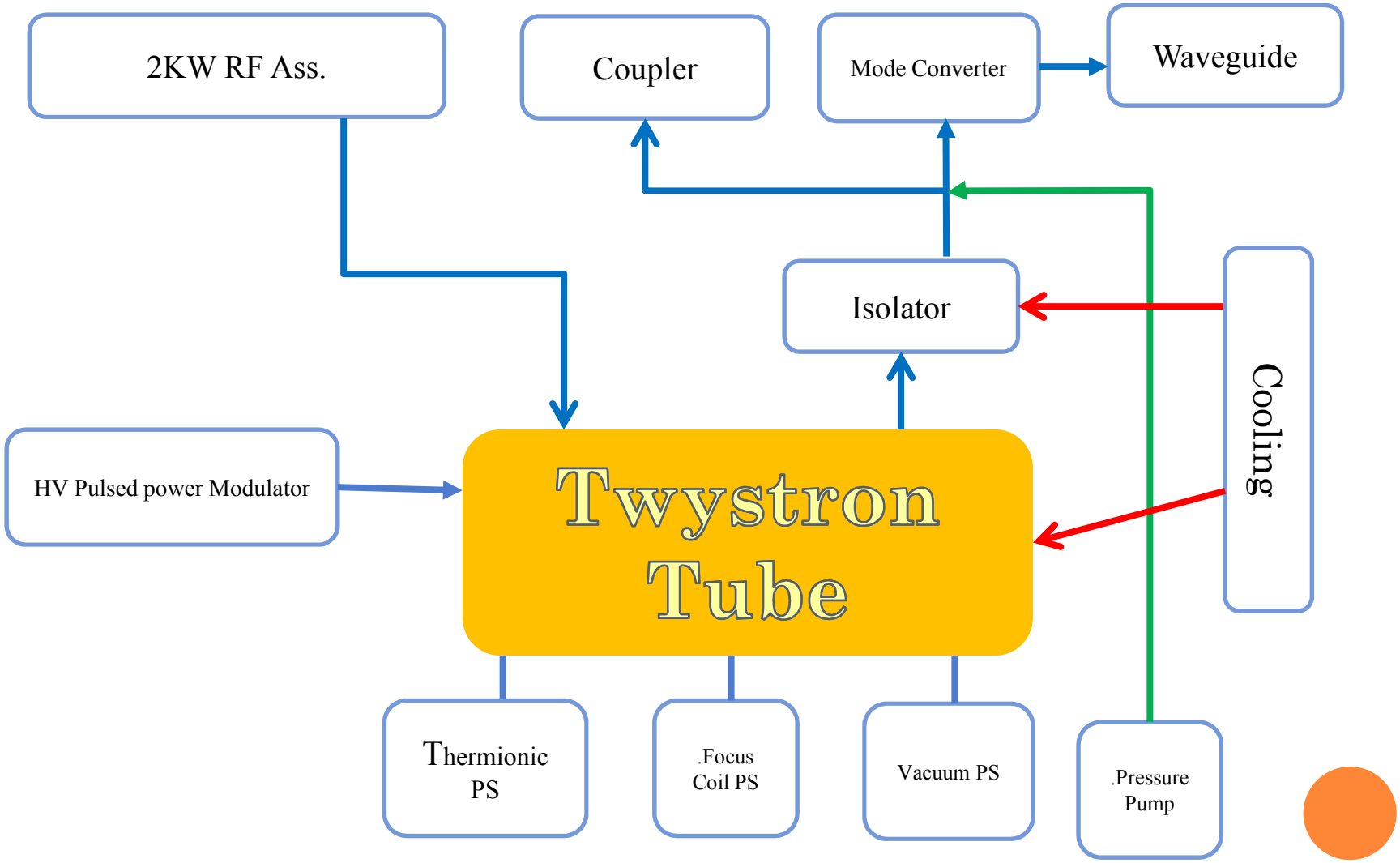
GENERAL CHARACTERISTICS

-Flow, minimum	6	L/min
-Pressure drop, at 6 L/min maximum	1.5	Kgf/cm^2
-Electron gun region	Oil, see outline drawing	

ELECTROMAGNET:

Electromagnet coil type	DZ-37(Equivalant type VA-1525E)	
-Voltage, maximum	270	V
-Current, maximum	11.5	A
-Dimension:		
Height, maximum	62	cm
Diameter, maximum	38.5	cm
-Weight,maximum	210	Kg
-Coolant	Water	
Flow, maximum	5	L/min
Pressure drop, at 5 L/min	1.5	Kgf/cm^2

Driving Assembly Block Diagram



Other Tube Power Supply

Filament Power Supply

Parameter	Value
Voltage	8V
Current	35A
Mode	DC
Type	SMPS

Focus Coil Power Supply

Parameter	Value
Voltage	60V
Current	17A
Mode	DC
Type	SMPS

Vacuum Ion Pump Power Supply

Parameter	Value
Voltage	3kV
Current	20mA
Mode	DC
Type	SMPS

Cooling Assembly

- Thermometers
- Thermostat
- Pressure gauge
- Flow controller
- Circulation pump
- condenser
- Filter Ass.

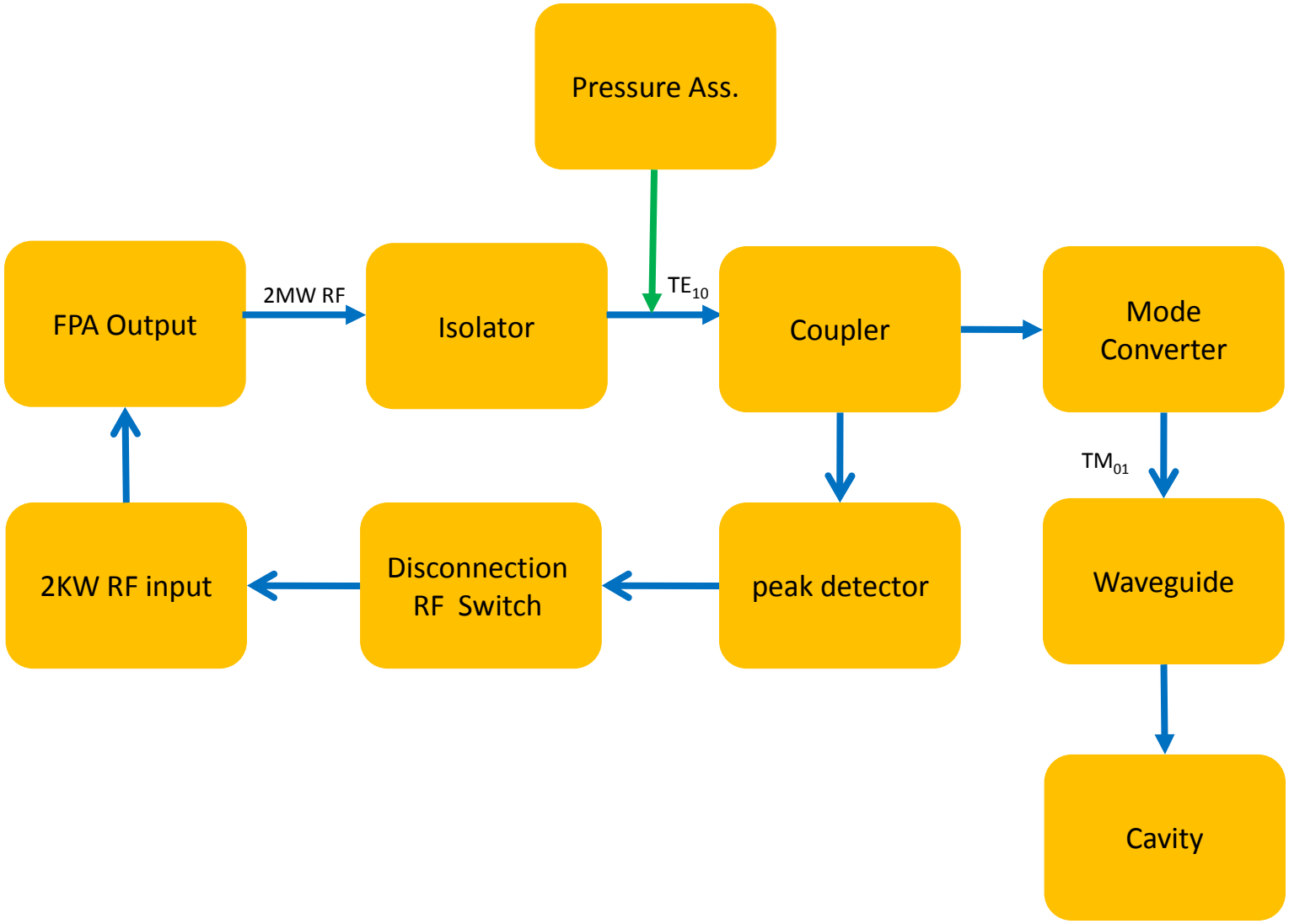
- It uses for cooling both isolator and Twystron Tube

Pressure Assembly

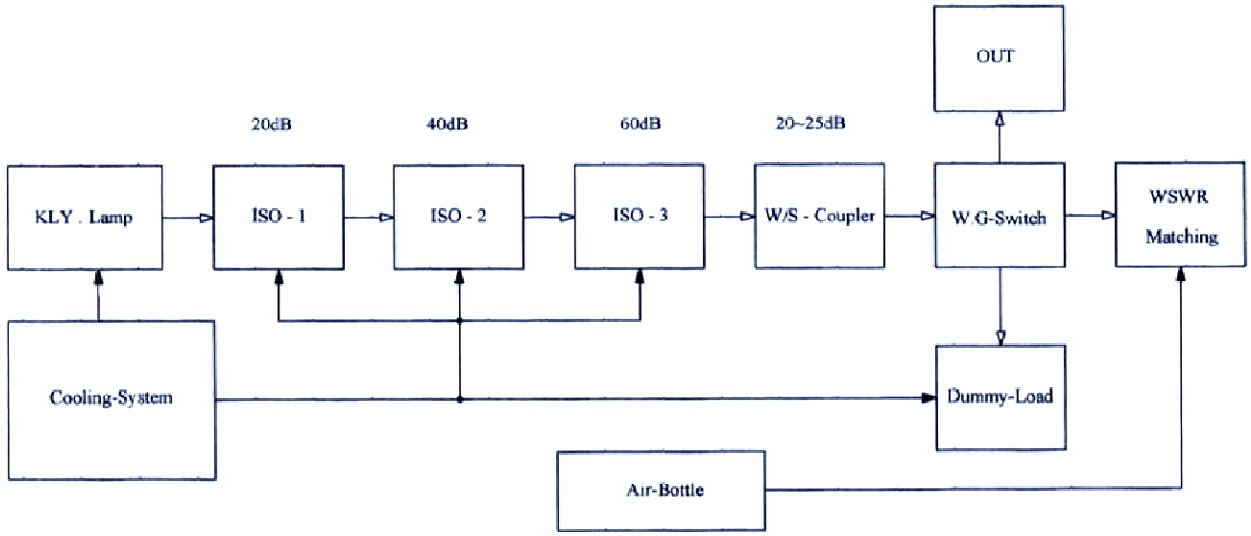
- It uses for pressurizing microwave assemblies after tube

- Storage tank
- manometer
- Circulation pump
- Drying ass.
- Filter ass.

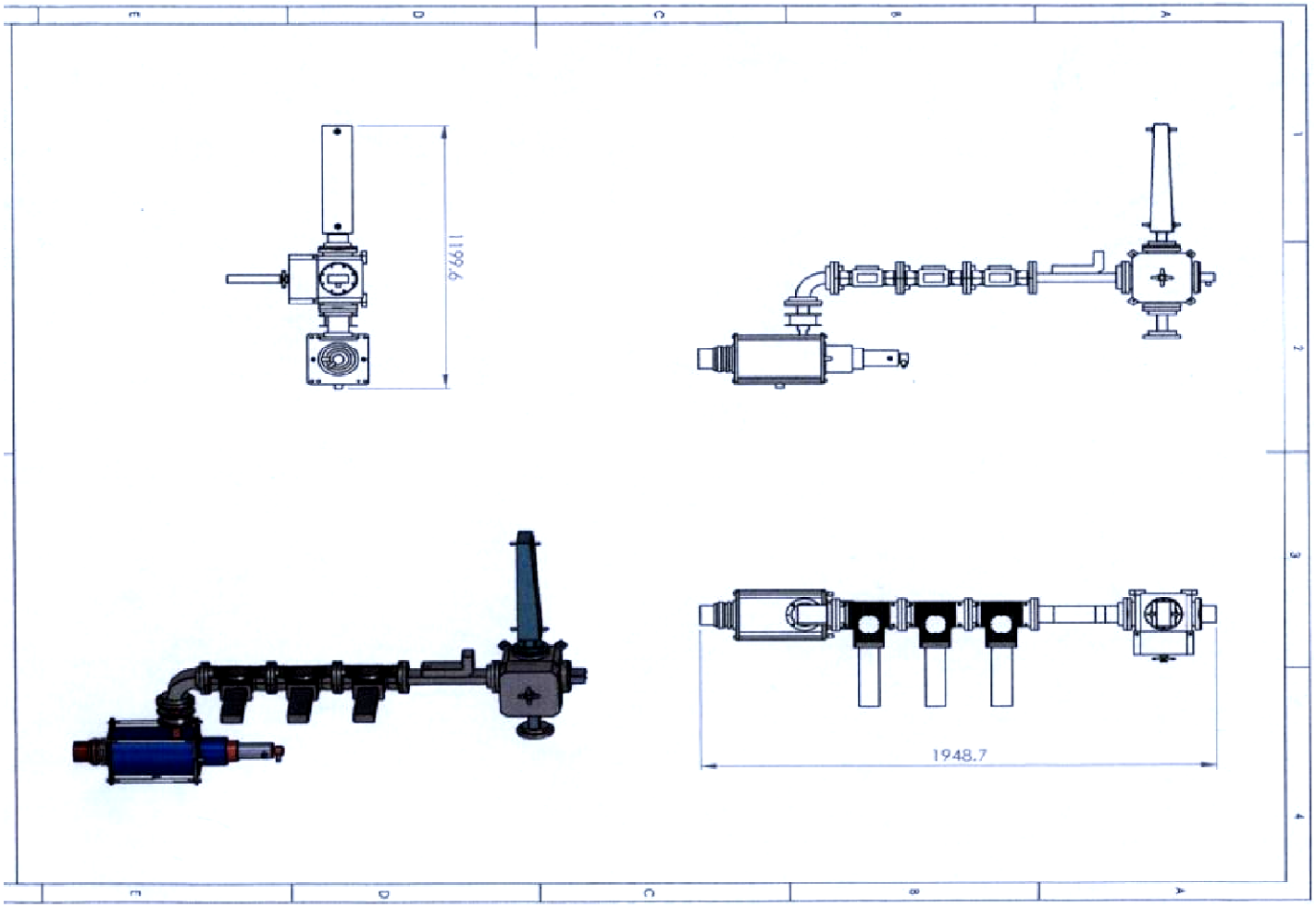
MICROWAVE ASSEMBLY



MICROWAVE ASSEMBLY



Microwave Assembly



Control System

- AC Power
- PS control:
  - Filament Power Supply
  - Focus Coil Power Supply
  - Vacuum Ion Pump Power Supply
  - Pulsed Power Modulator
- RF Reflection control
- Cooling Assembly
- Pressure Assembly

HV Modulator specification

Input:

- 3Ph , 30KVA, 380V ± 15%
- **Temperature:** 0°C ~ 50°C
- **Humidity:** 5% ~ 90% non-condensed

Output:

Filament:

- 27V/100A, ripple 0.25%, η > 80%, short circuit & Over voltage protection

Focus coil:

- 270V/12A, ripple 0.25%, η > 80%, short circuit & Over voltage protection

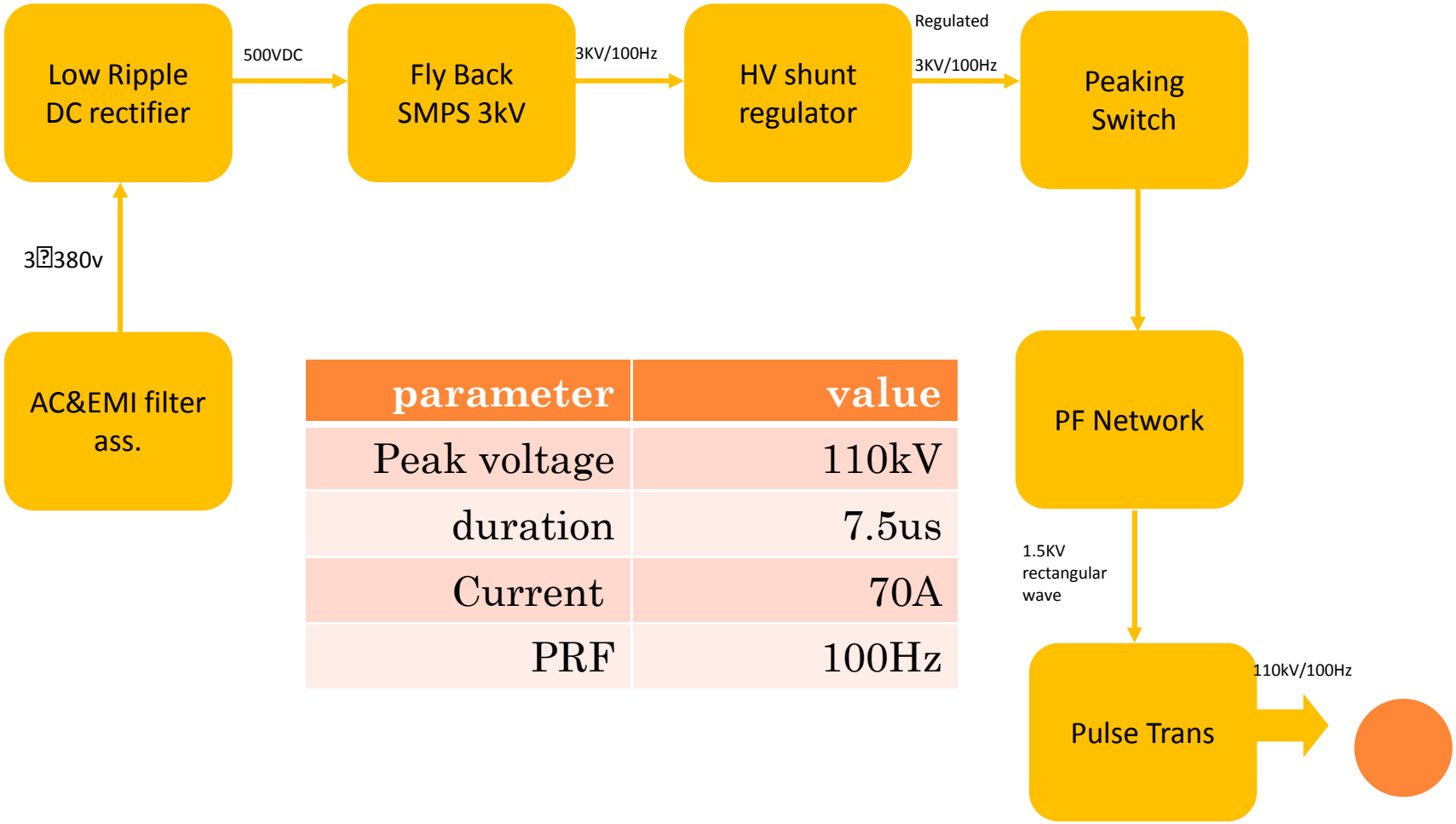
Ion Pump:

- 3KV/20mA, ripple 0.25%, η > 80%, short circuit & Over voltage protection

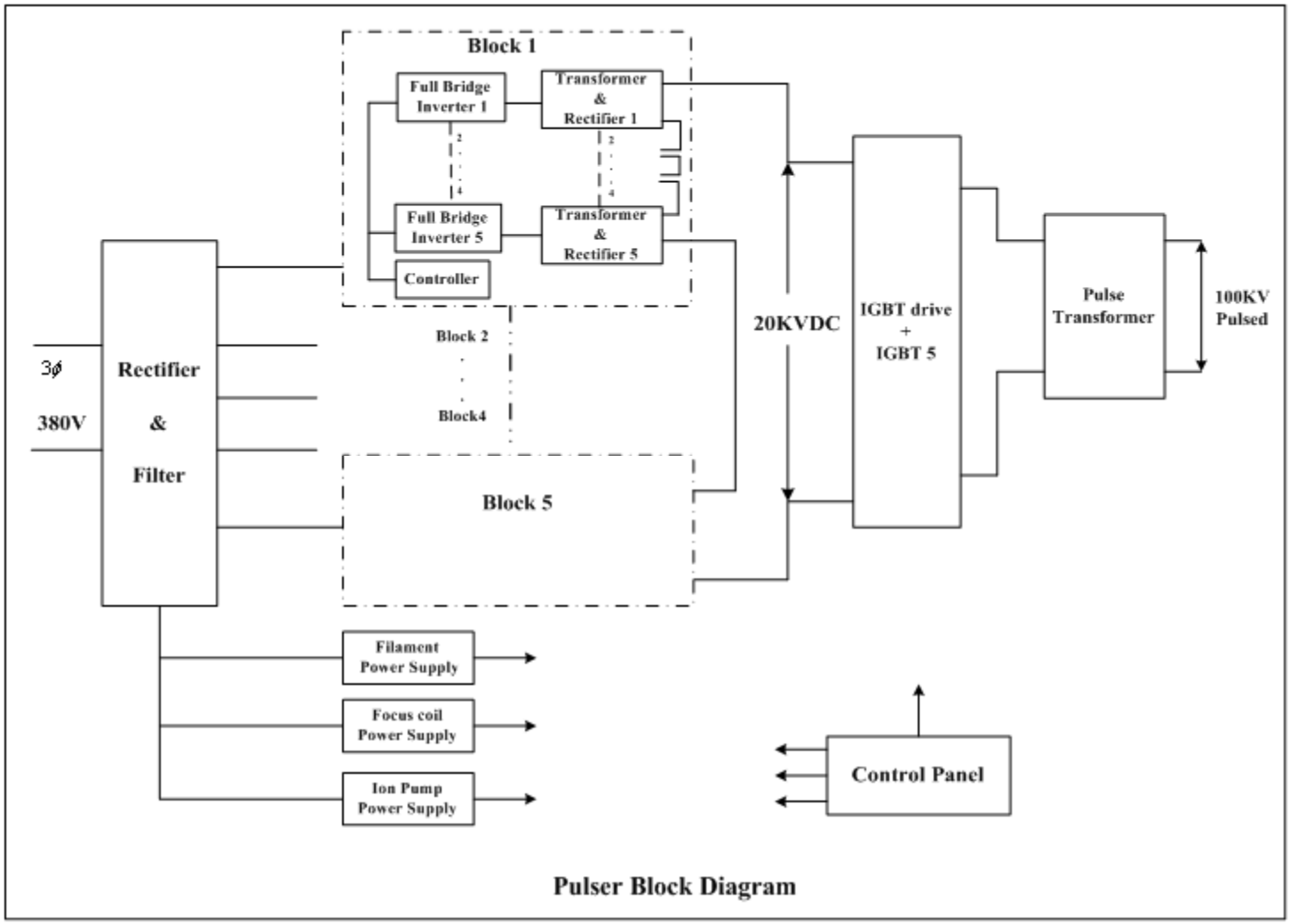
Modulator:

- 115KV adjustable, 80A
- **Pulse duration:** 2 ~ 7μs adjustable
- **Pulse rate:** 80 ~ 120Hz adjustable
- **Ripple:** 0.25%
- **η:** 80%
- **Protection:**
- Short- circuit
- Over voltage
- Filament power on sequence
- Over temperature

HV Pulsed Power Modulator



parameter	value
Peak voltage	110kV
duration	7.5us
Current	70A
PRF	100Hz



Pulser Block Diagram

SYSTEMS SECTIONS :

- **Inverter Section**
- **Pulser Section**
- **Output Pulse Transformer**
- **Filament Power Supply**
- **Focus Coil Power Supply**
- Ion Pump Power Supply
- **Control Panel**

SYSTEMS SECTIONS (CONTINUE)

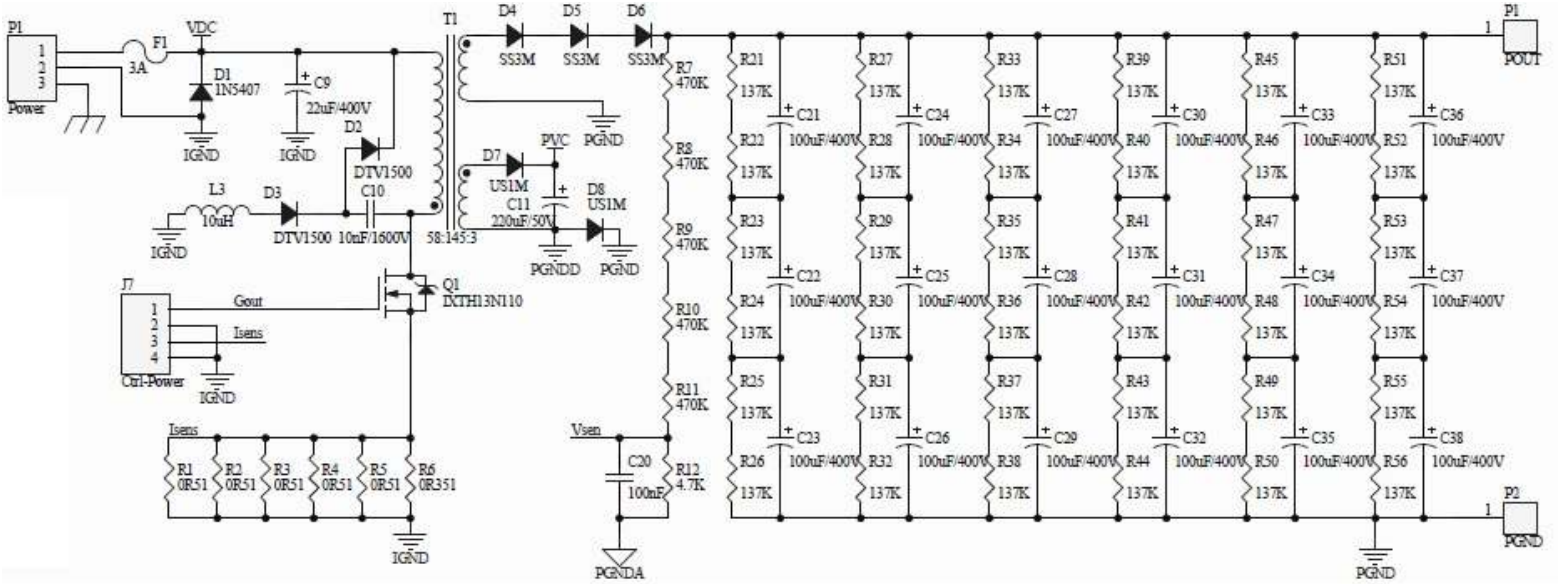
- **Inverter Section**
  - Comprise 6 blocks of Inverter Block
  - Each block comprise 5 inverter module
  - Each block has a inverter controller

INVERTER SECTIONS (CONTINUE)

- **Inverter module**
  - Flyback topology driver
  - Transformer with high isolation withstand
  - High voltage Isolator for feedback
  - Output Rectifier
  - Output Filter
  - Control Circuit
  - Output up to 1KV

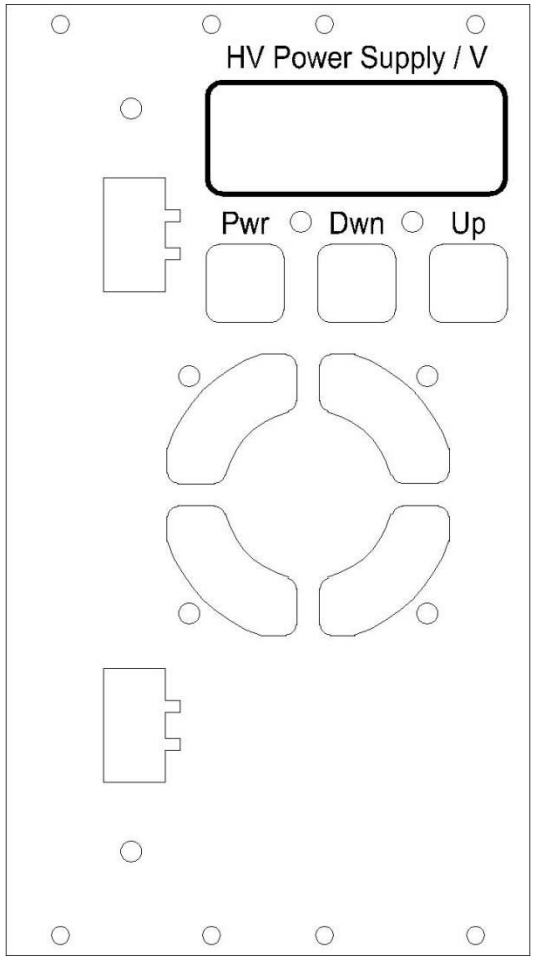
INVERTER SECTIONS (CONTINUE)

- **Inverter module**



INVERTER SECTIONS (CONTINUE)

- **Inverter module**

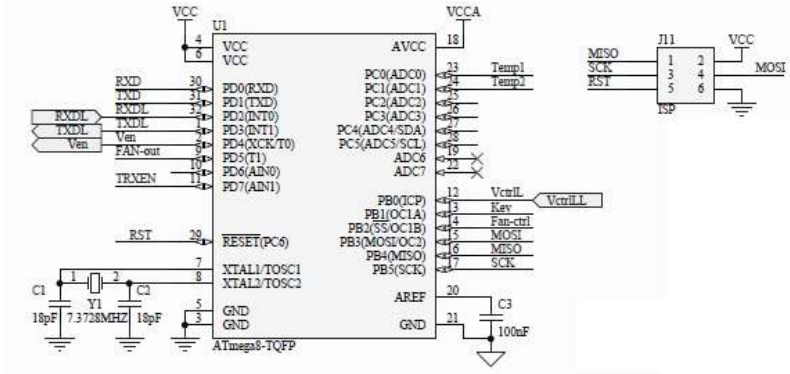


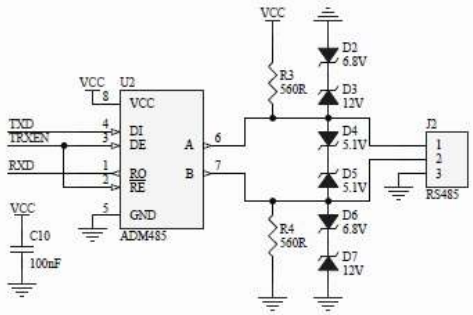
INVERTER SECTIONS (CONTINUE)

- **Inverter controller**
  - Input filter
  - PFC (Power Factor Corrector)
  - Rectifier
  - Output : constant HVDC
  - Controller
  - Interface : 2-way
  - Interface 1: with inverter modules
  - Interface 2: with control panel

INVERTER SECTIONS (CONTINUE)

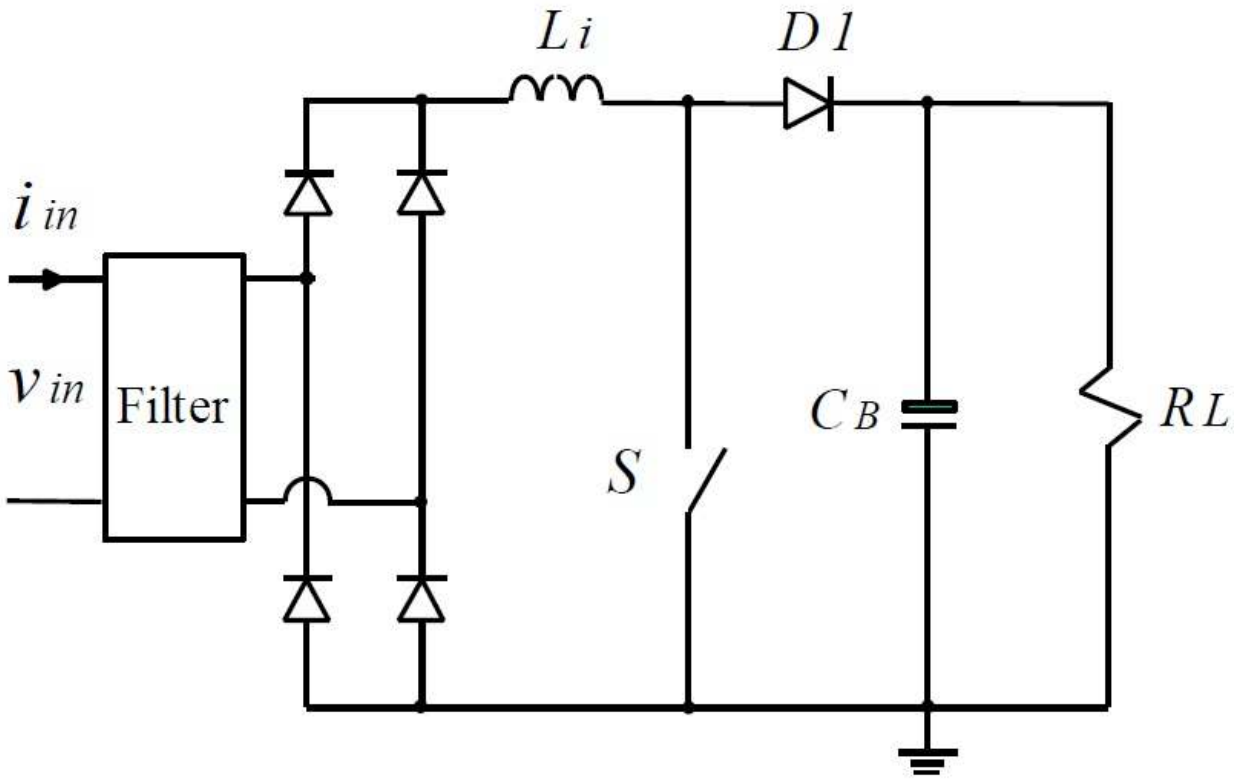
- **Inverter controller**





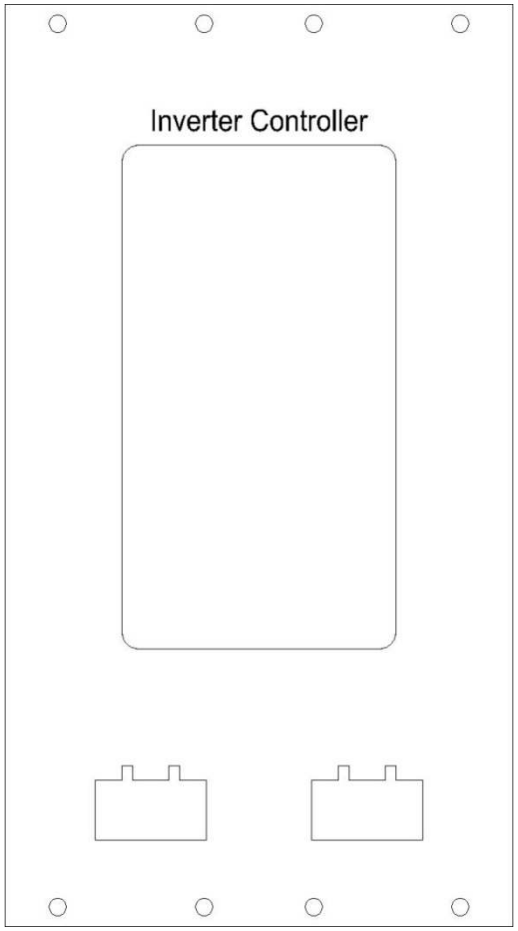
INVERTER SECTIONS (CONTINUE)

- **Inverter controller power stage**



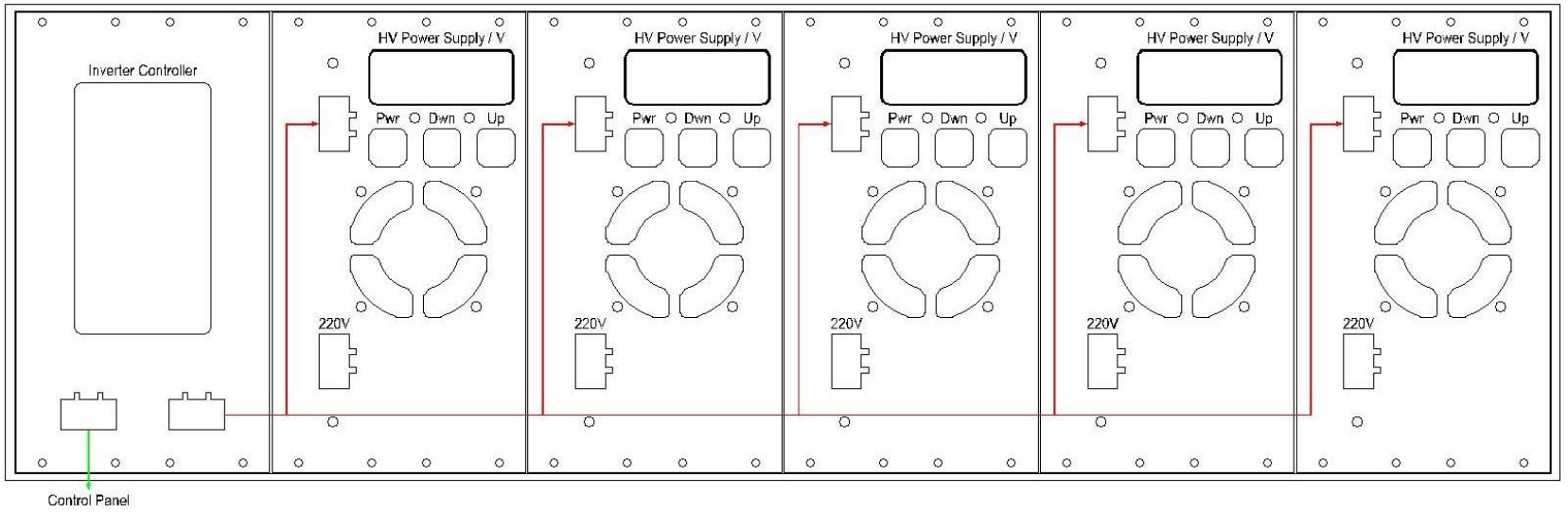
Inverter Sections (Continue)

- **Inverter controller**



INVERTER SECTIONS (CONTINUE)

- **Inverter module**



SYSTEMS SECTIONS (CONTINUE)

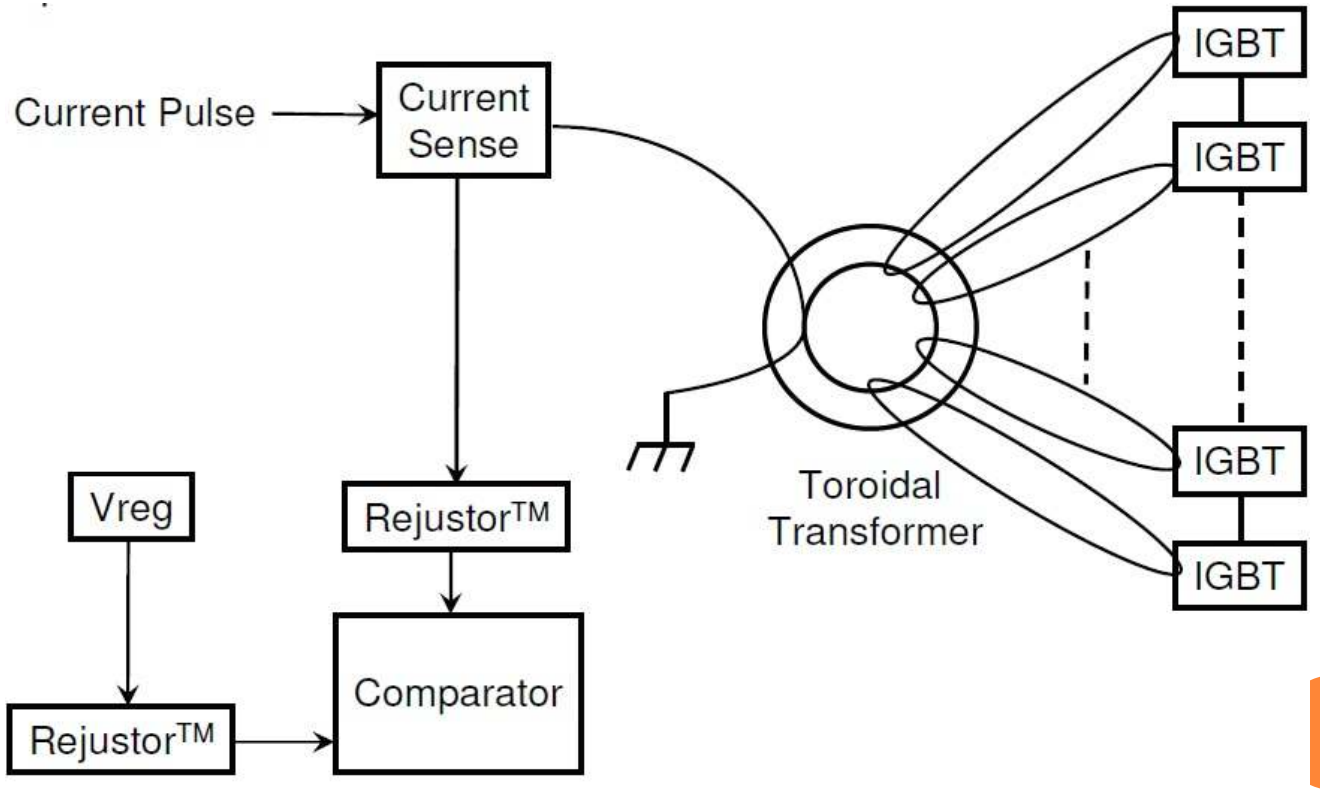
- **Pulser Module**
  - IGBT driver
  - IGBT device
  - Control Circuit

Any IGBT block comprise 5 IGBT module

System consist of 6 IGBT block

SYSTEMS SECTIONS (CONTINUE)

- **Pulser Module**



SYSTEMS SECTIONS (CONTINUE)

- **Filament Power Supply**
  - Input filter
  - PFC (Power Factor Corrector)
  - Rectifier
  - Full bridge driver
  - Full bridge MOSFET
  - Transformer
  - Output Rectifier
  - Output Filter
  - Control Circuit

SYSTEMS SECTIONS (CONTINUE)

- **Focus Coil Power Supply**
  - Input filter
  - PFC (Power Factor Corrector)
  - Rectifier
  - Full bridge driver
  - Full bridge MOSFET
  - Transformer
  - Output Rectifier
  - Output Filter
  - Control Circuit

SYSTEMS SECTIONS (CONTINUE)

- **Ion Pump Power Supply**
  - Input filter
  - PFC (Power Factor Corrector)
  - Rectifier
  - Full bridge driver
  - Full bridge MOSFET
  - Transformer
  - Output Rectifier
  - Output Filter
  - Control Circuit