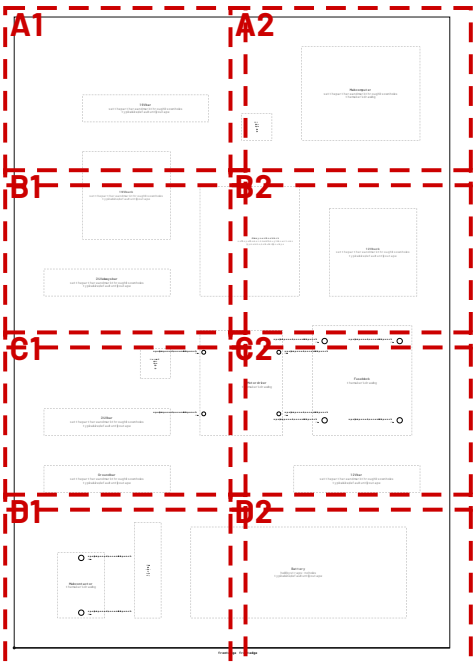


Every part on it, and what holds each (the stack each length comes from is in the hole table)
Battery: no holes; bit none; straps over it

Main fuse (ANL 60 A): count its own holes; bit the size of its own holes (mark through); a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm); a washer and a nylon-insert lock nut on the far side of the panel; tighten snug, then a quarter turn more (no maker torque)

Main contactor (HCZ02-100F-24P): 2 holes; bit #16 (0.1770 in, 4.50 mm); M4 socket head cap screw; M4 washer and M4 nylon-insert lock nut on the far side of the panel; tighten 1.8 to 2.5 N m (HIITIO HCZ02-100F-24P)

24V bar: count its own holes; bit the size of its own holes (mark through); a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm); a washer and a nylon-insert lock nut on the far side of the panel; tighten snug, then a quarter turn more (no maker torque)

Ground bar: count its own holes; bit the size of its own holes (mark through); a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm); a washer and a nylon-insert lock nut on the far side of the panel; tighten snug, then a quarter turn more (no maker torque)

Motor driver (Sabertooth 2x32): 4 holes; bit #30 (0.1285 in, 3.26 mm); #4-40 pan head machine screw; #4 SAE washer and #4-40 nylon-insert lock nut on the far side of the panel; tighten snug, then a quarter turn more (no maker torque)

Fuse block (Blue Sea 5028): 4 holes; bit #16 (0.1770 in, 4.50 mm); M4 socket head cap screw; M4 washer and M4 nylon-insert lock nut on the far side of the panel; tighten snug, then a quarter turn more (no maker torque)

19V buck: count its own corner holes; bit the size of its own holes (mark through); steel or nylon standoffs at its own holes, thread to fit them (the app's standoff table: Wurth steel, RAF nylon); a screw into each end of each standoff; tighten snug, then a quarter turn more (no maker torque)

Hub buck, set to 5 V: count its own corner holes; bit the size of its own holes (mark through); steel or nylon standoffs at its own holes, thread to fit them (the app's standoff table: Wurth steel, RAF nylon); a screw into each end of each standoff; tighten snug, then a quarter turn more (no maker torque)

19V bar: count its own holes; bit the size of its own holes (mark through); a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm); a washer and a nylon-insert lock nut on the far side of the panel; tighten snug, then a quarter turn more (no maker torque)

Main computer (Jetson Orin Nano): count its own corner holes; bit the size of its own holes (mark through); steel or nylon standoffs at its own holes, thread to fit them (the app's standoff table: Wurth steel, RAF nylon); a screw into each end of each standoff; tighten snug, then a quarter turn more (no maker torque)

4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

100 mm bar

Measure first

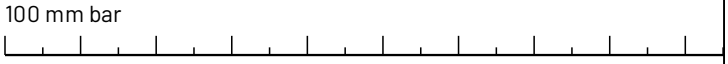
Every size this sheet rests on is on record.

Holds	Drill bit	Through	Fastener, and the stack its length comes from	Nut, washer, lock	Tighten	Holes	Note
Battery	none		straps over it			no holes	It has no mounting holes: it is held down by straps, and how they pass the board is not designed yet.
Main fuse (ANL 60 A)	the size of its own holes (mark through)	through	a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm). Stack: its base (measure) + the panel (measure) + washer + nut + 2 threads	a washer and a nylon-insert lock nut on the far side of the panel	snug, then a quarter turn more (no maker torque)	count its own holes	Set the part on its outline and mark through its own holes. If it is plastic or aluminium, a washer under the head too: check what it is made of.
Main contactor (HCZ02-100F-24P)	#16 (0.1770 in, 4.50 mm)	through	M4 socket head cap screw. Stack: its base (measure) + the panel (measure) + washer 0.8 + nut 6 + 2 threads 1.4 mm: the length waits on both	M4 washer and M4 nylon-insert lock nut on the far side of the panel	1.8 to 2.5 N m (HIITIO HCZ02-100F-24P)	2 holes	Holes: HCZ02-100 Specifications, DC contactor (file HCZ02-100F-A Epoxy Resin Contactor Specification), Zhejiang HIITIO New Energy Co., Ltd: the series sheet whose Product Model key (page 1) covers HCZ02-100F-24P: series Z02, 100 A, 24 VDC coil, F and P options. The maker names the screw: M4, 1.8 to 2.5 N m. If it is plastic or aluminium, a washer under the head too: check what it is made of.
24V bar	the size of its own holes (mark through)	through	a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm). Stack: its base (measure) + the panel (measure) + washer + nut + 2 threads	a washer and a nylon-insert lock nut on the far side of the panel	snug, then a quarter turn more (no maker torque)	count its own holes	Set the part on its outline and mark through its own holes. If it is plastic or aluminium, a washer under the head too: check what it is made of.
Ground bar	the size of its own holes (mark through)	through	a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm). Stack: its base (measure) + the panel (measure) + washer + nut + 2 threads	a washer and a nylon-insert lock nut on the far side of the panel	snug, then a quarter turn more (no maker torque)	count its own holes	Set the part on its outline and mark through its own holes. If it is plastic or aluminium, a washer under the head too: check what it is made of.

4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

100 mm bar



Drill bits on this sheet

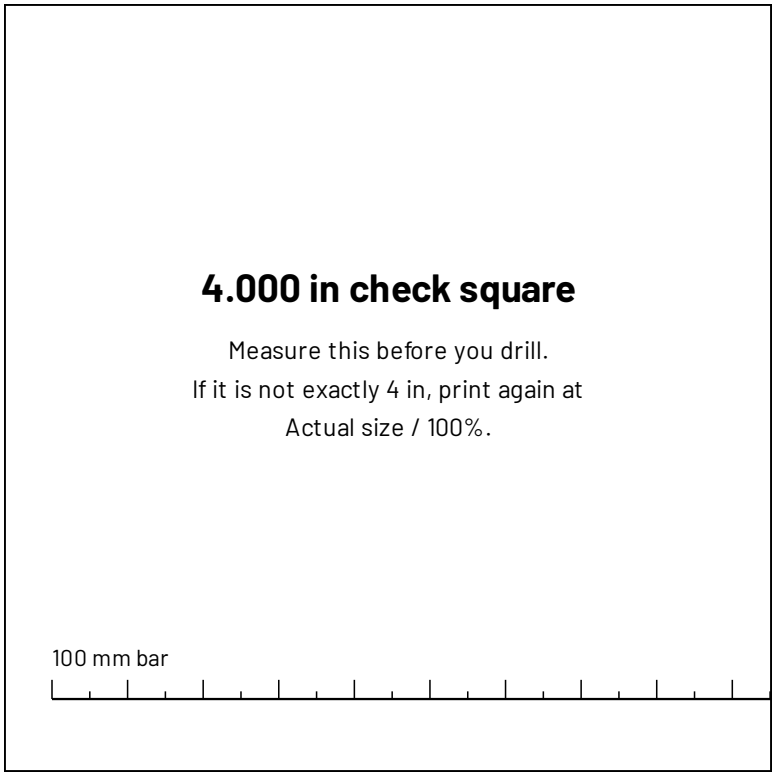
#30 (0.1285 in, 3.26 mm)

#16 (0.1770 in, 4.50 mm)

Bit sizes: AmesWeb's drill chart (ASME B94.33), checked against Engineers Edge's (ASME B94.11M). Clearance holes: ISO 273 medium, ASME B18.2.8 normal.

No countersinks: every hole is a plain through hole.

Holds	Drill bit	Through	Fastener, and the stack its length comes from	Nut, washer, lock	Tighten	Holes	Note
Motor driver (Sabertooth 2x32)	#30 (0.1285 in, 3.26 mm)	through	#4-40 pan head machine screw. Stack: its base (measure) + the panel (measure) + washer 1 + nut 3.6 + 2 threads 1.3 mm: the length waits on both	#4 SAE washer and #4-40 nylon-insert lock nut on the far side of the panel	snug, then a quarter turn more (no maker torque)	4 holes	Holes: Sabertooth 2x32 user's guide, Dimension Engineering LLC: Drawings, page 56 (top view and side view); Mounting, page 55. The maker names the screw: 4-40 machine screw, 5/8 in supplied. If it is plastic or aluminium, a washer under the head too: check what it is made of.
Fuse block (Blue Sea 5028)	#16 (0.1770 in, 4.50 mm)	through	M4 socket head cap screw. Stack: its base (measure) + the panel (measure) + washer 0.8 + nut 6 + 2 threads 1.4 mm: the length waits on both	M4 washer and M4 nylon-insert lock nut on the far side of the panel	snug, then a quarter turn more (no maker torque)	4 holes	Holes: 5028 Dimensioned Drawing, Blue Sea Systems: front view and side view; specifications from the product page (bluesea_5028_page). The maker names the screw: #8 or M4. If it is plastic or aluminium, a washer under the head too: check what it is made of. Of #8, M4, the M4: the fastener table's lengths and nut heights.
19V buck	the size of its own holes (mark through)	through	steel or nylon standoffs at its own holes, thread to fit them (the app's standoff table: Wurth steel, RAF nylon). Stack: standoff tall enough that nothing under the board reaches the surface	a screw into each end of each standoff	snug, then a quarter turn more (no maker torque)	count its own corner holes	Set the part on its outline and mark through its own holes. A bare circuit board stands off the board on standoffs at its own corner holes, so no solder joint under it touches the surface.
Hub buck, set to 5 V	the size of its own holes (mark through)	through	steel or nylon standoffs at its own holes, thread to fit them (the app's standoff table: Wurth steel, RAF nylon). Stack: standoff tall enough that nothing under the board reaches the surface	a screw into each end of each standoff	snug, then a quarter turn more (no maker torque)	count its own corner holes	Set the part on its outline and mark through its own holes. A bare circuit board stands off the board on standoffs at its own corner holes, so no solder joint under it touches the surface.



Drill bits on this sheet

#30 (0.1285 in, 3.26 mm)

#16 (0.1770 in, 4.50 mm)

Bit sizes: AmesWeb's drill chart (ASME B94.33), checked against Engineers Edge's (ASME B94.11M). Clearance holes: ISO 273 medium, ASME B18.2.8 normal.

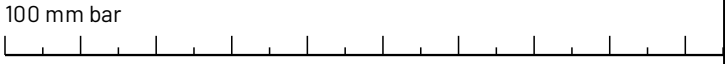
No countersinks: every hole is a plain through hole.

Holds	Drill bit	Through	Fastener, and the stack its length comes from	Nut, washer, lock	Tighten	Holes	Note
19V bar	the size of its own holes (mark through)	through	a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm). Stack: its base (measure) + the panel (measure) + washer + nut + 2 threads	a washer and a nylon-insert lock nut on the far side of the panel	snug, then a quarter turn more (no maker torque)	count its own holes	Set the part on its outline and mark through its own holes. If it is plastic or aluminium, a washer under the head too: check what it is made of.
Main computer (Jetson Orin Nano)	the size of its own holes (mark through)	through	steel or nylon standoffs at its own holes, thread to fit them (the app's standoff table: Wurth steel, RAF nylon). Stack: standoff tall enough that nothing under the board reaches the surface	a screw into each end of each standoff	snug, then a quarter turn more (no maker torque)	count its own corner holes	Set the part on its outline and mark through its own holes. A bare circuit board stands off the board on standoffs at its own corner holes, so no solder joint under it touches the surface.
IMU (BNO085)	the size of its own holes (mark through)	through	steel or nylon standoffs at its own holes, thread to fit them (the app's standoff table: Wurth steel, RAF nylon). Stack: standoff tall enough that nothing under the board reaches the surface	a screw into each end of each standoff	snug, then a quarter turn more (no maker torque)	count its own corner holes	Set the part on its outline and mark through its own holes. A bare circuit board stands off the board on standoffs at its own corner holes, so no solder joint under it touches the surface.
24V always bar	the size of its own holes (mark through)	through	a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm). Stack: its base (measure) + the panel (measure) + washer + nut + 2 threads	a washer and a nylon-insert lock nut on the far side of the panel	snug, then a quarter turn more (no maker torque)	count its own holes	Set the part on its outline and mark through its own holes. If it is plastic or aluminium, a washer under the head too: check what it is made of.
Always-on fuse block	the size of its own holes (mark through)	through	a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm). Stack: its base (measure) + the panel (measure) + washer + nut + 2 threads	a washer and a nylon-insert lock nut on the far side of the panel	snug, then a quarter turn more (no maker torque)	count its own holes	Set the part on its outline and mark through its own holes. If it is plastic or aluminium, a washer under the head too: check what it is made of.
12V bar	the size of its own holes (mark through)	through	a through-bolt to fit its own holes (ISO 273 medium: an M3 takes 3.4 mm; an M4 takes 4.5 mm; an M5 takes 5.5 mm). Stack: its base (measure) + the panel (measure) + washer + nut + 2 threads	a washer and a nylon-insert lock nut on the far side of the panel	snug, then a quarter turn more (no maker torque)	count its own holes	Set the part on its outline and mark through its own holes. If it is plastic or aluminium, a washer under the head too: check what it is made of.

4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

100 mm bar



Drill bits on this sheet

#30 (0.1285 in, 3.26 mm)

#16 (0.1770 in, 4.50 mm)

Bit sizes: AmesWeb's drill chart (ASME B94.33), checked against Engineers Edge's (ASME B94.11M). Clearance holes: ISO 273 medium, ASME B18.2.8 normal.

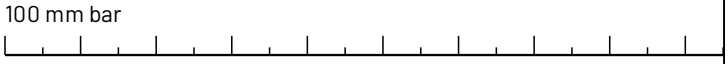
No countersinks: every hole is a plain through hole.

Holds	Drill bit	Through	Fastener, and the stack its length comes from	Nut, washer, lock	Tighten	Holes	Note
12V buck	the size of its own holes (mark through)	through	steel or nylon standoffs at its own holes, thread to fit them (the app's standoff table: Wurth steel, RAF nylon). Stack: standoff tall enough that nothing under the board reaches the surface	a screw into each end of each standoff	snug, then a quarter turn more (no maker torque)	count its own corner holes	Set the part on its outline and mark through its own holes. A bare circuit board stands off the board on standoffs at its own corner holes, so no solder joint under it touches the surface.

4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

100 mm bar



Drill bits on this sheet

#30 (0.1285 in, 3.26 mm)

#16 (0.1770 in, 4.50 mm)

Bit sizes: AmesWeb's drill chart (ASME B94.33), checked against Engineers Edge's (ASME B94.11M). Clearance holes: ISO 273 medium, ASME B18.2.8 normal.

No countersinks: every hole is a plain through hole.

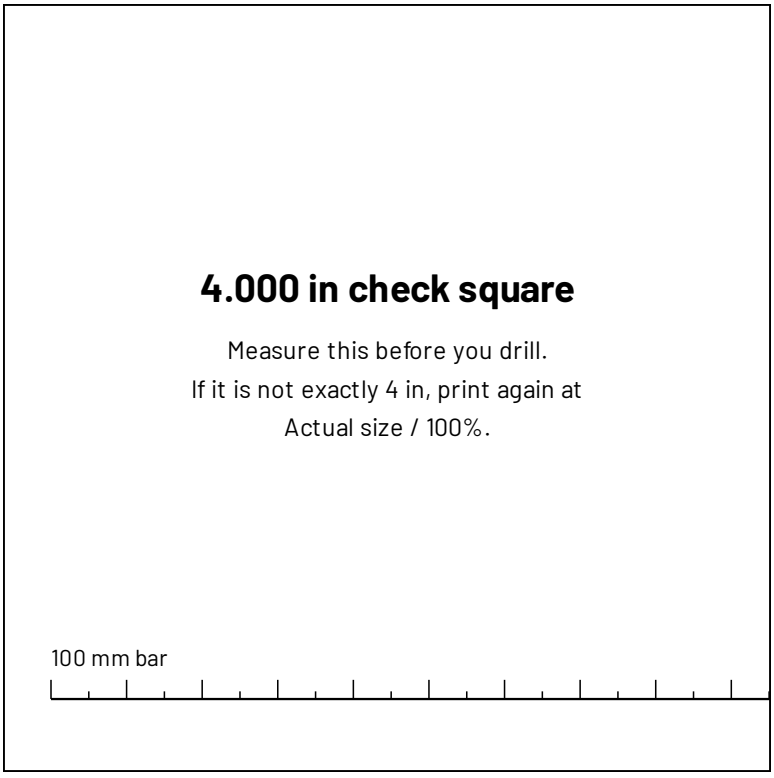
How to drill this surface (what it is made of is not on record: the steps for any material)

1. Measure the 4 in square on a page first. If it is not exactly 4 in, print again at Actual size / 100%.
2. Lay the tiles in order, each next tile on the shaded band of the one before, align marks on align marks, and tape them.
3. Lay the taped sheet on the surface, its edges on the drawn edges, and tape it down.
4. Centre-punch every crosshair through the paper: the mark lets the bit bite where it should. Punch lightly enough not to dent the board round it. (Pilot Holes and Field Matching Drilling Aluminum and Steel, Engineers Edge: Center punch locations for fastener holes before beginning the actual drilling)
5. Hold a hard, smooth wooden backing block behind each hole as you drill. (Pilot Holes and Field Matching Drilling Aluminum and Steel, Engineers Edge: Hold a hard, smooth, wooden backing block securely in position behind the hole locations)
6. Hold the drill at right angles to the board, and never tip it as you drill or pull it out: a tipped bit makes an oval hole. (Pilot Holes and Field Matching Drilling Aluminum and Steel, Engineers Edge: Always hold the drill at right angles to the work; Never tip the drill sideways)

Hardware for this sheet

Summed from the hole table: each part's fastener, washer and nut, times its holes.

- **#4 SAE washer** · 4
- **#4-40 nylon-insert lock nut** · 4
- **#4-40 pan head machine screw** · 4
- **M4 nylon-insert lock nut** · 6
- **M4 socket head cap screw** · 6
- **M4 washer** · 6
- Main fuse (ANL 60 A): through-bolt to fit its holes, washer to fit, nylon-insert lock nut to fit, one each per hole: count its own holes
- 24V bar: through-bolt to fit its holes, washer to fit, nylon-insert lock nut to fit, one each per hole: count its own holes
- Ground bar: through-bolt to fit its holes, washer to fit, nylon-insert lock nut to fit, one each per hole: count its own holes
- 19V buck: steel or nylon standoff to fit its holes, screw to fit, each end of a standoff, one each per hole: count its own corner holes
- Hub buck, set to 5 V: steel or nylon standoff to fit its holes, screw to fit, each end of a standoff, one each per hole: count its own corner holes
- 19V bar: through-bolt to fit its holes, washer to fit, nylon-insert lock nut to fit, one each per hole: count its own holes
- Main computer (Jetson Orin Nano): steel or nylon standoff to fit its holes, screw to fit, each end of a standoff, one each per hole: count its own corner holes
- IMU (BNO085): steel or nylon standoff to fit its holes, screw to fit, each end of a standoff, one each per hole: count its own corner holes
- 24V always bar: through-bolt to fit its holes, washer to fit, nylon-insert lock nut to fit, one each per hole: count its own holes
- Always-on fuse block: through-bolt to fit its holes, washer to fit, nylon-insert lock nut to fit, one each per hole: count its own holes
- 12V bar: through-bolt to fit its holes, washer to fit, nylon-insert lock nut to fit, one each per hole: count its own holes
- 12V buck: steel or nylon standoff to fit its holes, screw to fit, each end of a standoff, one each per hole: count its own corner holes



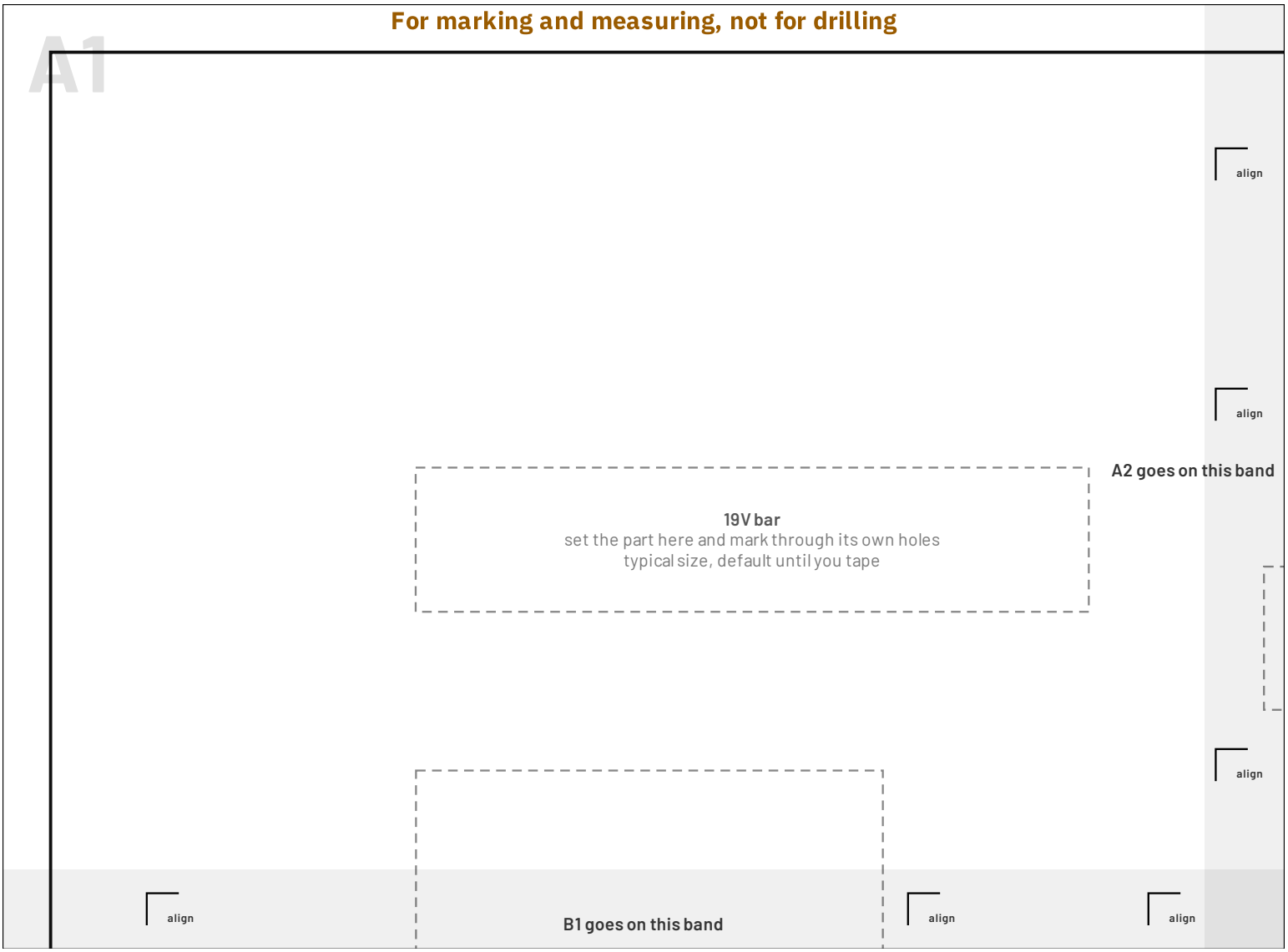
Drill bits on this sheet

#30 (0.1285 in, 3.26 mm)

#16 (0.1770 in, 4.50 mm)

Bit sizes: AmesWeb's drill chart (ASME B94.33), checked against Engineers Edge's (ASME B94.11M). Clearance holes: ISO 273 medium, ASME B18.2.8 normal.

No countersinks: every hole is a plain through hole.



4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

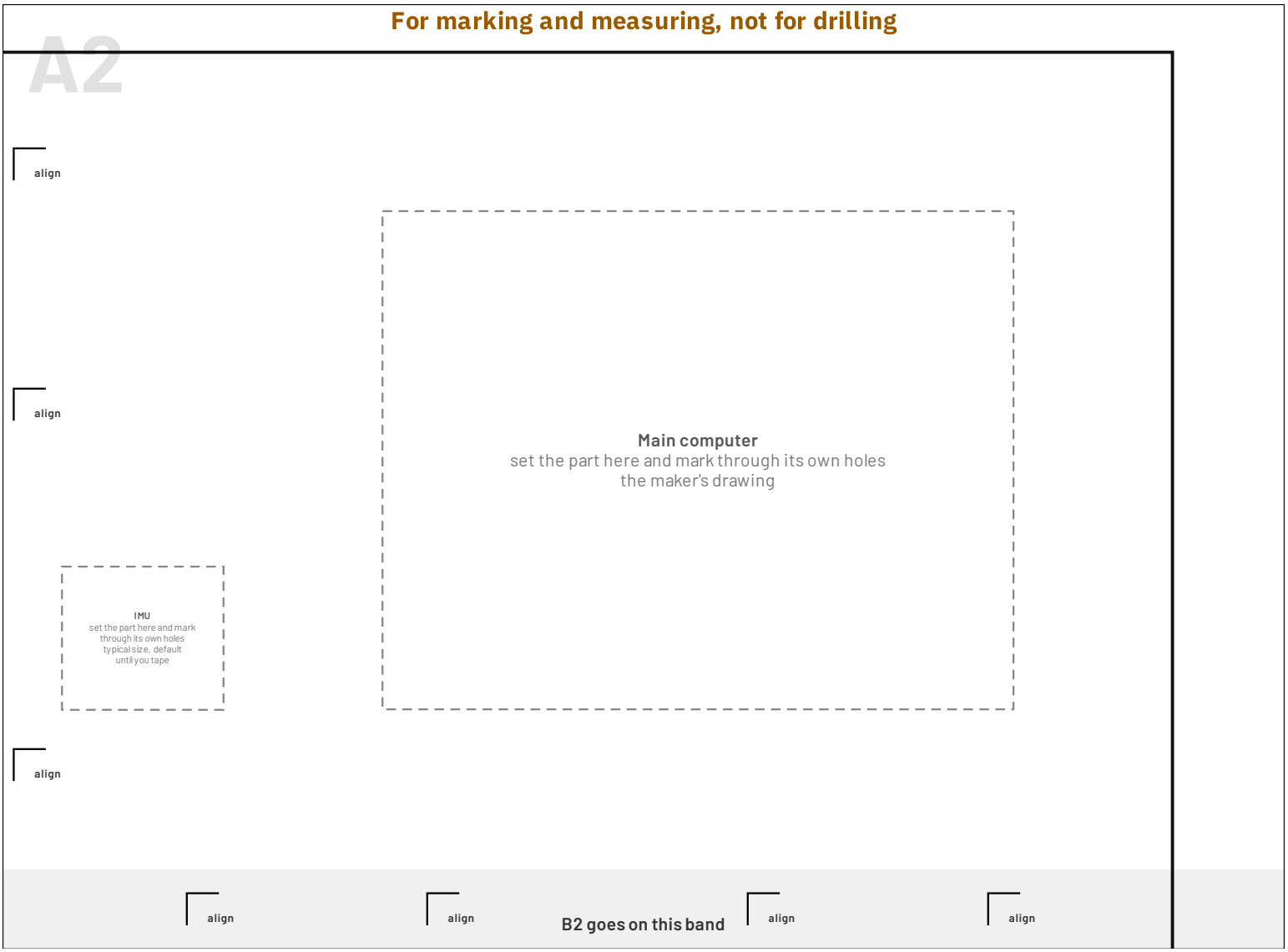
100 mm bar

Tile A1 of panel

For marking and measuring, not for drilling.

Trim nothing. Lay the tiles in order, each next tile on the shaded band of the one before, and lay each align mark on its twin. Tape them. Set the surface on the sheet, its edges on the drawn edges, and centre-punch every crosshair: each is a hole.

A1	A2
B1	B2
C1	C2
D1	D2



4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

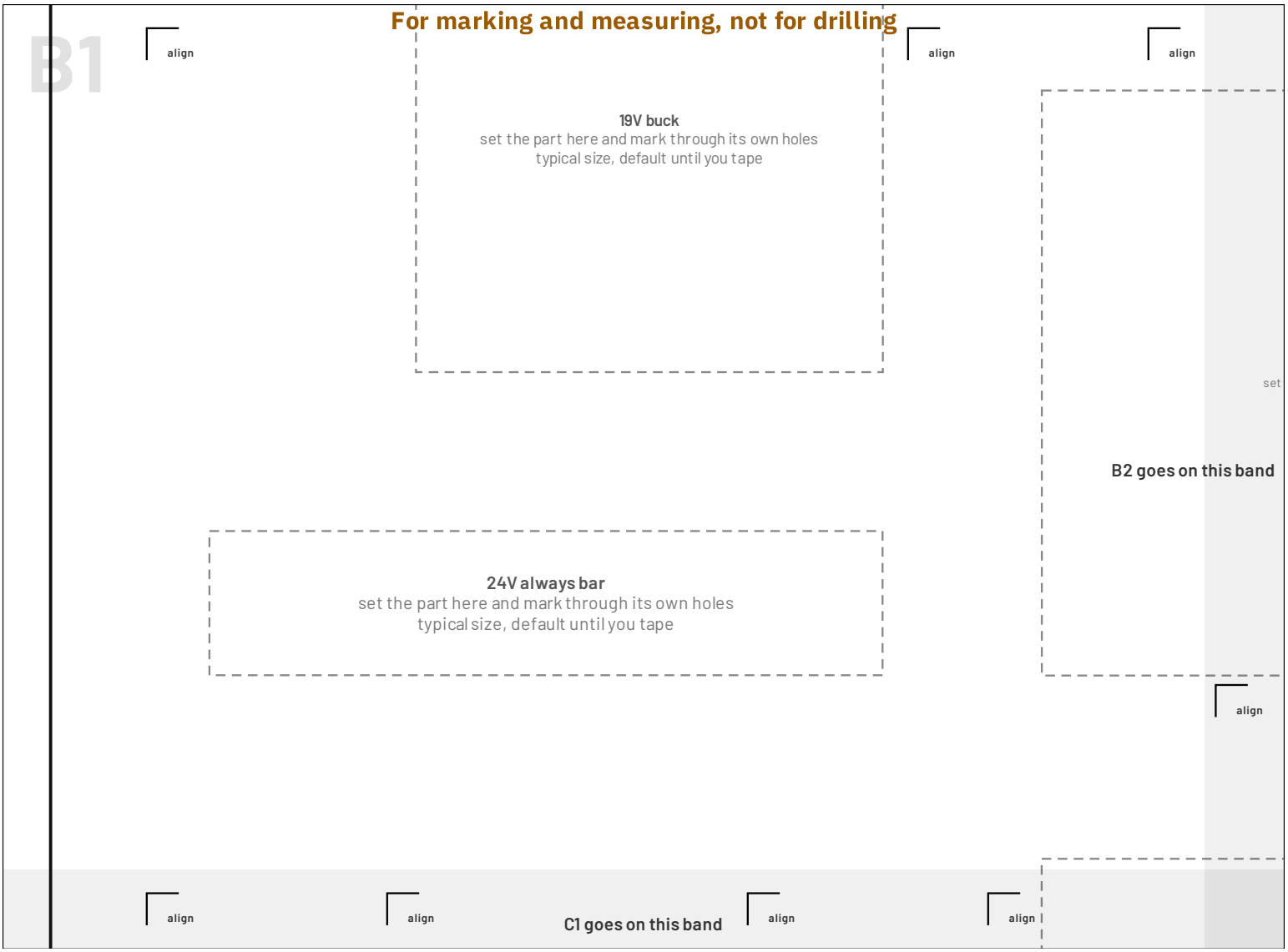
100 mm bar

Tile A2 of panel

For marking and measuring, not for drilling.

Trim nothing. Lay the tiles in order, each next tile on the shaded band of the one before, and lay each align mark on its twin. Tape them. Set the surface on the sheet, its edges on the drawn edges, and centre-punch every crosshair: each is a hole.

A1	A2
B1	B2
C1	C2
D1	D2



4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

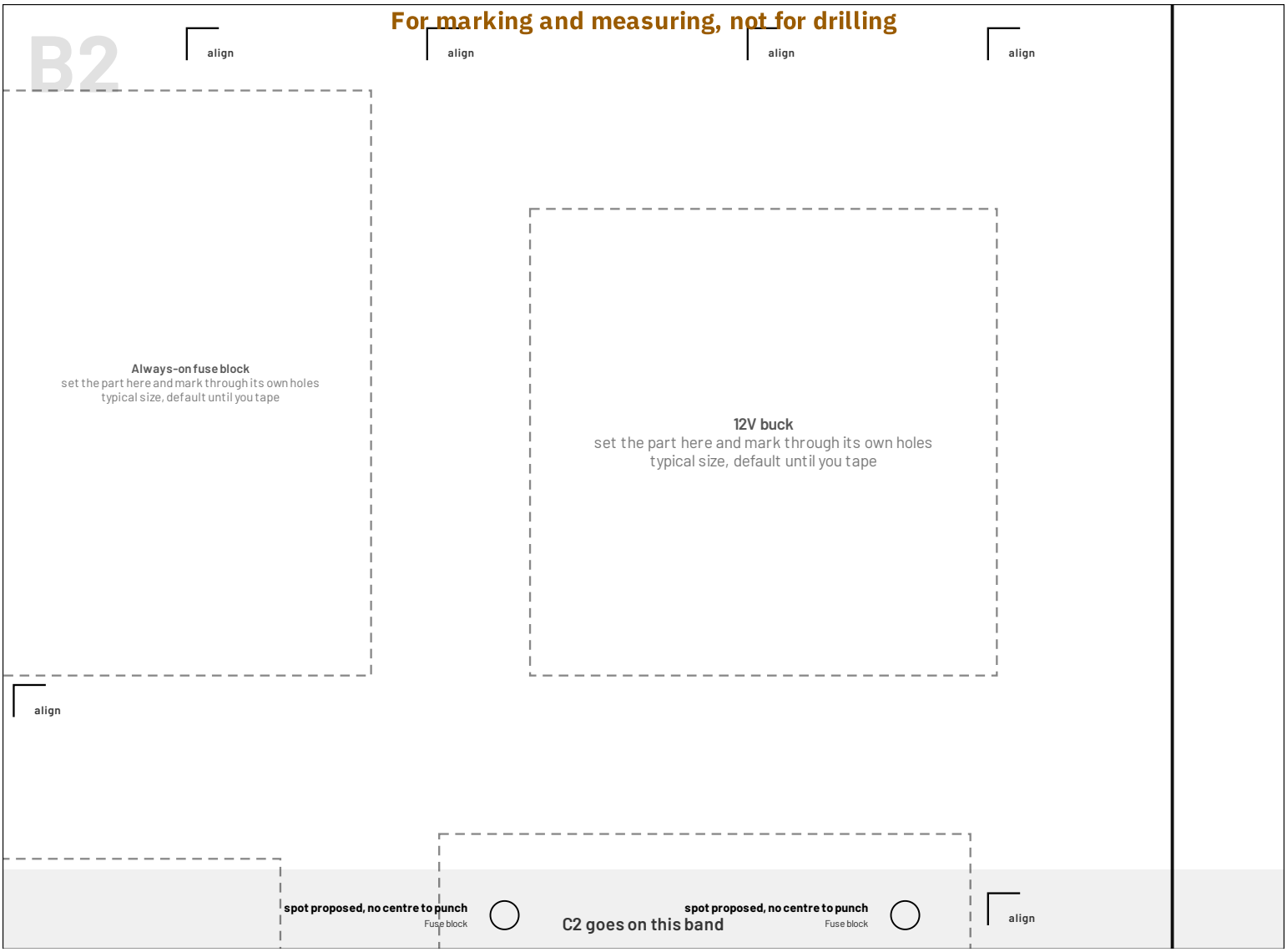
100 mm bar

Tile B1 of panel

For marking and measuring, not for drilling.

Trim nothing. Lay the tiles in order, each next tile on the shaded band of the one before, and lay each align mark on its twin. Tape them. Set the surface on the sheet, its edges on the drawn edges, and centre-punch every crosshair: each is a hole.

A1	A2
B1	B2
C1	C2
D1	D2



4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

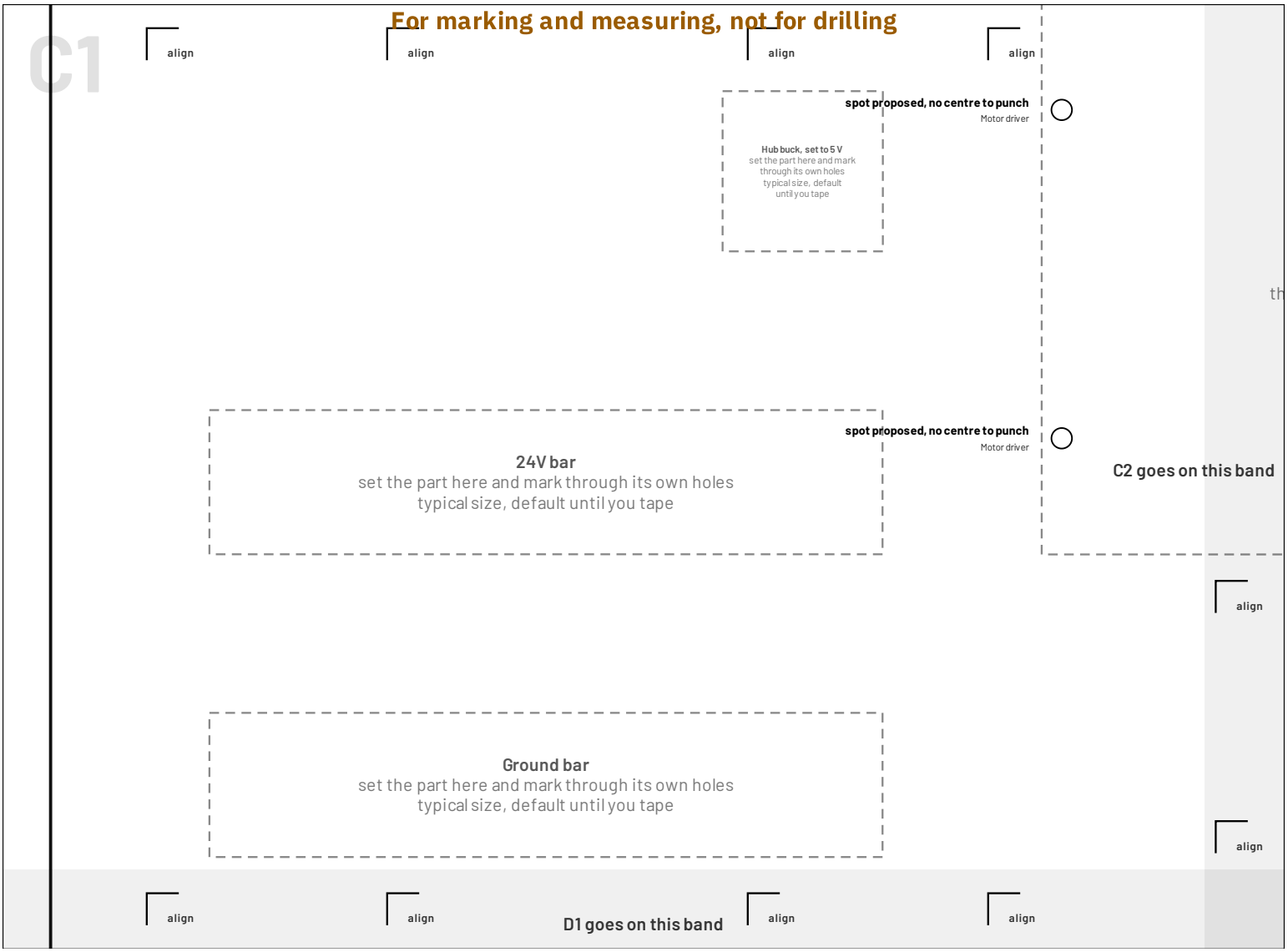
100 mm bar

Tile B2 of panel

For marking and measuring, not for drilling.

Trim nothing. Lay the tiles in order, each next tile on the shaded band of the one before, and lay each align mark on its twin. Tape them. Set the surface on the sheet, its edges on the drawn edges, and centre-punch every crosshair: each is a hole.

A1	A2
B1	B2
C1	C2
D1	D2



4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

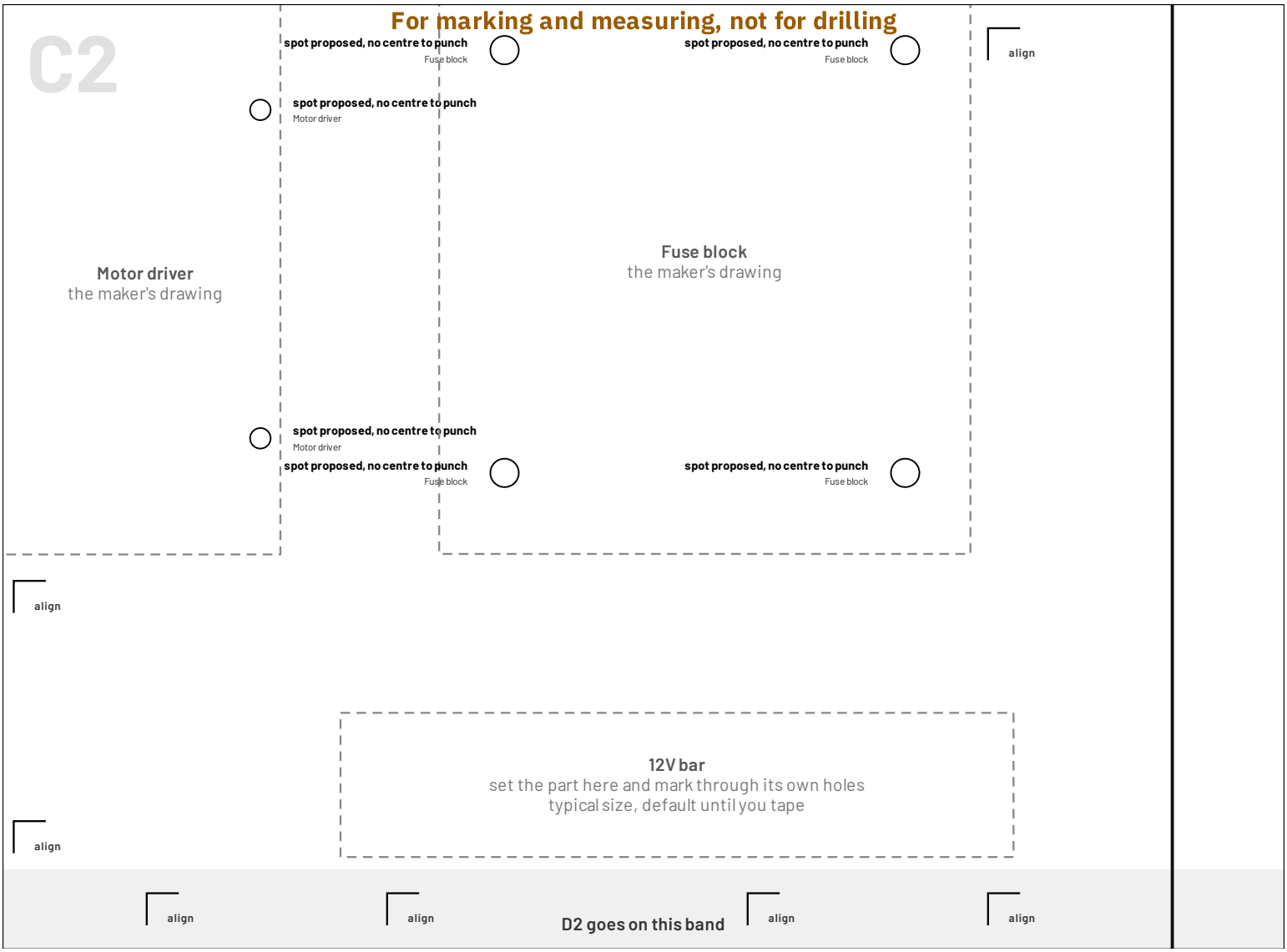
100 mm bar

Tile C1 of panel

For marking and measuring, not for drilling.

Trim nothing. Lay the tiles in order, each next tile on the shaded band of the one before, and lay each align mark on its twin. Tape them. Set the surface on the sheet, its edges on the drawn edges, and centre-punch every crosshair: each is a hole.

A1	A2
B1	B2
C1	C2
D1	D2



4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

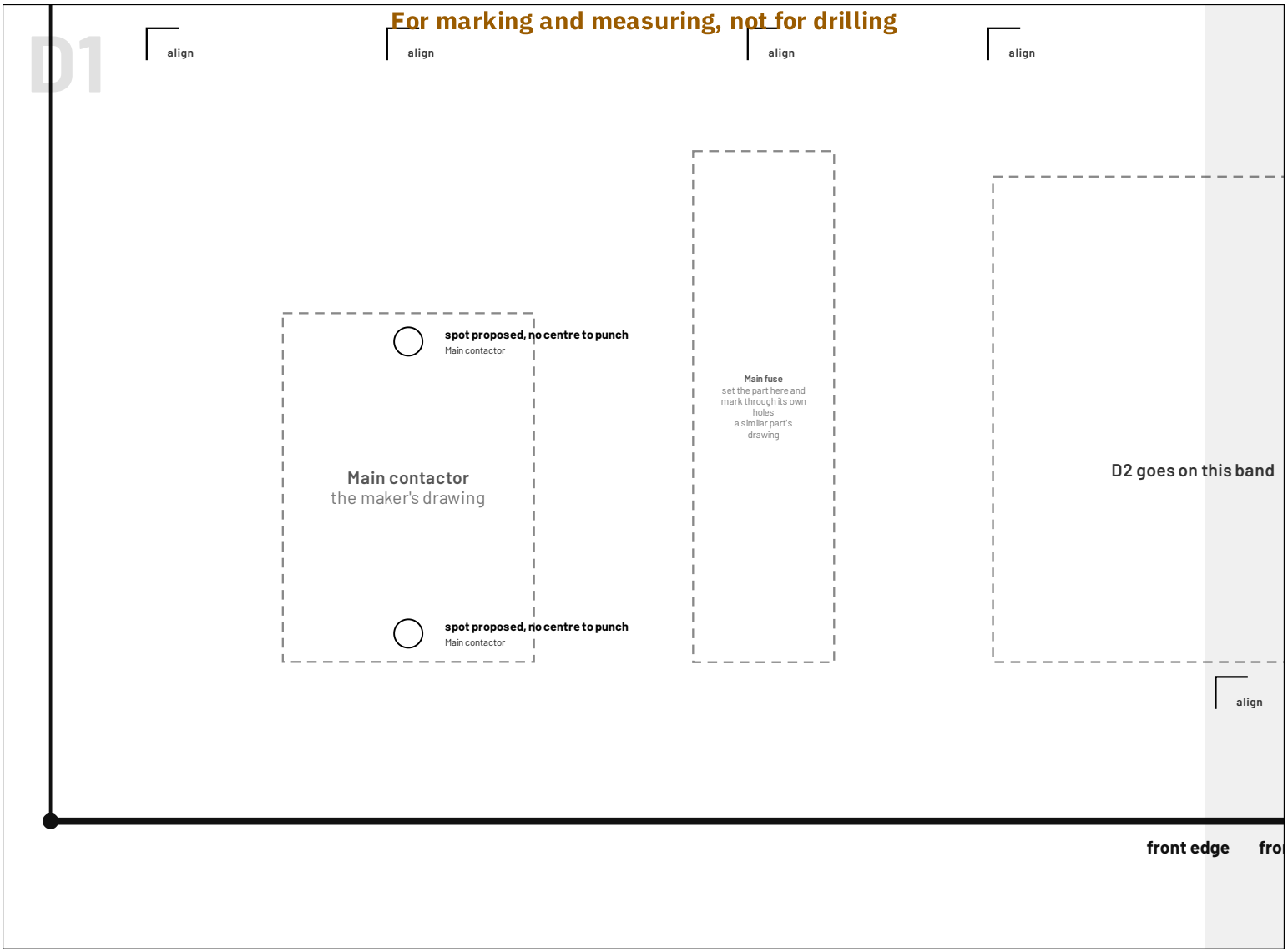
100 mm bar

Tile C2 of panel

For marking and measuring, not for drilling.

Trim nothing. Lay the tiles in order, each next tile on the shaded band of the one before, and lay each align mark on its twin. Tape them. Set the surface on the sheet, its edges on the drawn edges, and centre-punch every crosshair: each is a hole.

A1	A2
B1	B2
C1	C2
D1	D2



4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

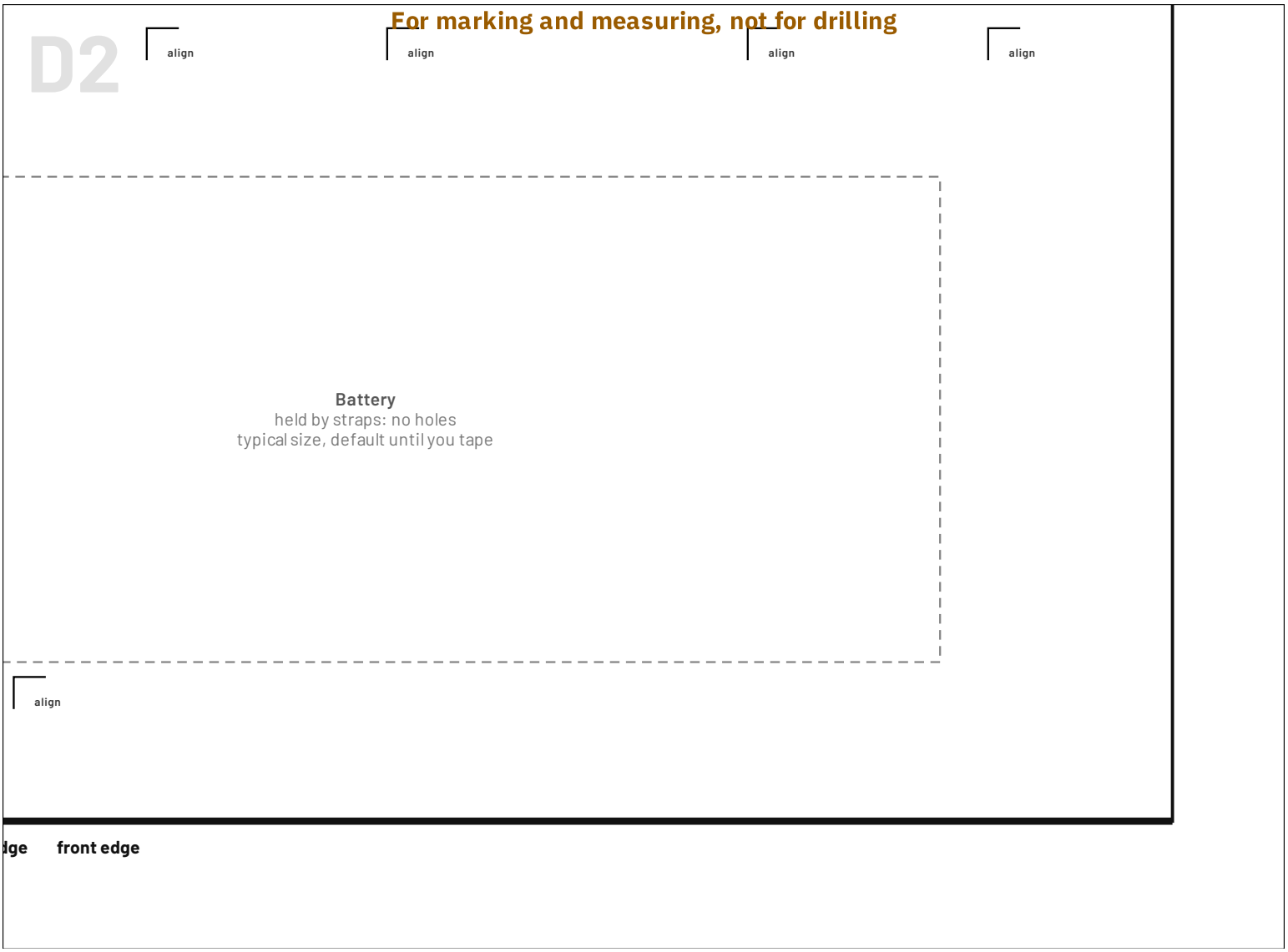
100 mm bar

Tile D1 of panel

For marking and measuring, not for drilling.

Trim nothing. Lay the tiles in order, each next tile on the shaded band of the one before, and lay each align mark on its twin. Tape them. Set the surface on the sheet, its edges on the drawn edges, and centre-punch every crosshair: each is a hole.

A1	A2
B1	B2
C1	C2
D1	D2



4.000 in check square

Measure this before you drill.
If it is not exactly 4 in, print again at
Actual size / 100%.

100 mm bar

Tile D2 of panel

For marking and measuring, not for drilling.

Trim nothing. Lay the tiles in order, each next tile on the shaded band of the one before, and lay each align mark on its twin. Tape them. Set the surface on the sheet, its edges on the drawn edges, and centre-punch every crosshair: each is a hole.

A1	A2
B1	B2
C1	C2
D1	D2