

<b>Title</b>	<b>Tender No. I-I/ET-TPT/23004/23-24 dated 26-09-2023 for Supply of 70kV Thyatron Unit with its Compatible Driver Module for Crowbar Application</b>
<b>Subtitle</b>	<b>PART-A(II): Scope of Supply, Scope of Work and Technical Specifications</b>

ITER-India, Institute for Plasma Research  
Block-A, Sangath Skyz, Bhat-Motera Road, Koteswar  
Ahmedabad- 380005, Gujarat State, India



## Table of Contents

List of Figures.....	3
List of Tables .....	3
1. Introduction.....	4
1.1 Description .....	4
1.2 Circuit Schematic .....	4
2. Scope of Supply .....	5
2.1 Hardware Deliverables .....	5
2.2 Document Deliverables .....	5
3. Technical Specifications.....	5
3.1 Important Notes .....	5
3.2 Technical Specifications of the Thyatron Tube .....	5
3.3 Technical Specifications of the Driver Module.....	6
4. Pre-Dispatch Inspection Report .....	6
5. Site Acceptance Tests.....	6
6. Technical Compliance Format .....	7
6.1 For Thyatron Device .....	7
6.2 For Driver Module .....	8

## List of Figures

Figure 1 Circuit schematic of the Application Installation .....	4
Figure 2 Simplified View of the Circuit schematic of the Application Installation .....	4

## List of Tables

Table 1 List of Hardware Deliverables .....	5
Table 2 List of Document Deliverables (Essentially in English) .....	5
Table 3 Technical Specifications of the Thyatron Tube .....	5
Table 4 Technical Specifications of the Driver Module .....	6

## 1. Introduction

### 1.1 Description

Gyrotron is a vacuum electronic device employed for generating high power high frequency RF power. Major specifications of the Gyrotron tube are 1MW Continuous, 170GHz. This Gyrotron is employed to aid the plasma heating application. In order to assist in the acceleration of electron beam two different power supplies viz., Main High Voltage Power Supply (MHVPS) & Body Power Supply (BPS) are being used. During the Gyrotron system operation, under any critical faults it is mandatory to switch off both the High Voltage Power Supplies (HVPSs) in fast time scales ( $< 10 \mu s$  which) which otherwise could damage the Gyrotron tube. This mandates us to have protection system that can divert the fault energy from dumping onto Gyrotron. We intend to procure a Thyatron switch & its compatible driver for protecting the Gyrotron in cathode circuit (MHVPS).

### 1.2 Circuit Schematic

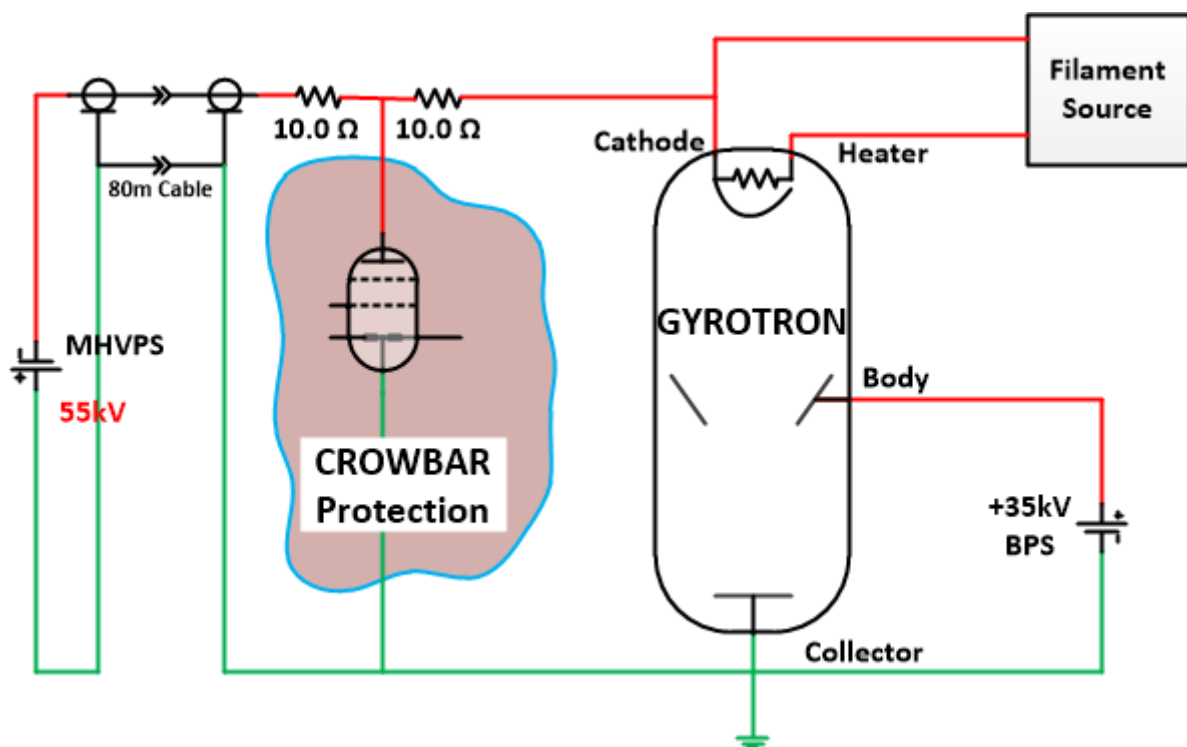


Figure 1 Circuit schematic of the Application Installation

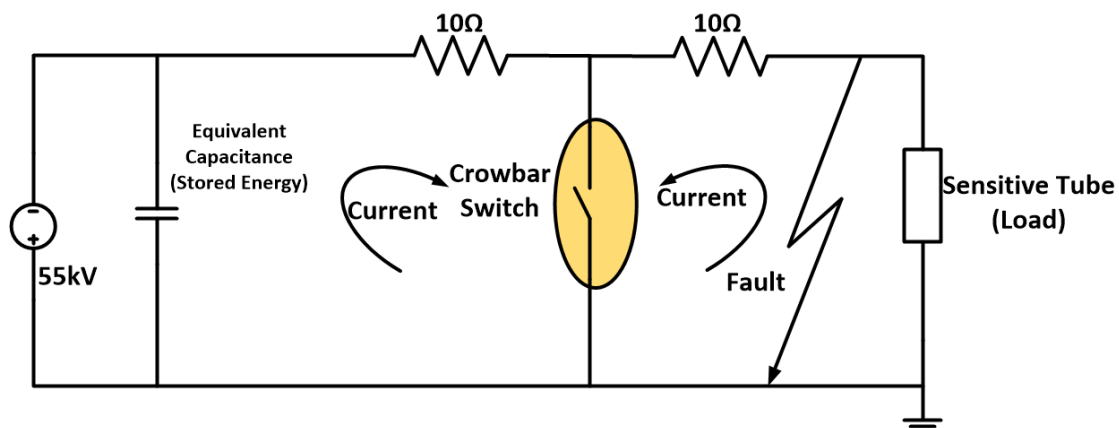



Figure 2 Simplified View of the Circuit schematic of the Application Installation

	<b>Supply of 70kV Thyatron Unit with its Compatible Driver Module for Crowbar Application</b>	<b>Tender No.</b>
		I-I/ET-TPT/23004/23-24

## 2. Scope of Supply

### 2.1 Hardware Deliverables

S.No	Name of Item	Qty
1.	Thyatron Unit with necessary mounting & connecting accessories	2 Set
2.	Driver Module Compatible with the offered Thyatron Tube	2 Set

Table 1 List of Hardware Deliverables

### 2.2 Document Deliverables

S.No	Name of Item	Qty
1.	Factory Test/Inspection Reports	1 Nos
2.	Operation/Instruction manual	1 Nos

Table 2 List of Document Deliverables (Essentially in English)

## 3. Technical Specifications


### 3.1 Important Notes

- The Thyatron Tube & Driver Module offered/supplied are to be mandatorily compatible with each other.
- A set of accessories which are not specified but are necessary for the operating the items are to be supplied along with the items.

### 3.2 Technical Specifications of the Thyatron Tube

S.No	Parameter	Value
1.	Model & Make	Specify
2.	Application	Crowbar
3.	Peak Forward anode voltage	≥70 kV
4.	Peak forward anode current	≥50 kA
5.	Peak reverse anode current	≥ 5kA
6.	Pulse repetition rate	≥ 0.5 Hz
7.	Heater Reservoir Voltage	Specify
8.	Heater Reservoir Current (at nominal heater voltage)	Specify
9.	Heater Grid current (at nominal grid Voltage)	Specify
10.	Peak open circuit trigger voltage	Specify
11.	Peak trigger current,	Specify
12.	Trigger current pulse duration,	Specify
13.	Anode Dissipation Factor	Specify in watts
14.	Housing	Specify
15.	Mounting & Terminations	Specify
16.	Dimensions	Specify
17.	Tube warm-up time, minutes	Specify
18.	Additional Accessories	Mounting brackets, Clamps, any other arrangements, etc are to be provided along with unit

Table 3 Technical Specifications of the Thyatron Tube

 <b>ITER-India</b>	<b>Supply of 70kV Thyatron Unit with its Compatible Driver Module for Crowbar Application</b>	<b>Tender No.</b>
		I-I/ET-TPT/23004/23-24

### 3.3 Technical Specifications of the Driver Module

The following technical specifications of Driver module are to be compatible for the smooth interface & operations with the Thyatron offered above.

S.No	ITER-India Requirement	
1.	Model & Make	Specify
2.	Number of Heater Channels	_____ Nos (Specify in numbers)
3.	Heater DC Voltage	These specifications are to be mandatorily compatible with the offered Thyatron Tube as above. Also furnish specifications along supporting datasheet.
4.	Heating Current	
5.	Number of <i>Trigger pulse channel s</i>	
6.	Pulse trigger Voltage (Open Circuit)	
7.	Peak Trigger Current	
8.	Output Pulse Duration	
9.	Rate of rise of output pulse voltage	
10.	Repetition rate, Hz	
11.	Fiber optic channel for Triggering	
12.	Specify Fiber optic channel interface	
13.	External triggering pulse voltage	
14.	External triggering pulse current	
15.	External triggering pulse duration	
16.	Supply Voltage	Single Phase 230V $\pm$ 10%, 50Hz
17.	Dimensions	Specify
18.	Mounting & Terminations	Specify
19.	Additional Accessories	Reservoir cables, Trigger Pulse Cables, HVU cables to Thyatron, power cables, etc of standard length to be provided along with unit

Table 4 Technical Specifications of the Driver Module


### 4. Pre-Dispatch Inspection Report

A test/inspection report shall be submitted to ITER-India for its review and approval prior to delivery.

### 5. Site Acceptance Tests

After the receipt of the unit at ITER-India site, ITER-India shall conduct performance tests on the Thyatron & driver module. Upon successful completion of the tests (after resolving issues completely, if any) at site, a final acceptance note shall be issued by ITER-India. The date of issuance of final acceptance note shall be considered as the date of final acceptance. The general tests such as following shall be conducted.

- (i) Visual inspection
- (ii) Check for accessories interfaces etc.
- (iii) High Voltage Withstand tests
- (iv) Functional tests

	<b>Supply of 70kV Thyatron Unit with its Compatible Driver Module for Crowbar Application</b>	<b>Tender No.</b>
		I-I/ET-TPT/23004/23-24

Supplier may provide support remotely for site installation & acceptance testing of the unit at the ITER-India's site ***if needed.***

## 6. Technical Compliance Format

The supplier must fill, sign, and stamp the below table as part of compliance to the requirements.

### 6.1 For Thyatron Device

S.No	Parameter	Value	Offered Values (To be filled by bidder)	Remarks (to be filled by the Supplier)
1.	Model & Make	Specify		
2.	Application	Crowbar		
3.	Peak Forward anode voltage	$\geq 70$ kV		
4.	Peak forward anode current	$\geq 50$ kA		
5.	Peak reverse anode current	$\geq 5$ kA		
6.	Pulse repetition rate	$\geq 0.5$ Hz		
7.	Heater Reservoir Voltage	Specify		
8.	Heater Reservoir Current (at nominal heater voltage)	Specify		
9.	Heater Grid current (at nominal grid Voltage)	Specify		
10.	Peak open circuit trigger voltage	Specify		
11.	Peak trigger current,	Specify		
12.	Trigger current pulse duration,	Specify		
13.	Anode Dissipation Factor	Specify in watts		
14.	Housing	Specify		
15.	Mounting & Terminations	Specify		
16.	Dimensions	Specify		
17.	Tube warm-up time, minutes	Specify		
18.	Additional Accessories	Mounting brackets, Clamps, any other arrangements, etc are to be provided along with unit		

## 6.2 For Driver Module

S.No	ITER-India Requirement		Offered Values (To be filled by bidder)	Remarks (to be filled by the Supplier)
1.	Model & Make	Specify		
2.	Number of Heater Channels	_____Nos (Specify in numbers)		
3.	Heater DC Voltage	These specifications are to be mandatorily compatible with the offered Thyatron Tube as above. Also furnish specifications along supporting datasheet.		
4.	Heating Current			
5.	Number of <i>Trigger pulse channels</i>			
6.	Pulse trigger Voltage (Open Circuit)			
7.	Peak Trigger Current			
8.	Output Pulse Duration			
9.	Rate of rise of output pulse voltage			
10.	Repetition rate, Hz			
11.	Fiber optic channel for Triggering			
12.	Specify Fiber optic channel interface			
13.	External triggering pulse voltage			
14.	External triggering pulse current			
15.	External triggering pulse duration			
16.	Supply Voltage	Single Phase 230V $\pm 10\%$ , 50Hz		
17.	Dimensions	Specify		
18.	Mounting & Terminations	Specify		
19.	Additional Accessories	Reservoir cables, Trigger Pulse Cables, HVU cables to Thyatron, power cables, etc of standard length to be provided along with unit		

Company (Bidder) Name \_\_\_\_\_

Bidder's Representative Name \_\_\_\_\_

Representative's Designation \_\_\_\_\_

Representative's Sign \_\_\_\_\_

Date \_\_\_\_\_ Company's Seal \_\_\_\_\_