

AURATAG PRODUCT PROPOSAL

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OVERVIEW

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PURPOSE

Description of intention for product and anticipated client base

PRODUCTION SYSTEM CONCEPT

Overall plan for production success

DESIGN SPECIFICATIONS

Parts breakdown including materials, production processes and relevant standards

FACILITY PLAN

Recommended plan of action for production facility defining production volume, and specifications of accommodating facility

CREDIT

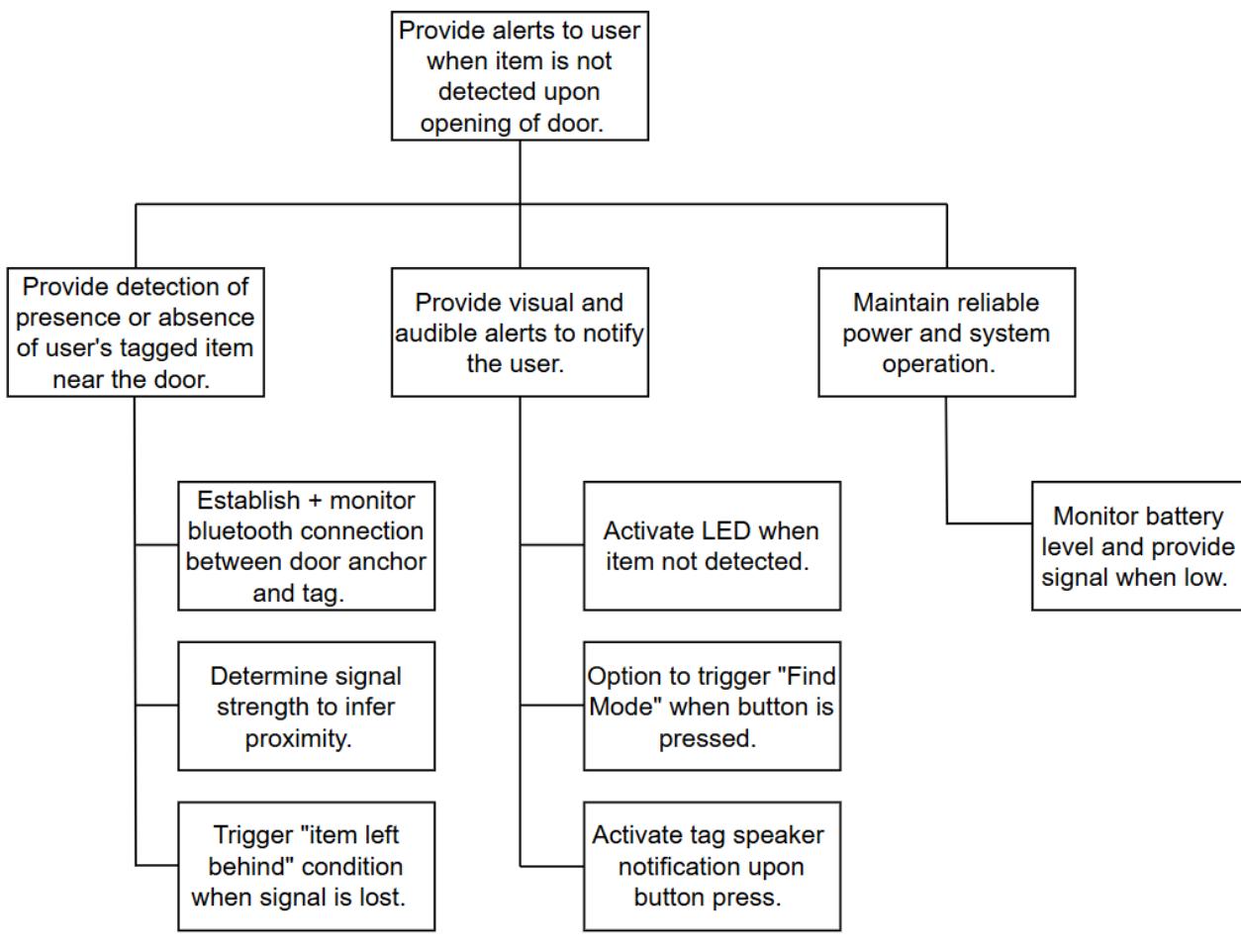
Credit to sources

PURPOSE



MODEL





A magnetically mounted anchor communicates with a small portable Bluetooth tag on keys/wallet etc.; if the portable tag remains at the door when the user leaves, the anchor flashes the LED. After notified, if the user chooses to press the button on the anchor, the tag emits an audible alert for six seconds.

PRODUCTION SYSTEM CONCEPT

TARGET CUSTOMER



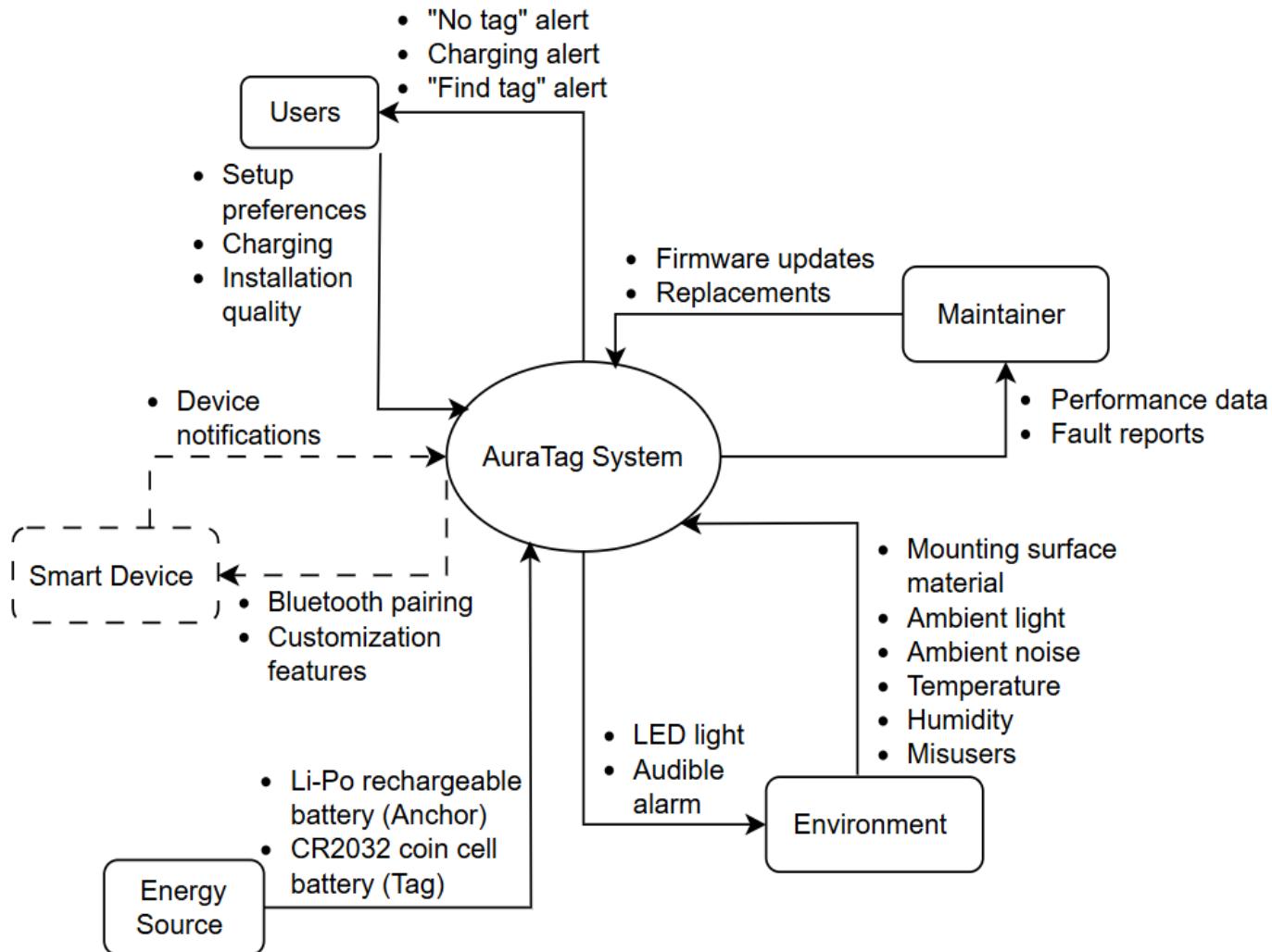
Mothers and elderly

Great gift for elderly

Both groups are more likely to have the budget

CONTEXT

- Maintenance involves coin cell replacement upon battery failure
- Other failures will lead to product replacement



Human Interaction

HUMAN FACTORS

Behavior: Button function described in instruction manual

Reliability: Influence magnet requirements

Sensation: Influence sound requirement (effective but not insufferable)

Perception: 1st notification is visual, 2nd is audible

Mental workload: Simple as possible

Decision making interactions: Assume decision to press the button will be made less than to not

ERGONOMICS

Cognitive: Minimal displays, one notification at a time

Anthropometric Mismatch: Recommended as purposeful for children

Biomechanical: Force consideration for anchor removal

Sensory: Db consideration for alerts

MISUSE ANTICIPATION

Incorrect initial application; will be countered with inclusion of explicit instruction manual

- Recommended to mount out of children's reach

APPLICATION :

Surface prep: Wipe with IPA on both anchor back (remove mold release) and the door surface; let dry.

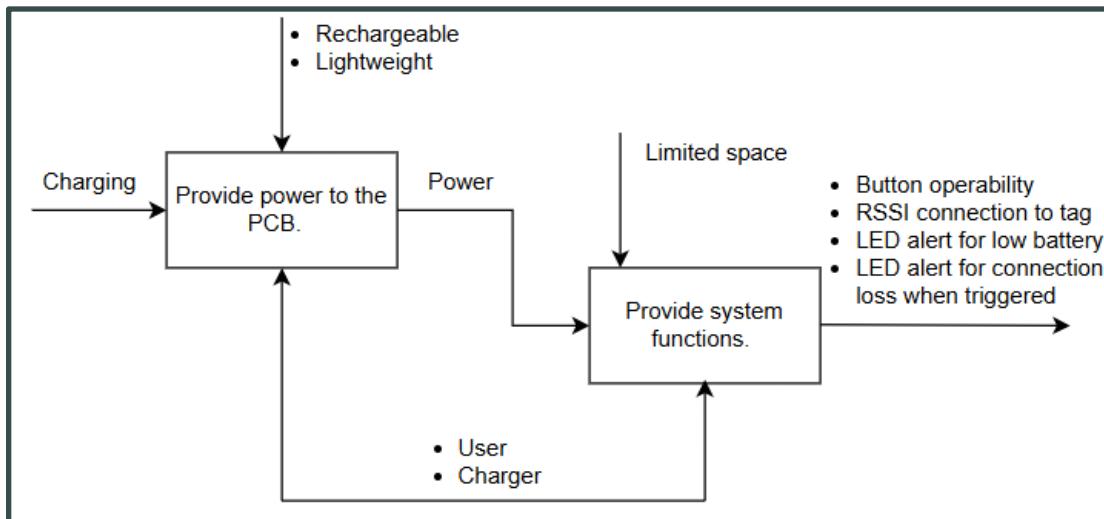
Application: Apply pad with alignment jig and press firmly (roller or press) to achieve intimate contact.

Press time: Hold firm pressure for 10–30 seconds.

Handling & cure: Initial tack is immediate, but full bond strength commonly reaches max after 24–72 hours. Wait 72 to mount.

Temperature: Operating range of VHB: -40°C to +90°C.





Battery Function + Requirements

Tag battery powers a standby life of ≥ 6 months.

UN38.3 and IEC 62133 testing for transport and safety of rechargeable Li-ion.

Tag must utilize a battery source that can be repurchased easily.

LED alerts user when anchor is low battery.

Anchor detachable for charging purposes.

Anchor fully recharges in ≤ 3 hours from empty using 5 V / 500 mA charger.

Anchor has a standby life of ≥ 7 days.

USB-C port close to STUSB4500, MCP73831 charger IC, and Li-Po battery terminals.

Keep away area around nRF52832 antenna ≥ 5 mm.

Signal & Alerts Function + Requirements

Potential Failure Mode and Effects Analysis							
System:	AuraTag				Prepared By:	Rae Ehrbar	
SubSystem:	Anchor, Tag				FMEA Date	11/27/2025	
Component:	A213 Anchor MCU, T111 Tag MCU			Page	1 of 1		
Item / Function	Potential Failure Mode(s)	Potential Effect(s) of Failure (system / user)	S	Potential Cause(s) / Mechanism(s)	O	Current Design Controls	D RPN Recommended Action(s)
A213, T111 - Manage BLE link, proximity logic, alerts	MCU fails to start or crashes	Anchor or tag completely dead; no "left-behind" detection, no LED, no audio alert; user gets no warning and may leave without keys/wallet.	9	Solder defect, power-on reset mis-configuration, brown-out, clock failure.	3	ATE functional boot test, power-on self-test, brown-out reset circuit, basic burn-in on engineering units.	6 162 Add watchdog that must be kicked by main loop. Add power-on self-test with fault code.
A213, T111 - Run BLE stack	MCU running but no RF communication	Anchor and tag both appear powered but stop talking; system may never trigger alert or may not respond to "find tag" button.	9	BLE firmware bug, unusual RF environment.	4	Use Nordic SDK with known-good examples; basic BLE connection test at end-of-line.	7 252 Implement hardware watchdog that resets on comms timeout. Add stress test (long-duration connection, interference) before release.
A213 - Proximity algorithm; T111 - Response	Incorrect proximity decision	Tag present but system thinks it is "left behind", tag actually left but user not alerted; user may stop trusting product.	8	RSSI threshold set wrong, poor calibration, antenna detuning from magnet/battery, temperature effects, firmware logic error.	5	Lab RF range tests, fixed RSSI threshold of -80 dBm, some empirical tuning.	6 240 Perform more home-environment test, add production RF test with RSSI window to screen bad antennas.
A213 - Button / LED logic; T111 - Audio control	MCU ignores button press or triggers wrong alert pattern	User presses anchor button but tag doesn't ring, or rings at wrong time; LED state doesn't match real system status. Confusing alerts and user can't find tag when needed.	7	Task priority issue, timer overflow.	5	Manual functional test prototypes; basic EOL test that checks button → LED and button → audio once.	7 245 Expand automated EOL test to exercise multiple button presses and timing, design + test cases to run on every firmware release.
A213, T111 - Power management & sleep	MCU not entering sleep / waking too often	Tag battery life < 6 months or anchor < 7 days; frequent charging or coin-cell replacement. User is frustrated and returns.	6	Wrong sleep mode, increased advertising interval, noisy accelerometer.	4	Initial current-measurement during design; some sample current checks in validation.	6 144 Set hard firmware budget for average current and log violation.

Proximity threshold of RSSI ≤ -80 dBm (8-12 m)

The wireless link between the anchor, tag and phone ≤ 0 dBm EIRP.

Tag audio alert must be ≥ 85 dB from within 1 m.

LED large enough to be visual from ≥ 500 mcd visible at 3 m indoors.

The tag alert runs for 6 seconds.

CRITERIA	WEIGHT	MAGNETIC MOUNT	COMMAND STRIP	VHB ADHESIVE MOUNT
EFFECTIVE ADHESIVE TIME	4	2	4	4
DESIGN COMPLEXITY	3	2	1	4
WEIGHT OF DESIGN	2	1	5	4
COST	3	2	2	4
REMOVABILITY	3	4	4	0
TOTAL		7	12	16

Mechanical Function + Requirements

Magnetic anchor attaches to its base with a strength ≥ 12 N.

Anchor shear resistance of ≥ 200 N shear along adhesive plane.

Anchor housing must have tensile / peel strength > 50 N per weld seam.

Pass a drop test 1.5 m onto concrete, 6 faces, 3 drops each.

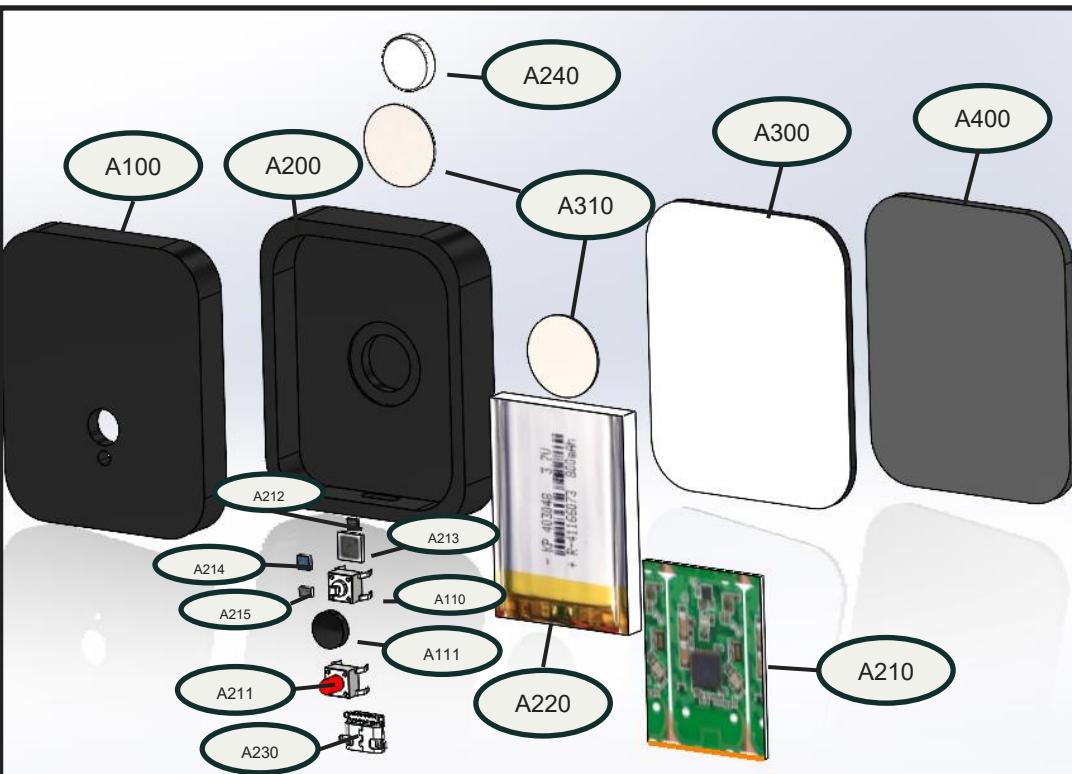
DESIGN SPECIFICATIONS

AuraTag Anchor



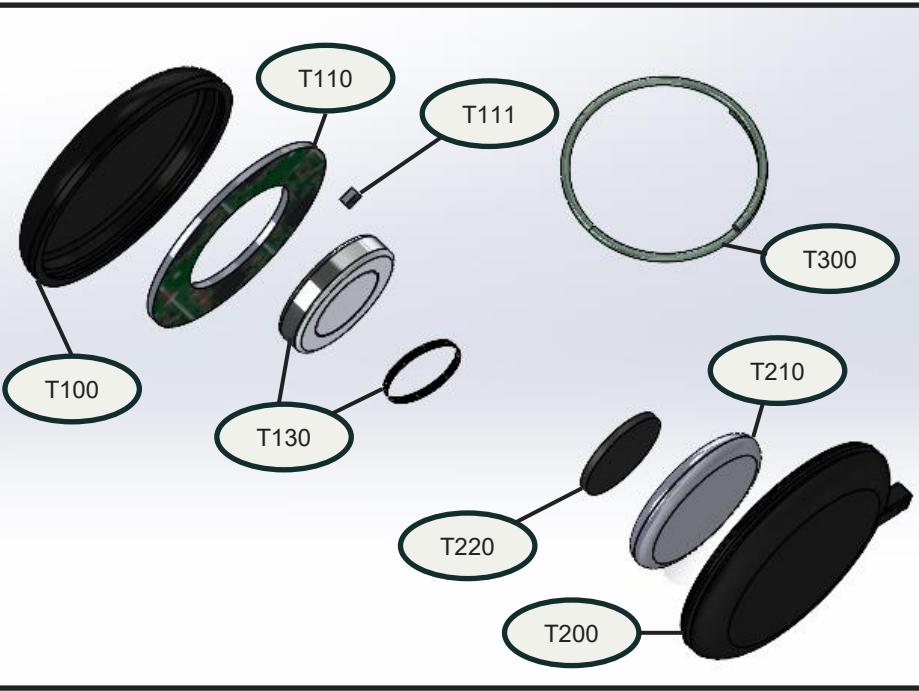
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.	M/O
A212	3-axis accelerometer	Provides XYZ acceleration data to MCU for device wake-up.	1	O
A100	Anchor Top Shell	Upper half enclosure, welded rim.	1	M
A215	Charger Integrated Circuit	Regulates input power from the USB-C for safe charging.	1	O
A220	Li-Po Pouch 800 mAh + holder	Rechargeable battery; pre-protected.	1	O
A213	MCU Processor	Provides system control, BLE comm., sensor interfacing, and firmware execution.	1	O
A210	PCB (2 layer FR-4 board	Supports and interconnects all surface mount electronics.	1	O
A214	STUSB4500	Safe power input management.	1	O
A230	USB-C Port	Battery charging and device programming.	1	O
A211	LED	Provide status feedback. (Charging, pairing, alerts)	1	O
A110	Switch Base	Provides electrical contact for button presses.	1	O
A111	Button Cap	Interfaces with the tactile switch.	1	M
A200	Anchor Base Shell	Lower half enclosure, welded rim.	1	M
A400	Adhesive Mounting Pad	Bonds the magnetic docking plate to the mounting surface.	1	M
A240	NdFeB Magnet	Embedded in Anchor Base Shell.	1	O
A310	Stainless Steel Insert	Enhances magnetic hold and structural reinforcement.	1	M
A300	Magnetic Docking Face	Permanent anchor point on the mounting surface.	1	M
A310	Magnetic Dock Stainless Steel Component	Mate's with the anchor base shell's magnet.	1	M

Parts Breakdown



AuraTag





Annular Snap Fit Design

Parts Breakdown

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
T100	Tag Housing Top	Upper shell of the tag; supports speaker diaphragm cavity.	M
T130	Speaker Magnet	Forms magnetic motor structure for the voice-coil speaker.	O
T130	Speaker Coil	Drives the speaker diaphragm.	O
T300	Metal Keyring Loop	Attachment loop.	O
T110	PCB 2 layer FR-4 Ring Board	Circular support for MCU, passives, antenna tuning elements, battery contacts.	O
T111	MCU Processor	BLE communication, audio control, battery management, system logic.	O
T210	CR2032 Coin Cell Battery	Provides primary power to the tag.	O
T200	Tag Housing Bottom	Lower shell of the tag; snap-fit with the upper shell.	M
T220	Spacer	Compression control and vibration damping.	M

Production Processes



INJECTION MOLDING

Injection Molding Press with Temperature-Controlled Mold + Automated Ejector System

Anchor Top Shell, Back Shell, Tag Housing Top and Housing Bottom, Button Cap

DIE CUTTING

Die-Cutter Press: Used for consistent dimension, high-volume repeatability

Adhesive Mounting Pads, Spacers, Stainless Steel Inserts



ULTRASONIC WELDING

Ultrasonic Welding System: Used to securely seal components in a tight, clean joint

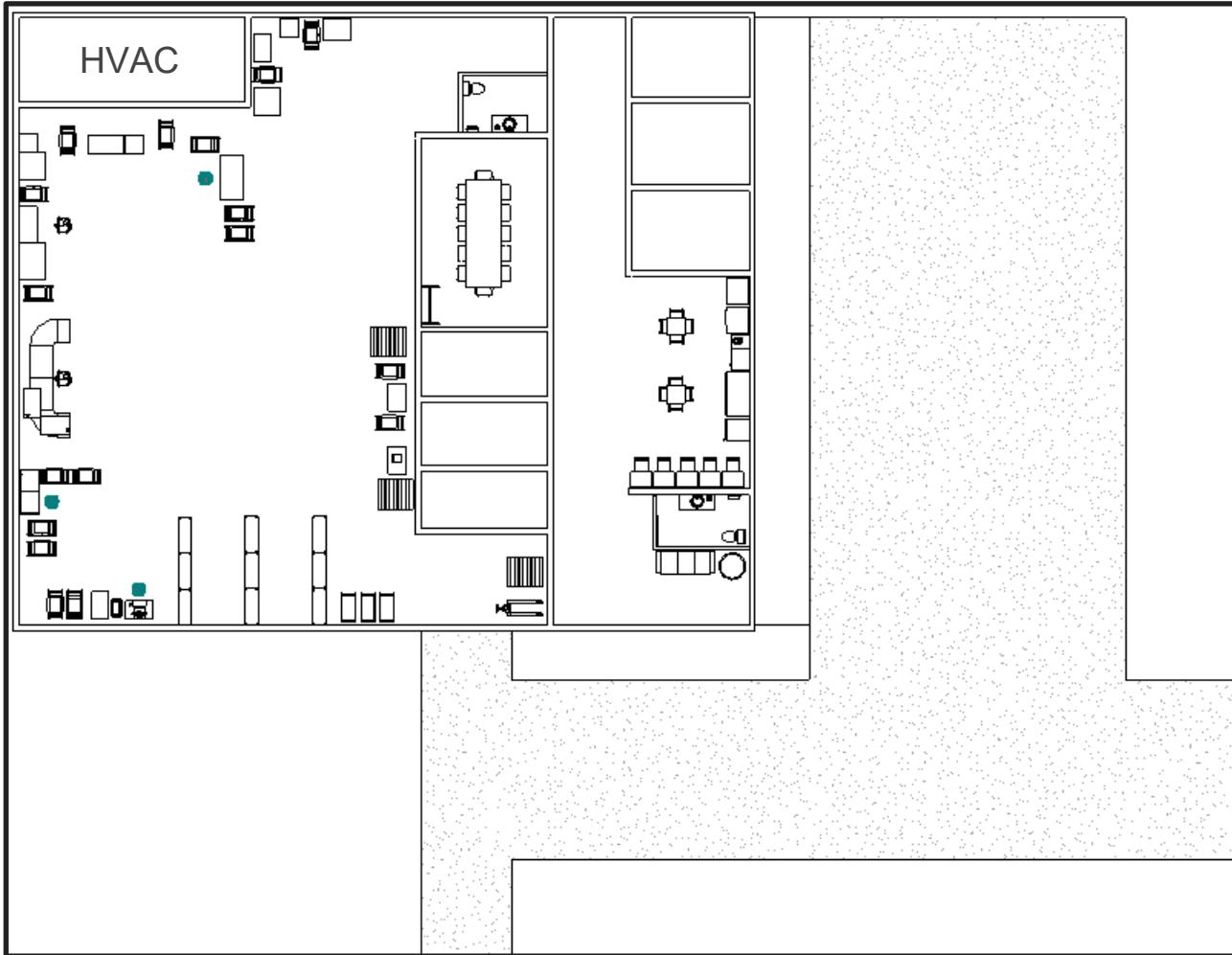
Anchor Shell

MANUAL ASSEMBLY

Manual Assembly Benches: Includes jigs, torque tools, small fixtures, and visual inspection stations to install magnets, insert PCBs, place batteries, mount buttons, and assemble mechanical subcomponents



FACILITY PLAN



Production Volume



Year 1	15,000
Year 2	18,140
Year 3	21,280

- Marketing strategy (*The Maker's Row*): Organic traffic, estimated 45 customers / 10,000 exposures, estimating 10,000 exposures per region
- Capable of 12,500 minimum in the first year
- Becomes 15,000 with 5% defect rate
- Clusterization => dynamic forecasting

Team + Team Spaces

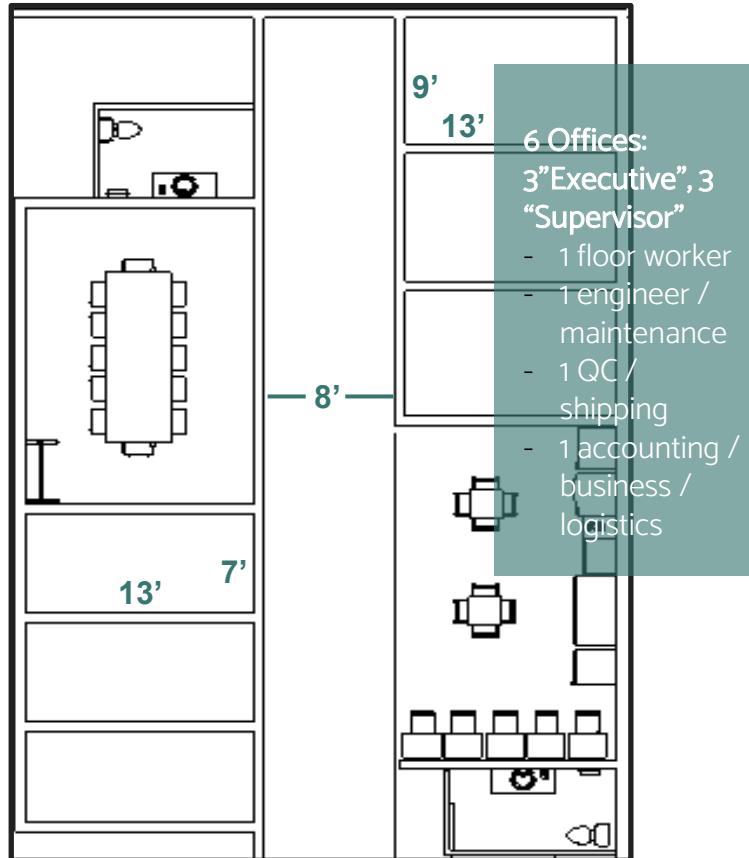


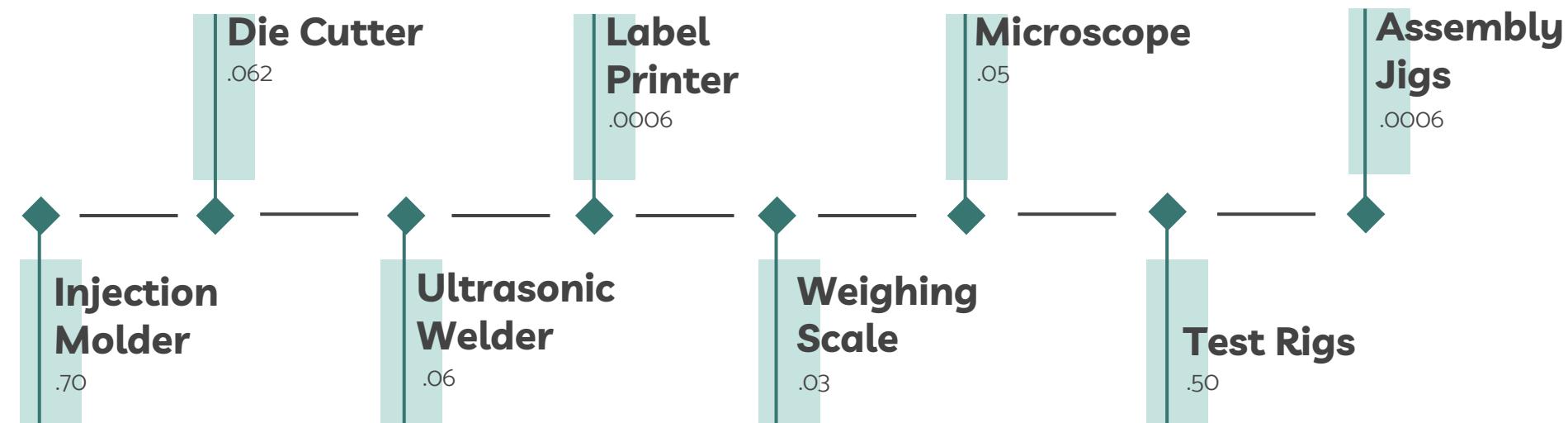
Table 3.5 Recommended Aisle Widths for Various Types of Flow

Type of Flow	Aisle Width (feet)
Personnel with doors opening into the aisle from two sides	8



MACHINES REQUIRED

Injection Molding Machine Calculation	\$2,000	Desktop Injection Molding Guide: INJEKTO 3 for Makers – Action BOX
Variable	Value	Reasoning
S	0.75	Researched injection molding takes about 30 seconds - 2 min, these are more complex parts, but the button should lower the time here.
Q	375	Producing 15,000 units annually on a four days / week, fifty weeks, schedule, but 5 parts will use this machine by interchanging molds.
E	0.875	Assuming the machine is operable 7 / 8 hours of each day.
H	480	8 hr work day => minutes
R	0.95	We chose to calculate based off a 5% defect rate which is low tier.
F	0.704887	



Production Volume



Year 1	15,000
Year 2	18,140
Year 3	21,280

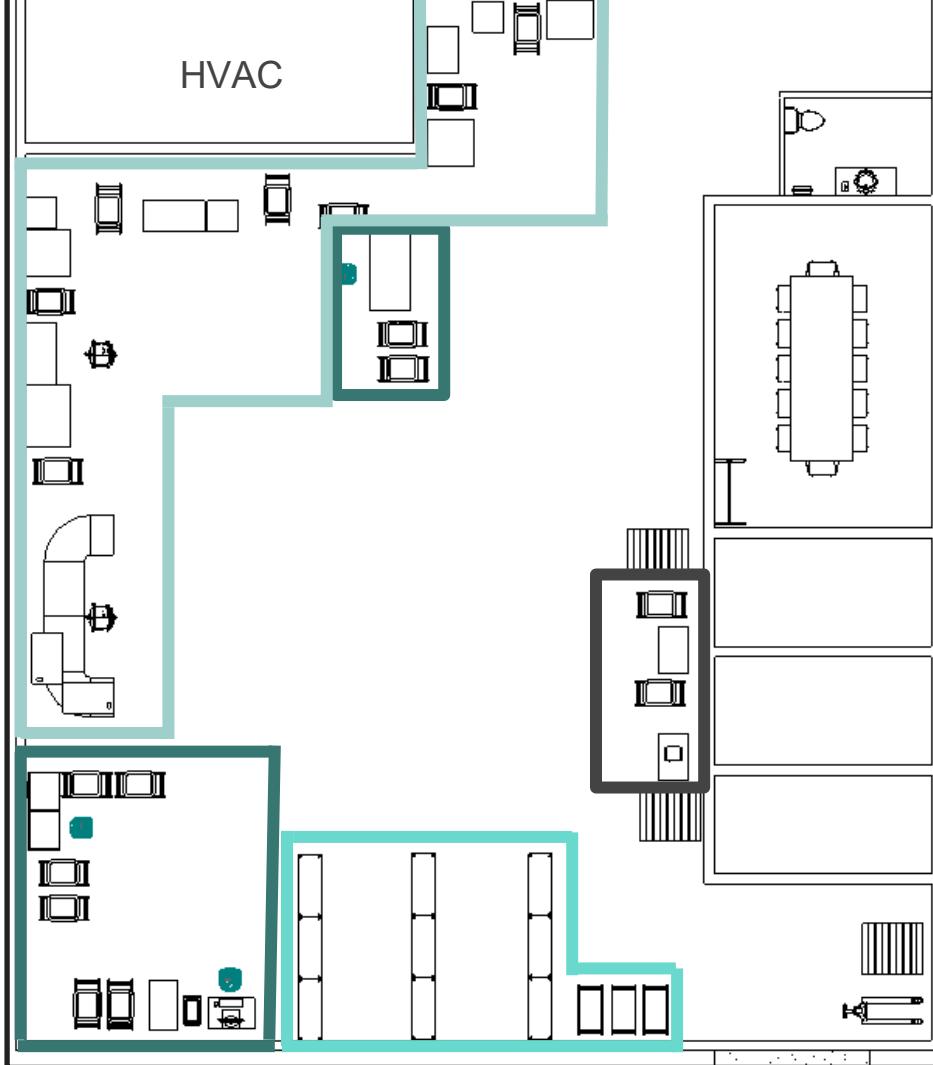
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Production Floor Layout

Parts	
Anchor Top Shell	A100
Button Cap	A111
Anchor Base Shell	A200
Anchor PCB (2 layer FR-4 board)	A210
Li-Po Pouch 800 mAh + holder	A220
USB-C port	A230
NdFeB Magnet	A240
Stainless Steel Insert	A250
Magnetic Docking Face	A300
Magnetic Dock Stainless Steel Component	A310
Adhesive Mounting Pad	A400
Packaging	AT400
Tag Housing Top	T100
PCB 2 layer FR-4 Ring Board	T110
QR Code Label	T120
Micro speaker (voice-coil)	T130
Tag Housing Bottom	T200
CR2032 Coin Cell Battery	T210
Spacer	T220
Metal Keyring Loop or Wallet Slot	T300

Machines	
Injection Molder	1
Die Cutter	2
Label Printer	3
Ultrasonic Welder	4
Assembly Jigs	5
Test Rigs	6
Weighing Scale	7
Microscope	8

Part #	Machine #							# of 1s
	5	6	8	1	2	4	3	
T210	1	1	1	1	1			5
A100	1	1		1	1			4
A200	1	1		1	1			4
A111	1	1	1	1				4
T110	1	1	1	1				4
A300	1	1		1				3
T220	1		1		1			3
A310	1	1			1			3
A400	1	1			1			3
A250	1	1	1		1			4
A210	1	1	1					3
A220	1	1	1					3
A230	1	1	1					3
A240	1	1	1					3
T100	1	1	1					3
T130	1	1	1					3
T300	1	1	1					3
T200	1	1	1			1		4
T120	1					1	1	2
AT400							1	1
# of 1s	19	17	13	6	4	3	2	1



Production Floor

Legend

Assembly & Testing Cell Block

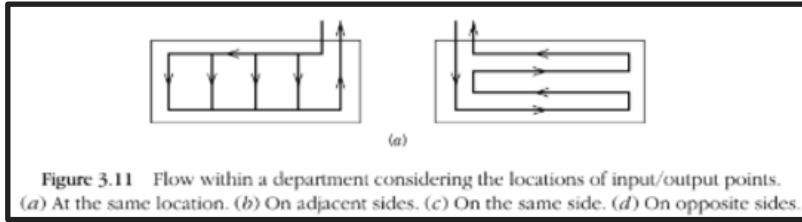
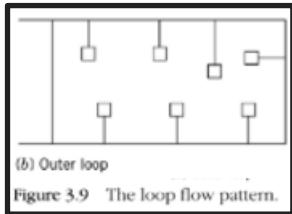
In House Production Cell Block

Packaging & Final QC

Parts/Materials/Maintenance Tools Storage

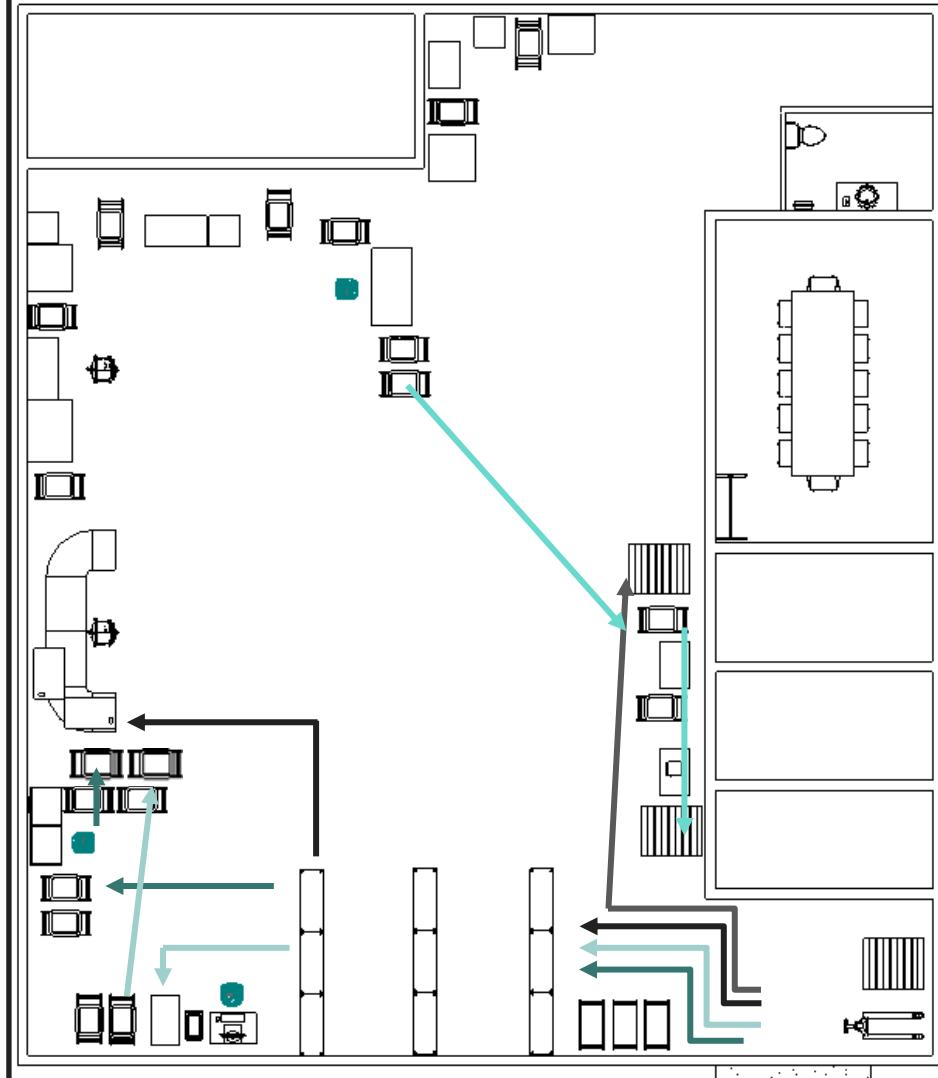
Part #	Machine #							# of 1s
	5	6	8	1	2	4	3	
T210	1	1	1	1	1			5
A100	1	1		1	1			4
A200	1	1		1		1		4
A111	1	1	1	1				4
T110	1	1	1	1				4
A300	1	1		1				3
T220	1		1		1			3
A310	1	1			1			3
A400	1	1			1			3
A250	1	1	1		1			4
A210	1	1	1					3
A220	1	1	1					3
A230	1	1	1					3
A240	1	1	1					3
T100	1	1	1					3
T130	1	1	1					3
T300	1	1	1					3
T200	1	1	1				1	4
T120	1					1	1	2
A400							1	1
# of 1s	19	17	13	6	4	3	2	1

Material flow



Material Handling Planning Chart												Layout Alternative: 1 Sheet 1 of 12			
Company: Tech Solutions Product: Anchor Shell Base					Prepared By: Rae Date: 11/26/2025					Layout Alternative: 1 Sheet 1 of 12					
Step No.	O	T	S	I	Description	Operation No.	Dept.	Cont. Type	Size	Wt.	Qty. Per Cont.	Freq	Dist.	Method of Handling	
1	X				Storage of plastic pellets		Receiving & Shipping								
2	X				Transportation of plastic pellets to Injection Mold storage		Receiving & Shipping	Bag	N/A	25 kg	1	1	10 ft	Roller cart	
3	X				Injection Mold plastic	101A	Production								
5	X				Transportation to Assembly Line storage		Assembly	TOTE Bin	15" x 24" x 24"	.032 kg	320	1	20 ft	Roller cart	
6	X				Adhesive applied to integrate with other parts	102A	Assembly								
7	X				Transportation to testing.		QC	TOTE Bin	15" x 24" x 24"	.032 kg		1		Roller cart	
8	X				Battery and signal testing performed.	103A	QC								
9					Transportation to the Ultrasonic Welder		Production	TOTE Bin	15" x 24" x 24"	.032 kg		1		Roller cart	
10	X				Ultrasonic welded to the Anchor Shell Top	104A	Production								
11	X				Transportation to QC		QC	TOTE Bin	15" x 24" x 24"	.032 kg	320	1	10 ft	Roller cart	
12	X				Final inspection	105A	QC								
13	X				Transportation to packaging		Receiving & Shipping	TOTE Bin	15" x 24" x 24"	.032 kg		1		Roller cart	
14	X				Packaging and label	106A	Receiving & Shipping								
15	X				Transportation to final storage		Receiving & Shipping	TOTE Bin	15" x 24" x 24"	.032 kg		1		Roller cart	

Key: Operation -- O. Transportation -- T. Storage -- S. Inspection -- I.



Material Flow

Legend	
Plastics	
Metals	
Outsourced parts	
Packaging Material	
Final Product	

Test M-1: Magnetic pull test (sampling)

• Purpose: Verify MOP-M1 / MOS-5 and TPM-5.

• Method:

- Use a force gauge with standard test plate.
- Attach a sample anchor; pull off at defined speed.

• Pass criteria:

- Measured pull force $\geq 12\text{ N}$ (with margin, e.g., $\geq 15\text{ N}$).

Test M-2: Adhesive shear test (sampling)

• Purpose: Verify MOP-M2.

• Method:

- Bond sample anchors to specified wall material.
- Load in shear using force rig until failure.

• Pass criteria:

- Failure load $\geq 200\text{ N}$.

Test M-3: Housing weld / snap strength test (sampling)

• Purpose: Verify MOP-M3.

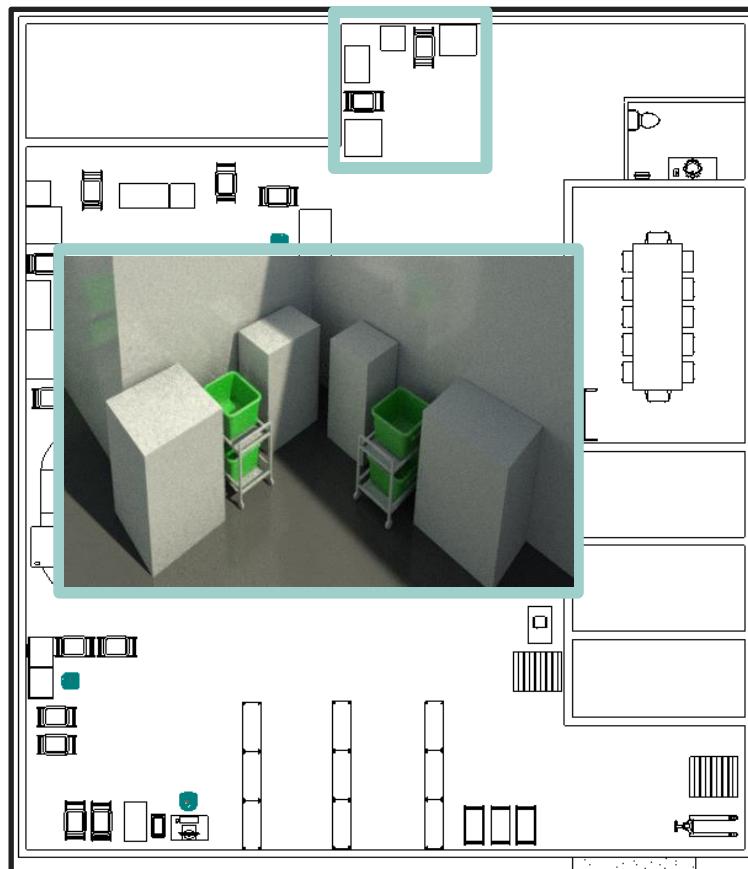
• Method:

- Pull-apart test of enclosure seam with force gauge.

• Pass criteria:

- **50 N** peel/tensile.

Mechanical & Environmental Validation & Verification



Test R-1: BLE link & presence-detection test (EOL)

• **Purpose:** Verify detection logic & basic MOE-1, MOP-R1/R2/R3.

• **Setup:**

- Fixture with two stations: “near” (\approx 1–2 m) and “far” (\approx 10 m)

• **Procedure:**

- Pair anchor and tag in test mode.
- Place tag “near”, verify device does not trigger “left behind” LED after a defined dwell time.
- Move tag to “far”.
- Verify anchor recognizes “left behind” state and LED alert activates within ≤ 5 s.

• **Pass criteria:**

- Correct state in both near and far positions.
- Alert response time within spec.

Test R-2: RF continuity / antenna check (EOL)

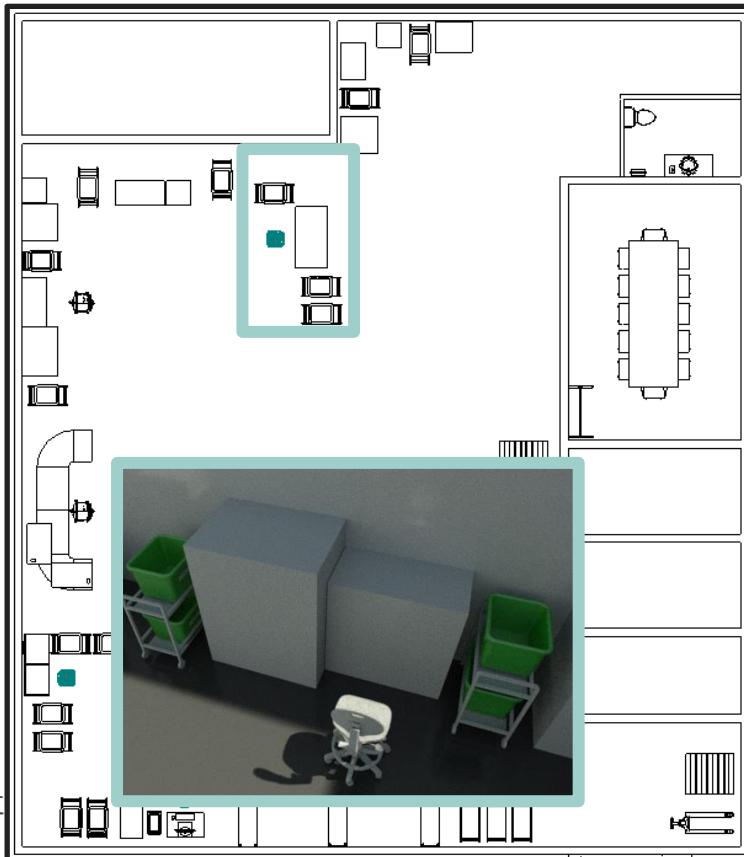
• **Purpose:** Detect major RF/antenna failures.

• **Method:**

- In test mode, tag transmits and anchor records RSSI at fixed distance.
- Measured RSSI must be within a window (**-45 to -65 dBm**).

• **Pass criteria:** Within window → antenna path OK; Outside window → reject

Radio / System Level Validation & Verification



Workstation Considerations

- Receiving and storing inbound materials
- Holding in-process materials
- Storing outbound materials and shipping
- Holding tools, fixtures, etc. and maintenance materials
- Storing and shipping waste and scrap



- Operator travel past stationary objects **≥ 30" aisle**
- Operator walks between a stationary object and an operating machine **≥ 36" aisle**
- operator walks between two operating machines **≥ 42" aisle**



Shipping/Receiving

Description	Unit Loads				Size of Shipment (Unit Loads)	Frequency of Shipment	Transportation		Material Handling	
	Type	Capacity	Size	Weight (kg)			Mode	Specifications	Method	Time
PCB (2 layer FR-4 board)	Panel Stacks	100 panels / box	250 x 250 mm	5 kg	13 panel stacks	Every month	Ground	N/A	Manual	2 min / panel stacks
Li-Po Pouch 800 mAh + holder (pre-protected)	Box (Cells in Trays)	100 pcs / box	250 x 200 x 80 mm	2-3 kg	13 boxes	Every month	Ground	N/A	Manual	3 min / boxes
Internal PCB	Panel Stacks	100 panels / box	200 x 200 mm	4 kg	13 panel stacks	Every month	Ground	N/A	Manual	2 min / panel stacks
CR2032 Replaceable Coin Cell	Box	500 pcs / box	200 x 200 x 150 mm	3 kg	5 boxes	Every 2 mos.	Ground	N/A	Manual	2 min / boxes
Metal Keyring Loop	Box	1,000 pcs / box	200 x 200 x 150 mm	2 kg	1 box	Every 3 weeks	Ground	N/A	Manual	1 min / boxes
Reservoir capacitor 47-330 µF	Reel	1,000 pcs / reel	180 mm reel	.5 kg	1 reel	Every 3 weeks	Ground	N/A	Manual	1 min / reels
Micro Speaker (voice-coil)	Box	300 pcs / box	300 x 300 x 50 mm	2 kg	3 boxes	Every 3 weeks	Ground	N/A	Manual	3 min / boxes
Plastic Injection Material (ABS)	Box	25 kg bag	~ 500 x 800 x 150 mm	25 kg	3 bags	Every 2 mos.	Ground	N/A	Lift table dolly	3 min / bag
Silicone foam	Sheets	200 sheet box	300 x 300 mm	6 kg	2 boxes	Every 3 mos.	Ground	N/A	Manual	1 min / box
Adhesive Material	Roll	60-yard roll	300 mm width	1.5 kg	3 rolls	Every 2 mos.	Ground	N/A	Manual	1 min / roll
USB-C port	Reel	1,000 pcs / reel	180 mm reel	1 kg	1 reel	Every 3 weeks	Ground	N/A	Manual	1 min / reels
Stainless Steel Sheet	Sheets	50 sheets / bundle	300 x 300 mm	6 kg	2 bundles	Every 2 months	Ground	N/A	Manual	1 min / bundle
NdFeB Magnet	Box	1,000 pcs / box	200 x 200 x 150 mm	5 kg	3 boxes	Every 2 months	Ground	N/A	Manual	1 min / box
PCB 2 layer FR-4 Ring Board	Panel Stacks	100 panels / box	250 x 250 mm	5 kg	13 panel stacks	Every month	Ground	N/A	Manual	2 min / panel stacks
Dowsil 3145	Bottle	10 bottles / box	300 x 200 x 100 mm	1.2 kg	1 box	Every 3 months	Ground	N/A	Manual	1 min / box
Pogo-pin programming/test pads	Box	1 set / box	25 x 25 x 25 mm	.1 kg	1 box	Every 6 months	Ground	N/A	Manual	1 min / box
Outer Retail Box	Box	200 pcs / pallet layer	300 x 200 x 120 mm	50 kg	2 pallets	Every 3 months	Ground	Truck	Pallet jack	5 min / pallet
Anti-static Bag	Box	3,000 pcs / box	120 x 90 mm	Negligible	1 box	Every 2 months	Ground	N/A	Manual	1 min / box
Manual Card	Stack	1,000 cards / pack	200 x 100 mm	.5 kg	5 packs	Every 4 months	Ground	N/A	Manual	1 min / pack

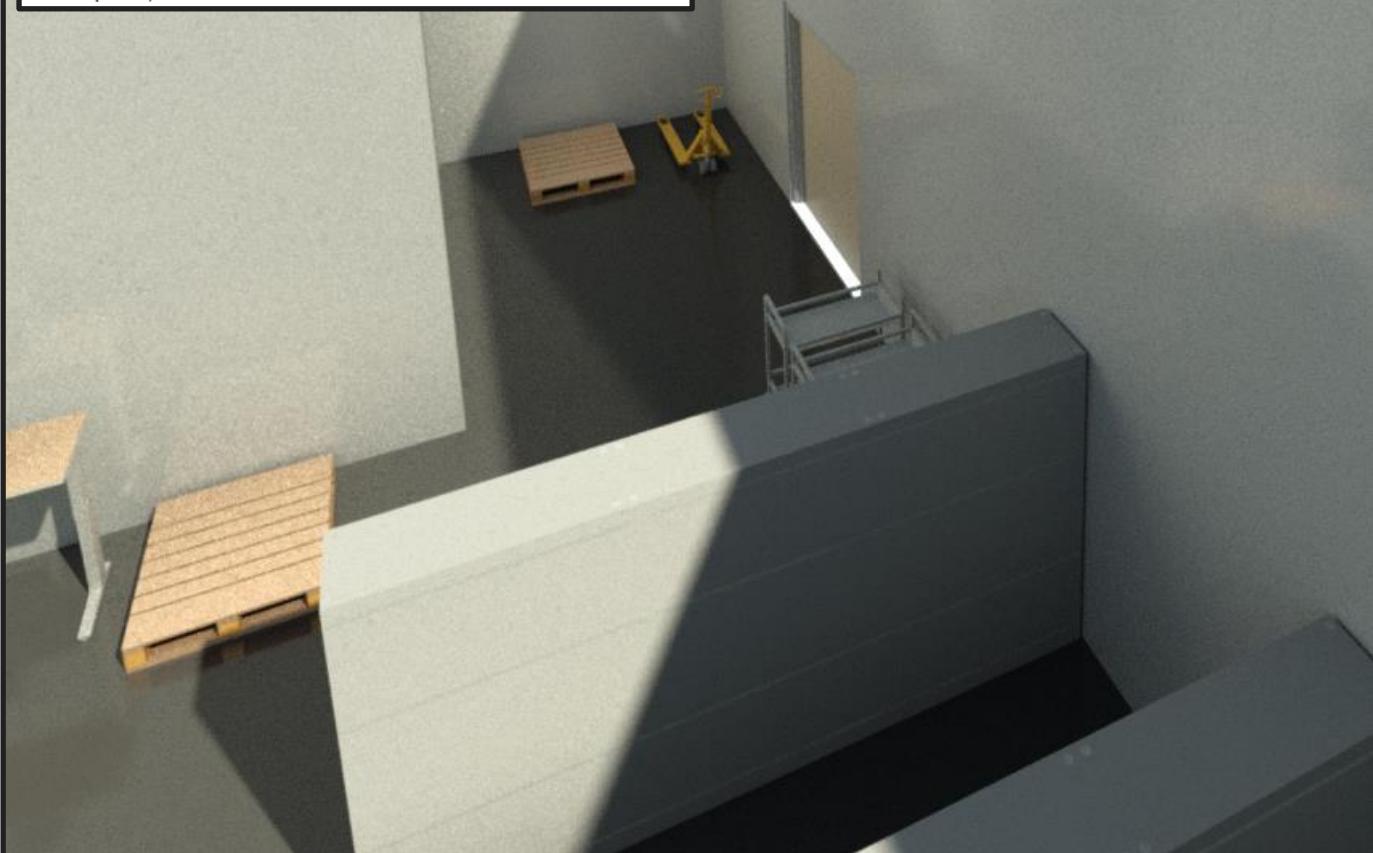
Plant goal of achieving JIT manufacturing

Description	Unit Loads				Size of Shipment (Unit Loads)	Frequency of Shipment	Transportation		Material Handling	
	Type	Capacity	Size	Weight (kg)			Mode	Specifications	Method	Time
AuraTag	Pallet	3,750	1.22 x 1.02 x .79 mm	405 kg	1 pallet	Quarterly	Ground	N/A	Pallet jack	5 min / pallet

Receiving

Table 5.4 *Recommended Aisle Widths for Facility Design*

Equipment Type	Pick Aisle	Cross Aisle
Manual pallet jack	6'	8'-10'



Shipping

Table 7.3 Minimum Maneuvering Allowances for Receiving and Shipping Areas

Material Handling Equipment Utilized	Minimum Maneuvering Allowance (feet)
Tractor	14
Platform truck	12
Forklift	12
Narrow-aisle truck	10
Handlift (jack)	8
Four-wheel hand truck	8
Two-wheel hand truck	6
Manual	5

Table 7.1 Space Requirements for 90° Docks

Truck Length (feet)	Dock Width (feet)	Apron Depth (feet)
40	10	46
	12	43
	14	39

Table 3.4 Aisle Allowance Estimates

If the Largest Load Is	Aisle Allowance Percentage Is ^a
Less than 6 ft ²	5–10
Between 6 and 12 ft ²	10–20
Between 12 and 18 ft ²	20–30
Greater than 18 ft ²	30–40

^aExpressed as a percentage of the net area required for equipment, material, and personnel.

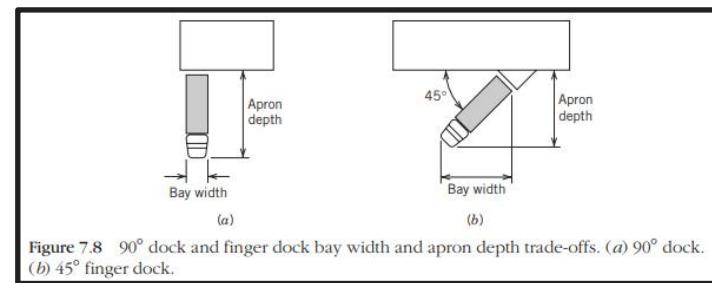
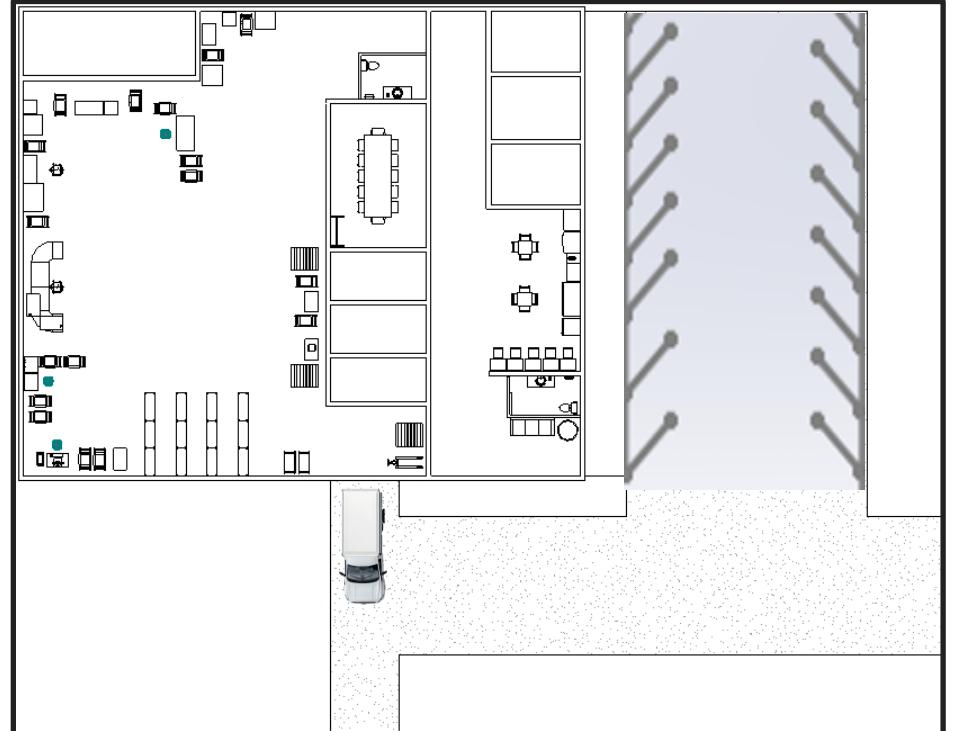
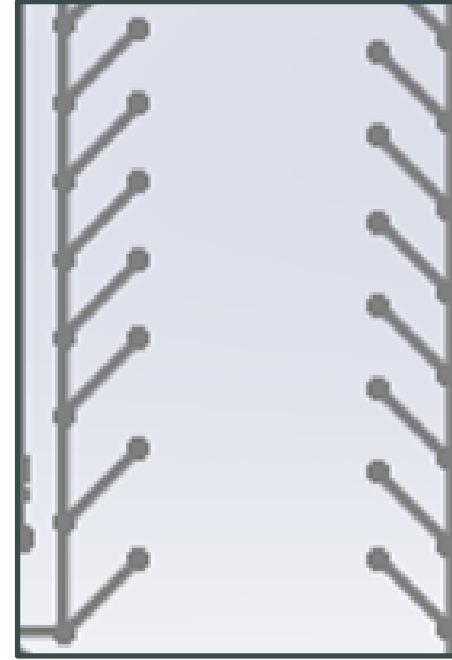
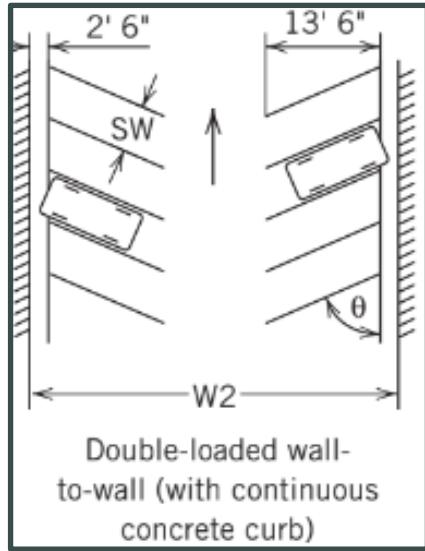


Figure 7.8 90° dock and finger dock bay width and apron depth trade-offs. (a) 90° dock. (b) 45° finger dock.

Parking Lot

- Site not serviced by public transportation
- Min 1 spot/1.25 employees
- Min 2 handicap spots per 100 spaces.



Spot Type	Width	Length	Angle	Quantity
Handicap	17'	16'	45°	2
Standard	12'	16'	45°	10
Total				12

Figure 4.2 Single- and double-loaded module options. (Source: Ramsey and Sleeper [8].)

Figure 4.1 Recommended range of stall widths (SW). (Source: Ramsey and Sleeper [8].)

Facility Systems

Structural Systems

Steel, heavy wall, round, tubular columns; 36' x 24' spacing

Flooring

Plant floor: concrete with synthetic fibers mixed in to prevent cracking with rebar support and epoxy sealant on top. Office spaces: carpet

Temperature + Airflow

Between 68°F and 76°F, .6 ft³/min-ft² of supply air, .3 ft³/min-ft² of exhaust air, and 4 air changes/hour

Fire Safety

Class ABC extinguishers, 1 / 3,000ft² => 1 for production floor, 1 for office space

HVAC

250 m², 5% of facility

CREDIT

Dr. Schrewe's Powerpoints, ChatGPT, Sources listed in
AuraTag Database.  Template by
Slidesgo, Icons by Flaticon, Infographics by Freepik,
Images created by Freepik