Fusion Reactor | ATM10

> **Introduction**
> The **Fusion Reactor** is Mekanism's end-game multiblock power generator capable of producing enormous amounts of energy through nuclear fusion. Unlike the Fission Reactor, the Fusion Reactor cannot melt down, making it one of the safest large-scale power generation methods available in **All The Mods 10**.
> This guide explains how to construct the reactor, understand the Reactor Controller, produce D-T Fuel, ignite the reaction, and maintain continuous power generation.

Overview

The Fusion Reactor consumes **D-T Fuel** (Deuterium-Tritium Fuel) to sustain a fusion reaction. Once ignited, it continuously generates energy while fuel is supplied.

The reactor can operate in one of two modes:

- **Passive Mode** - Generates FE directly.
- **Water-Cooled Mode** - Produces Steam for an Industrial Turbine, resulting in significantly higher power output.

Feature	Fusion Reactor
Meltdown Risk	None
Fuel Type	D-T Fuel
Power Output	Very High
Cooling Options	Passive or Water-Cooled
Ignition Required	Yes

Required Components

Before constructing the Fusion Reactor, gather the following components.

Component	Required	Purpose
Fusion Reactor Controller	✔	Controls the multiblock and displays reactor information.

Component	Required	Purpose
Fusion Reactor Frame	✔	Forms the reactor casing.
Fusion Reactor Port	✔	Transfers fluids, gases and energy.
Laser Focus Matrix	✔	Required for laser ignition.
Fusion Reactor Logic Adapter	Optional	Provides automation and redstone control.

Building the Reactor

Construct the multiblock structure exactly as shown in JEI. The interior of the reactor must remain completely hollow for the structure to form correctly.

Once construction is complete, right-click the **Fusion Reactor Controller**.

> **Information**
> If the multiblock has been assembled correctly, the controller will display **Structure Formed**. If it reports **Structure Incomplete**, verify that:
>
> - Every required Fusion Reactor Frame has been placed.
> - The interior is completely hollow.
> - A Laser Focus Matrix has been installed.
> - At least one Fusion Reactor Port is present.

Reactor Controller

The Reactor Controller provides access to all reactor information and settings. Right-click the Controller to open its interface.

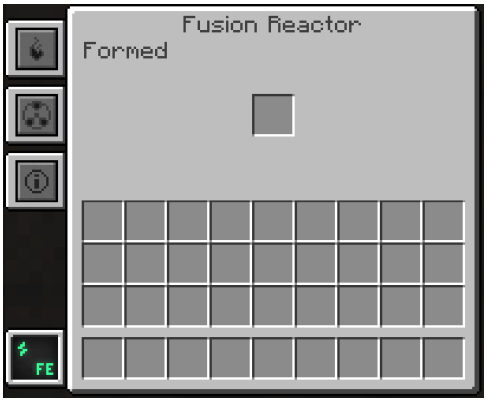
Main Screen

The Main Screen displays the overall status of the Fusion Reactor.

- Structure status
- Charged Hohlraum slot
- Access to the Heat, Fuel and Statistics tabs

The text displayed at the top of the interface indicates whether the reactor structure is correctly assembled.

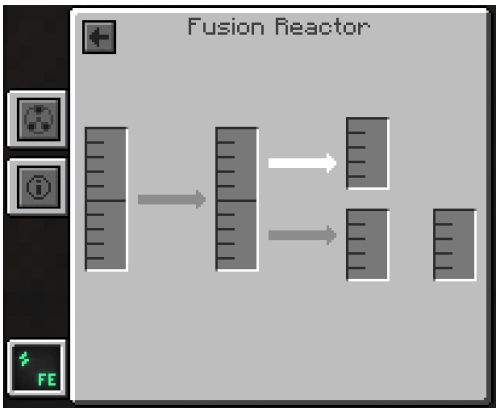
> **Important**
> The Main Screen contains a single inventory slot. A **Charged Hohlraum** must be inserted into this slot before a laser can ignite the Fusion Reactor.



Heat Tab

The Heat tab displays the reactor's operating temperatures and internal storage.

Indicator	Description
Plasma Temperature	Current plasma temperature inside the reactor.
Case Temperature	Temperature of the reactor casing.
Internal Energy	Current FE stored within the reactor.
Water	Amount of water stored for cooling.
Steam	Steam currently stored inside the reactor.

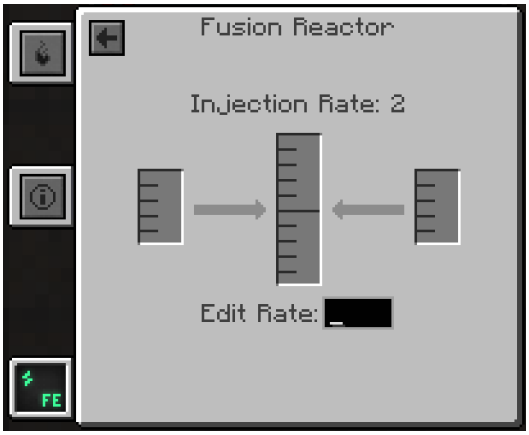


Fuel Tab

The Fuel tab displays the reactor's fuel supply and current Injection Rate.

Tank	Contents
Left	Deuterium
Centre	D-T Fuel
Right	Tritium

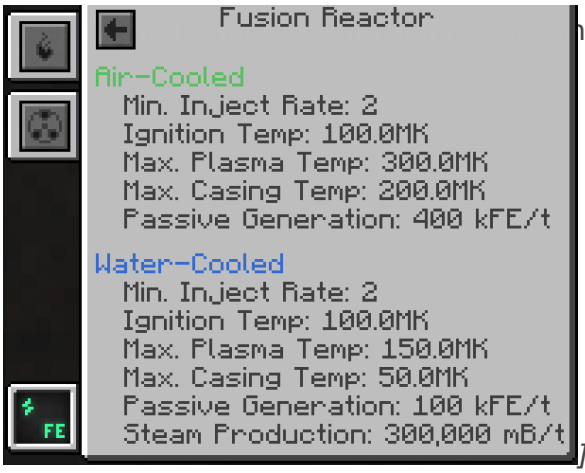
The reactor consumes Deuterium and Tritium at a rate equal to **half of the current Injection Rate per tick**.



Statistics Tab

The Statistics tab displays technical information about the reactor.

- Current Injection Rate
- Maximum Plasma Temperature
- Passive FE Generation
- Steam Production



ng reactor performance and tuning power output.

Producing D-T Fuel

The Fusion Reactor requires **D-T Fuel** to sustain the fusion reaction. D-T Fuel is produced by combining **Deuterium** and **Tritium** in a Chemical Infuser.

Both gases are produced from Water using Mekanism's gas processing machines.

> **Information**
> Producing Tritium can take significantly longer than Deuterium due to the Solar Neutron Activator only operating during the daytime. Consider building multiple Solar Neutron Activators to increase production.

Producing Tritium

Tritium is produced by converting Hydrogen inside a Solar Neutron Activator.

Step 1 - Produce Hydrogen

Supply Water to an **Electrolytic Separator**.

The machine separates Water into:

- Hydrogen
- Oxygen

Only the Hydrogen output is required for Tritium production.

Step 2 - Convert Hydrogen into Tritium

Pipe the Hydrogen into a **Solar Neutron Activator**.

The Solar Neutron Activator requires:

- Direct access to the sky.
- Daylight.

The Hydrogen will gradually be converted into **Tritium**.

Producing Deuterium

Deuterium is produced by condensing Hydrogen into its liquid form.

Step 1 - Produce Hydrogen

Supply Water to an **Electrolytic Separator**.

Collect the Hydrogen output.

Step 2 - Condense the Hydrogen

Pipe the Hydrogen into a **Rotary Condensentrator**.

Set the Rotary Condensentrator to **Condensentrating Mode**.

The Hydrogen will be converted into **Deuterium**.

Producing D-T Fuel

Once both gases have been produced, they can be combined into D-T Fuel.

Input	Machine	Output
Deuterium + Tritium	Chemical Infuser	D-T Fuel

Insert both gases into the Chemical Infuser and it will continuously produce **D-T Fuel**.

Charging a Hohlraum

The **Hohlraum** is a critical item used to ignite the Fusion Reactor.

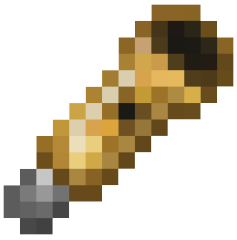
Without a **Charged Hohlraum**, the Fusion Reactor cannot be started using lasers.

Charging the Hohlraum

To charge a Hohlraum:

1. Produce at least **10 mB** of D-T Fuel inside a Chemical Infuser.
2. Insert an empty **Hohlraum** into the centre slot of the Chemical Infuser.
3. The Hohlraum will absorb the fuel and become a **Charged Hohlraum**.
4. Remove the Charged Hohlraum and insert it into the inventory slot of the **Fusion Reactor Controller**.

> **Important**
> A Charged Hohlraum is consumed when the Fusion Reactor is successfully ignited. If the reactor shuts down in the future, another Charged Hohlraum will be required to restart it.



Preparing for Ignition

Before attempting to start the Fusion Reactor, verify that all of the following requirements have been met.

Requirement	Status

Fusion Reactor Structure Formed	Required
Laser Focus Matrix Installed	Required
Charged Hohlraum Installed	Required
D-T Fuel Available	Required
Laser Amplifier or Heat Source	Required

> **Tip**
> Keep one or more Charged Hohlraums stored nearby. If the reactor is shut down for maintenance or runs out of fuel, you'll be able to restart it immediately without waiting for another Hohlraum to charge.

Starting the Fusion Reaction

Unlike most Mekanism generators, the Fusion Reactor does not start automatically. Before the fusion reaction can begin, the reactor's plasma must reach **100 MK (100 Million Kelvin)** while a **Charged Hohlraum** is installed inside the Reactor Controller.

Once ignited, the Charged Hohlraum is consumed and the reactor will begin generating power while continuously consuming D-T Fuel.

Method 1 - Laser Ignition (Recommended)

Laser ignition is the fastest and most commonly used method of starting a Fusion Reactor.

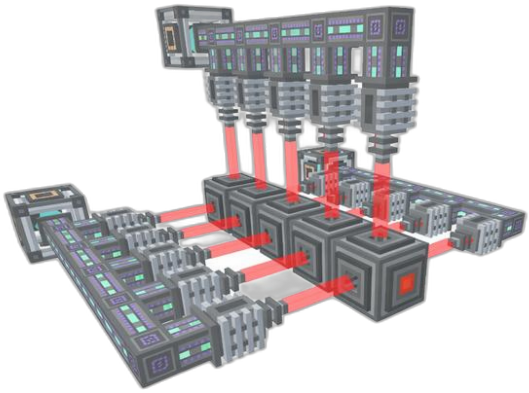
Requirements

Requirement	Minimum
Charged Hohlraum	1
Laser Amplifier Energy	1 GFE
Laser Focus Matrix	Installed

Ignition Steps

1. Insert a Charged Hohlraum into the Reactor Controller.
2. Charge a Laser Amplifier until it contains at least **1 GFE**.
3. Aim one or more Lasers into the Laser Amplifier.
4. Set the Laser Amplifier Redstone Mode to **Normal**.

5. Trigger the amplifier with a Button or Redstone signal.
6. The stored laser energy will fire into the Laser Focus Matrix and instantly ignite the reactor.



> **Tip**
> Leave the Laser Amplifier connected after ignition. Keeping it charged allows the reactor to be restarted immediately if it ever shuts down.

Power Generation Modes

The Fusion Reactor supports two operating modes.

Mode	Output	Recommended For
Passive Mode	FE	Simple power generation
Water-Cooled Mode	Steam	Industrial Turbine setups

Passive Mode

Passive Mode produces FE directly from the reactor.

- Simple to set up.
- No Steam management required.
- Ideal for smaller installations.

Water-Cooled Mode

Supplying Water to the reactor enables Water-Cooled Mode.

The reactor converts Water into Steam, which can then be sent into an **Industrial Turbine**.

This configuration produces considerably more usable power than Passive Mode and is recommended for most late-game bases.

Maintaining the Reactor

Once ignited, the Fusion Reactor will continue operating as long as it has a continuous supply of fuel.

Fuel Production

- Keep Electrolytic Separators supplied with Water.
- Ensure Solar Neutron Activators have direct access to the sky.
- Keep Rotary Condensentrators and Chemical Infusers powered.
- Maintain a reserve of D-T Fuel inside Chemical Tanks.

Injection Rate

The Injection Rate determines how much fuel is consumed every tick.

Higher Injection Rate	Effect
Fuel Consumption	Increases
Power Output	Increases
Steam Production	Increases

> **Information**
> Only increase the Injection Rate once your Deuterium and Tritium production can continuously supply the reactor. Running out of fuel will cause the reactor to shut down.

Troubleshooting

Problem	Possible Cause	Solution
Structure Incomplete	Missing or incorrectly placed blocks.	Verify the multiblock matches the JEI structure.
Reactor Will Not Ignite	Missing Charged Hohlraum or insufficient laser energy.	Install a Charged Hohlraum and fire at least 1 GFE into the Laser Focus Matrix.
No Tritium Production	Solar Neutron Activator blocked or operating at night.	Provide direct sky access or wait until daytime.
Reactor Stops Running	Fuel production has stopped.	Restore Deuterium and Tritium production.
Low Power Output	Low Injection Rate.	Increase the Injection Rate once fuel production is sufficient.

> **Tip**
> For the highest possible power output, pair the Fusion Reactor with a correctly sized Industrial Turbine and maintain a steady supply of D-T Fuel. This setup provides one of the most efficient long-term power solutions available in ATM10.

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