Building a commercial-sized **24" x 48" Laminar Flow Hood** is a rite of passage for serious mushroom cultivators. A hood of this size provides a massive sterile workspace, allowing you to easily handle large runs of grain bags, agar plates, and liquid cultures without the cramped constraints of a still air box.

While you can purchase the mechanical and hardware components from Amazon, **you should source the lumber locally** (from a Home Depot, Lowe's, or local lumberyard). Ordering 4x8 sheets of 3/4" plywood on Amazon is cost-prohibitive due to freight shipping.

Here are the plans, required math, and estimated costs for a 2x4 commercial flow hood.

The Math: Matching the Fan to the Filter

To achieve true laminar flow, the air must push through the HEPA filter at exactly **100 Feet Per Minute (FPM)**, give or take 20%.

1. **Calculate Filter Area:** 2 feet x 4 feet = **8 square feet**.
2. **Calculate Target CFM:** 8 sq. ft. x 100 FPM = **800 CFM** (Cubic Feet per Minute).
3. **Account for Static Pressure:** A dense H14 HEPA filter creates resistance (working static pressure), usually around 0.8" to 1.0" of water gauge (WG).
4. **The Blower Requirement:** You need a blower that can push **~800 to 1000 CFM at 1.0" of static pressure**. (An AC Infinity Cloudline 10-inch inline fan or a Dayton 1TDT8-style centrifugal blower fits this profile).

Parts List & Approximate Cost (Amazon & Local)

Component	Description / Spec	Approx. Cost	Source
HEPA Filter	24" x 48" x 5.875" H14 Filter (99.99% @ 0.3 microns)	$300 - $400	Amazon
Blower Fan	10" Inline Duct Fan (e.g., AC Infinity) or 1/3 HP Centrifugal	$180 - $220	Amazon
Pre-Filter	20" x 20" MERV 8 or 11 HVAC Filter	$15 - $20	Amazon
Sealants	100% Silicone Caulk (2 tubes) & HVAC Foil Tape	$25 - $30	Amazon
Gasket Tape	1/2" wide x 1/4" thick Closed-Cell Neoprene Weatherstripping	$15	Amazon
Electrical	15A Toggle Switch, Switch Box, 14 AWG Appliance Cord	$25	Amazon
Hardware	1.25" Wood Screws (Box of 100)	$10	Amazon
Lumber	Two 4'x8' sheets of 3/4" sanded plywood or MDF	$80 - $120	**Local**
	Total Estimated Build Cost	**$650 - $830**	

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Build Instructions: Step-by-Step

Step 1: Cut the Lumber (The Plenum Box)

The plenum is the pressurized box behind the HEPA filter. The depth of the box needs to be roughly equal to or greater than the radius of your fan's intake to ensure proper air distribution (usually 12 to 18 inches deep).

Cut List for a 24x48 Filter (assuming a 15-inch deep box):

- **Top & Bottom Panels:** Two pieces @ 49.5" x 15"
- **Side Panels:** Two pieces @ 24" x 15"
- **Back Panel:** One piece @ 49.5" x 25.5"

Step 2: Assemble the Plenum Box

1. Assemble the four sides (Top, Bottom, Left, Right) using wood glue and 1.25" screws.
2. Attach the back panel to close off the box. You should now have a five-sided box with the exact internal dimensions of your HEPA filter (roughly 24" x 48" inside, depending on your filter's exact housing measurements—**always measure your specific filter before cutting!**).
3. **Seal the Box:** This is critical. Run a heavy bead of silicone caulk along every single interior seam. If air can escape through the wood joints, you lose static pressure and risk sucking unfiltered air into the sterile slipstream.

Step 3: Create the Blower Intake Hole

1. On the **back panel** (or the top panel, depending on how you want it oriented), trace the exhaust output of your blower fan.
2. Use a jigsaw to cut the hole.
3. Mount the blower fan securely over the hole. Use foil tape and silicone to aggressively seal the mating point between the fan flange and the wood.

Step 4: Add the Pre-Filter Frame

The pre-filter traps large dust and pet hair, extending the life of your expensive HEPA filter from 1 year to 5+ years.

1. Build a simple wooden frame over the intake of your blower fan (using scrap wood).
2. Size it to snugly fit your 20" x 20" MERV 8 filter.
3. Slide the filter in. It does not need to be perfectly airtight, just secure enough to catch ambient room dust.

Step 5: Mount and Seat the HEPA Filter

Handle the HEPA filter by the metal/wooden frame only. If you touch the white paper pleats, you will permanently damage the filter.

1. Apply the closed-cell neoprene weatherstripping around the inside front lip of your plenum box. This creates an airtight gasket.
2. Carefully slide the 24" x 48" HEPA filter into the open front of the plenum box.
3. Push it tightly against the weatherstripping.
4. Secure the filter in place. You can do this by screwing small wooden cleats or metal L-brackets into the *plenum walls* tightly against the front of the filter frame, locking it in.
5. Apply a layer of foil tape around the gap where the filter frame meets the wooden box for a final layer of security.

Step 6: Electrical and Testing

1. Wire the blower fan to your toggle switch and appliance cord.
2. Turn the fan on.
3. **The Lighter Test:** To test for laminar flow, hold a standard BIC lighter about 3 inches away from the face of the HEPA filter.
    - If the flame is blown out aggressively, your airflow is too high (adjust with a speed controller).

- If the flame flickers wildly and dances in circles, you have turbulent flow (often caused by air leaks or a box that is too shallow).
- If the flame bends over to a smooth, steady 45-degree to 90-degree angle without flickering or blowing out, you have achieved perfect laminar flow.