Elevating Construction Commissioning

A Superintendent's Step-by-Step Manual

Turning Over Confidence

From Day One to Handover

Commissioning is the disciplined act of proving the promise.

Six Parts. Thirty-Six Chapters. Eight Appendices.
Built for superintendents who own the building from day one to handover.

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Introduction — Why This Manual Exists

This manual is written for the people who lead construction projects from the field: superintendents, project managers, project engineers, and field engineers. It is not written for commissioning agents. There are already excellent resources for them.

The premise is simple: the project superintendent and project manager — not the commissioning agent, not the owner, not the MEP foreman — are the people most responsible for whether a building gets commissioned on time. That is not a popular thing to say in our industry, where commissioning is often treated as an MEP-only effort that lives somewhere on the back of the schedule. The premise of this manual is that this framing is the cause, not the symptom, of late commissioning.

The big thesis. A superintendent does not commission the building alone, but the superintendent creates the conditions that allow commissioning to succeed. The CxA verifies the building. The trades execute the work. But the superintendent creates the conditions for commissioning to flow.

Or stated another way: commissioning is where the truth of the project is revealed. The superintendent's job is to make sure that truth is discovered early, fixed quickly, verified honestly, and turned over with confidence.

How This Manual Is Built

The manual has six parts and eight appendices, designed so a superintendent can read it cover to cover or jump to the part they need.

Part 1 — The Superintendent's Mindset. Why commissioning starts on Day 1, urgency as the hidden variable, the vocabulary you must own, why supers must personally own commissioning, and the eight-state progression from installed to operational.

Part 2 — The Level 0-6 Framework. The procedural spine. Each of the seven commissioning levels gets its own chapter, with step-by-step procedures a superintendent can run as written.

Part 3 — Field Systems That Make Commissioning Flow. Nine practical systems the super builds, runs, and defends: HVAC visualization, scheduling, system readiness, MEP rooms, controls, TAB, life safety, documentation, and the deficiency log.

Part 4 — The People Side. Kickoff, CxA partnership, owner training, the Lean construction connection, and Takt planning for commissioning.

Part 5 — The Superintendent's Playbook. Step-by-step procedures: daily and weekly rhythms, startup readiness walks, FPT preparation, IST preparation, owner training delivery, close-out strategy, substantial vs. final completion.

Part 6 — Lessons from the Field. The ten most common commissioning failures and the behaviors that separate the supers whose projects land cleanly.

Appendices A through H. The reference tools: activities map, milestone-by-milestone field checklist, yellow brick road template, system readiness checklists for thirteen equipment types, commissioning responsibility matrix, daily huddle agenda, weekly meeting agenda, and a common-failures quick reference.

How to Read This Manual

Each chapter follows the same shape: an analogy that frames the topic, an explanation of how it actually works on a project, and one or more "How to Do It" callouts with concrete actions. Many chapters end with a step-by-step procedure that a superintendent can run as written.

Read the manual once cover to cover when you first start leading commissioning. After that, treat it as a reference. The chapters are designed to stand alone. The appendices are designed to be printed, signed, and pinned on the trailer wall.

A note for the engineers and commissioning experts who may pick this up. You will read sections of this manual and feel that they are oversimplified. They are. That is the design. A field builder does not need to know the building automation system at the level a commissioning agent does. A field builder needs to know enough to ask the right questions, hold the right milestones, and never delegate the systems sequence. That is what this manual provides.

On we go.

Part 1 — The Superintendent's Mindset

Before the procedures, the mindset. The super does not commission the building alone — the super creates the conditions where commissioning can flow.

This manual is built around a simple premise: commissioning is the moment when a project's truth is revealed. Every shortcut, every weak handoff, every undocumented decision, every system installed but never verified — all of it surfaces in the back half of the schedule. The superintendent's job is not to perform every test. It is to make sure that truth is discovered early, fixed quickly, verified honestly, and turned over with confidence.

Before the framework, before the procedures, before the checklists, the five chapters in this part establish how a superintendent should think about commissioning. Get the mindset right and the rest of the manual is execution. Get the mindset wrong and the rest of the manual cannot save you.

Chapter 1 — Why Commissioning Must Start on Day 1

How you finish is how you did.

Analogy: The Commissioned Human

Building the structure is the skeleton. The walls, the slab, the steel, the skin — that is bone and muscle. But a skeleton with muscles on it is not a person. A person has a nervous system that fires, a circulatory system that flows, a respiratory system that breathes, a brain that coordinates the lot of it. Everything has to talk to each other in the right sequence at the right time, or the body does not function.

A commissioned building is the same. The structure goes up and the walls close in, but until power talks to controls, controls talk to the air handlers, the air handlers talk to the dampers and the dampers talk to the fire alarm, you do not have a building. You have a very expensive shell.

Commissioning is the discipline of making the building actually work. It is the quality-focused process of verifying and documenting that the facility and all of its systems are planned, designed, installed, tested, and operated to meet the owner's requirements.

A Story: The Building That Looked Done

One project looked beautiful at the end. The corridors were clean. The ceiling tiles were in. The walls were painted. The lights were on. The mechanical rooms had that fresh-project smell — new pipe insulation, painted floors, labeled equipment, shiny valves. The electrical rooms looked organized. The equipment pads were clean. The owner was walking the building and starting to feel the excitement of occupancy.

But under the surface, the building was not ready.

A pump was running backward. A valve tag did not match the control sequence. A sensor was installed in the wrong location. A generator test had been performed, but not under the correct load condition. The BAS showed points, but several were mapped incorrectly. The air handlers could start, but they had not been tested through all operating modes. The fire alarm contractor had tested devices, but the full interface with HVAC shutdown and elevator recall had not been proven together. The O&M manuals were being assembled, but the facilities team had not been trained on what mattered most.

To the untrained eye, the project looked finished. To a builder, it was not finished at all.

That is the danger in construction. We can confuse completion with readiness. We can confuse activity with verification. We can confuse installed with operational. Commissioning is what protects us from making that confusion in front of the owner.

Why "Day 1"

Every commissioning schedule on every project starts at least six weeks too late. Sometimes six months. This is not a guess and it is not pessimism — it is the default. The commissioning agent is incentivized to fail the system on behalf of the owner, not to keep your schedule. The owner's facilities team is incentivized to keep their equipment off until handover. The trade partners are incentivized to finish installs without being interrupted by point-to-point testing. None of these incentives line up with finishing your building on time.

The only person on the project whose incentive is to finish on time and whose authority spans all of those parties is the project superintendent, supported by the project manager. That is why the answer to "when does commissioning start" is not "when we are framed in" or "when the air handlers land." It is day one.

Day one looks like this: who is the commissioning agent? Do we have a commissioning plan? Who is the controls contractor and when do they start their graphics? When is the kickoff? When are pre-functional checklists released? When do air handlers fly? When do we have permanent power, internet, and vertical controls? These are the questions you start asking the day after the notice to proceed, and you keep asking them until the building is turned over.

Rule of the Six-Week Lag

Assume every commissioning milestone on the current schedule is at least six weeks later than it should be. Pull them all forward six weeks. Then ask whether even that is enough.

Mindset: How You Finish Is How You Did

There is a tendency in construction to treat commissioning as the last thing — the cherry on top, the closeout chore, something for the MEP folks to figure out near the end. That mindset is the single biggest contributor to crash-landed projects. It treats the most complex part of the work as if it were the simplest, and it does so right when the team is most fatigued.

Flip it. Commissioning is the spine of the back half of the project. Site work and structure feed it. Interiors feed it. Power, controls, internet, hydronics, duct — all of it converges on commissioning. The team that internalizes "how we finish is how we did" does not wait for commissioning. They build toward it from the dirt up.

You do not have to be a commissioning expert to lead it. The superintendent and project manager who own commissioning do not have to know more about the building automation system than the controls contractor. They have to know enough to ask the right questions, hold the right milestones, and never delegate the sequence to anyone else.

How to Do It — Day 1 Moves

Within the first two weeks of NTP: identify the commissioning agent and read the commissioning plan cover to cover.

Within the first month: introduce yourself to the CxA in person, take them to lunch, and start the relationship.

Within the first month: confirm who the controls contractor will be and when they will begin building automation system graphics.

On your master Takt plan: place commissioning, pre-functional checklists, test and balance, functional performance testing, integrated systems testing, and final acceptance testing — even if dates are rough.

On a recurring weekly cadence: a standing 30-minute commissioning sync between superintendent, project manager, MEP coordinator, and CxA. It runs from NTP to handover. No exceptions.

Chapter 2 — Urgency: The Hidden Cause of Late Commissioning

Most projects do not lose time because the work is slow. They lose time because the planning was not urgent.

Analogy: The Driver Who Plans the Trip

Two people leave for the same destination 200 miles away. One leaves at 7 a.m. with a packed bag, a full tank, a route mapped, and a coffee in the cup holder. The other rolls out at 9, realizes at 9:30 they forgot something, doubles back, hits traffic, stops for gas, then for snacks, then takes the wrong exit. Both drivers were doing the same number of miles per hour. One arrives by noon. The other arrives at 4.

This is the difference urgency makes on a project. It is not about speed in the field. It is about how far out ahead the planning is.

What Urgency Is and Is Not

Urgency is the quality of treating a task as requiring immediate attention or swift action — recognizing that delay will cause negative consequences. On a project, that means pre-planning earlier, sooner, better, more in depth, with more people, to get ahead of situations before they become problems.

Urgency is not pushing. Pushing is what happens when you did not plan: you push resources, you push crews, you push the trades to make up for what was not ready. Urgency is what prevents the need to push. We do not push with people. We push with our planning.

> **The Commissioning Agent Who Said "You Were Right"**
>
> On one project the commissioning experts kept saying "we're fine, we don't need to start yet." The superintendent moved the commissioning sequence up by six weeks anyway. As the installation work that enables commissioning came into view, it became clear there was no other way. After substantial completion, the commissioning agent said: "You were right. We were not urgent enough. We would have missed substantial completion if you hadn't done that."

Where Lack of Urgency Hides

Most of what feels like execution problems trace back to urgency problems. The crew that has a false start because materials were not there — lack of urgency. The switchgear that arrived three months late — lack of urgency. The trailer that was not set up — lack of urgency. The dust

control permit that delayed earthwork — lack of urgency. The commissioning kickoff that happened in month nine instead of month three — lack of urgency.

This is not a criticism. It is a category. Once you see it as a category, you can solve it. The fix is not to work faster — it is to plan further out, with more depth, and with more people in the room, sooner.

How to Do It — Urgency Discipline

Pick the three commissioning milestones you are most worried about: air handlers in hand, permanent power, vertical controls connectivity. Put a date on each in your Takt plan today.

From those dates, work backward to identify the earliest point each could have been planned. That is your start-by date — not the end date.

Run a weekly question loop: "What are we about to be six weeks late on?" If the answer is anything but "nothing," that becomes your top priority for the week.

When you catch yourself thinking "we don't need to do that yet," treat it as a warning. That is how every late commissioning effort starts.

Chapter 3 — Commissioning Vocabulary You Must Own

You cannot lead what you cannot name.

You do not have to be an engineer to lead commissioning, but you do have to be fluent in the language. The trades, the commissioning agent, and the engineers will use these terms in every meeting from kickoff to turnover. If they mean something different to you than to them, the schedule will quietly drift while everyone nods along.

What follows are the core terms a field builder needs to own. They are written in the form a superintendent or project manager actually uses them on a job site, not the form they appear in a textbook.

Commissioning

The quality-focused process of verifying and documenting that the facility and its systems are planned, designed, installed, tested, and operated to meet the owner's requirements. The key word is operated. Building it is easy. Getting it to actually function as designed is commissioning.

Commissioning Authority (CxA)

The independent party — most often a third-party firm hired by the owner — who leads, plans, and documents the commissioning process on behalf of the owner. The CxA is on your team, but their job is to find what does not work. Treat them as a partner, take them to lunch, build trust, and accept that their incentive structure is not yours.

Owner's Project Requirements (OPR)

The written document that captures the owner's functional needs, performance criteria, and expectations for the project. Think of the OPR as the owner's conditions of satisfaction in written form. Everything downstream — design, install, test — has to trace back to it.

Basis of Design (BOD)

The designer's narrative explaining the concepts, assumptions, calculations, and decisions used to meet the OPR. If the OPR is what the owner wants, the BOD is how the engineers got there. The CxA uses the BOD to verify that what you built matches what was designed, and that what was designed actually meets the OPR.

Commissioning Plan

The roadmap the CxA uses to define the scope, schedule, roles, responsibilities, and procedures for the commissioning work. It is a long, dense, wall-of-text document. Read it anyway. The schedule embedded in it is where most of your field decisions will live for the second half of the job.

Sequence of Operations (SOO)

The written description of how a system is supposed to operate under all expected conditions. The SOO does four jobs for you. It tells you the path of construction (you cannot test step C before step B is built). It identifies the key interfaces between systems. It describes how the system will be tested. And it tells you exactly how the commissioning agent is going to try to fail it.

Systems Manual

The turnover document that compiles the OPR, BOD, sequences of operations, as-builts, O&M information, and test results so the owner can operate the building after you leave. This is built as you go. Trying to assemble it at the end of the project is how teams crash-land their closeouts.

Issues Log

A running list of deficiencies, observations, and resolutions tracked by the CxA — usually weekly, with photographs. Field teams sometimes resist this because they do not want the owner seeing the raw list. Do not. The earlier the issues surface, the cheaper they are to fix. Your job is not to suppress the log; it is to respond to it quickly.

Factory Acceptance Test (FAT)

A test performed at the equipment manufacturer's facility before the equipment ships. The FAT verifies that the equipment was built and configured correctly, that controls and sequences work, and that documentation is complete. Find problems at the factory before they become field problems.

Pre-Functional Checklist (PFC)

An installation and startup verification checklist confirming that a piece of equipment is properly installed, connected, and ready for testing. PFCs are issued by the CxA, executed by the trades, and verified during installation. The single biggest leverage point you have as a field builder is starting PFCs sooner than the commissioning schedule says you can.

Startup

The contractor's process of energizing and initially running equipment per the manufacturer's instructions. Startup proves that the unit is wired correctly, fans rotate the right direction, safeties are removed, and the equipment is ready for further testing. One bad startup will fail the system later — get it right the first time.

Test and Balance (TAB)

The discipline of measuring and adjusting air and water flows in HVAC systems to match design values. TAB happens after pre-functional testing and before functional performance testing. The biggest TAB pitfall is scheduling it on top of fire alarm testing — when smoke dampers are slamming shut, you cannot balance air.

Functional Performance Testing (FPT)

Active testing of systems under various operating modes to verify they perform per the OPR, BOD, and SOO. FPT is where the building actually proves it works. By this point the CxA is in charge of the choreography; the builder's job is to remove every obstacle that prevents tests from running.

Integrated Systems Testing (IST)

Testing how multiple systems work together. Does fire alarm trigger smoke control? Does the generator pick up on power loss? Do the elevators recall properly? IST is a subset of FPT and is the moment when the building starts behaving like a building.

Acceptance Testing (AT)

The formal testing required for the owner to accept a system as completed and operational. AT usually happens in the final weeks of the project with the authority having jurisdiction (AHJ) and the engineers of record present. Schedule it. Do not hope it fits.

Building Automation / Management System (BAS / BMS)

The network platform that monitors and operates the HVAC, lighting, and other building systems. The BAS is the brain of the commissioned building. For it to work, you need vertical controls connectivity floor-to-floor, internet to the building, IDF rooms built out, and racks installed. Often a temporary cable bundle is run up the building before the permanent network is complete — pay the controls contractor for it; do not wait.

How to Do It — Vocabulary Fluency

Print this list and tape it inside the front cover of your project notebook for the first 90 days.

Use the exact terms in meetings. Saying "point-to-point" instead of "that controls check thing" buys you credibility with the trades and the CxA.

Before the kickoff meeting, hand this list to every project engineer and assistant superintendent on the job. If they are going to support commissioning, they need the same vocabulary you have.

Chapter 4 — Why Superintendents Must Own Commissioning

The CxA verifies the building. The trades execute the work. The superintendent creates the conditions where commissioning can flow.

The Three-Role Truth

On every commissioning effort, three roles are present and each one is essential:

- **The Commissioning Authority (CxA)** verifies the building. They write the checklists, witness the tests, document the results, and sign off on systems on behalf of the owner.
- **The trade partners** execute the work. They install the equipment, hook up the systems, run the controls, perform the startups, fix the issues, and stand up to be witnessed.
- **The superintendent** creates the conditions where the first two can do their jobs.

This is the most important distinction in this manual. The superintendent does not perform every test, write every script, program every control point, or balance every system. But the superintendent absolutely owns the environment in which commissioning can succeed.

What the Superintendent Owns

The superintendent owns:

- **Access** — every room, panel, and piece of equipment is reachable when it needs to be tested.
- **Sequence** — work happens in an order that allows commissioning, not against it.
- **Cleanliness** — coils, filters, panels, and rooms are protected through to startup.
- **Trade coordination** — multiple trades arrive at the right time, in the right place, with prerequisites met.
- **Area readiness** — rooms are turned over to commissioning in known states.
- **Constraint removal** — anything blocking the next test gets cleared within the day.
- **Field communication** — the daily and weekly rhythms that keep everyone moving in the same direction.
- **Room turnover** — formal handoffs of MEP rooms to commissioning.
- **Safety** — lockout, tagout, energization, and emergency-mode testing all happen safely.
- **Schedule flow** — commissioning is in the production plan, not bolted on the end.
- **Protection of completed work** — finished systems are not damaged by ongoing installs.
- **Testing readiness** — every prerequisite is met before a test begins.

- **Daily accountability** — issues are owned, dated, and tracked to closure.

Why This Cannot Be Delegated

The list above touches every trade, every system, every room, and every milestone in the back half of the project. No one else on the project has authority across all of those things. The MEP superintendent does not have authority over the architectural punch list. The project engineer does not have authority over crews. The CxA does not have authority over installation sequence.

Only the superintendent does.

If you delegate commissioning to anyone else on your team, you are delegating something that only your role can deliver. That does not mean you do every walk yourself. It means you own the result. You walk the path of critical flow weekly with the MEP coordinator. You sit in every commissioning meeting. You make the call on every readiness gate. You are the single point of accountability.

The Promotion Question

If you are an assistant super, a project engineer, or a young PM reading this — the field builders who get promoted are the ones who learn to own commissioning. Not the ones who avoid it. The complexity of commissioning is exactly what makes it the proving ground for senior field leadership.

How to Do It — Take Ownership

In the first month: tell your team out loud that you personally own commissioning. Say it in a meeting. Make it real.

On the org chart: write your name next to commissioning. Not the MEP super's. Yours.

On the weekly schedule: block a recurring two-hour MEP and commissioning walk every week. Walk it personally. No exceptions.

In every weekly meeting: open with the commissioning status. If commissioning is not on the agenda, the project is not commissioning-ready.

When something fails: do not look for someone to blame. Ask what the conditions were that allowed the failure to happen. That is the superintendent's job.

Chapter 5 — Installed Is Not Operational

The progression that separates a finished-looking building from a working one.

Eight States of a System

Every system on the project moves through a progression of eight states. Most teams collapse them in their heads and treat "installed" as if it meant "done." The result is the building that looks done but is not ready. A superintendent who tracks the eight states separately keeps the team honest about what has actually been proven.

State	What It Means	Who Confirms
Installed	Equipment is in place, connected to its rough utilities. Looks finished.	Trade
Inspected	Installation has been physically verified — anchoring, terminations, labels, clearances.	Trade / Super
Started	Equipment has been energized and the manufacturer's startup has been performed.	Trade / Mfr
Pre-functionally tested	Pre-functional checklist complete. Equipment can operate individually.	Trade / CxA
Functionally tested	System runs through every mode in the sequence of operations and passes.	CxA / Trade
Integrated tested	System has been proven to interact correctly with every other system it touches.	CxA / Trade / AHJ
Trained	Owner's operators have been taught how to operate, alarm, recover, and maintain.	Trade / Vendor / Super
Turned over	Documentation delivered, deficiencies closed, warranty active, owner accepts.	PM / Owner / CxA

Why the Distinction Matters in the Field

When the project manager asks "how is the chiller coming along?" the right answer is not "installed" — it is which of the eight states the chiller is in today. "Installed and inspected, startup scheduled Thursday, PFC will follow next week" is a real answer. "Installed" is not.

The same applies system by system across the whole project. The eight-state model is what separates a project status report that looks confident from one that actually is.

The Visual Control

Build a System Readiness Board on the trailer wall. Rows are the major systems. Columns are the eight states. A magnetic dot or sticky note marks the current state of each system. Walk it weekly. If two systems do not move for two weeks, something is stuck.

Common Confusions to Reject

- **"It's installed, so we're good."** — Installed is two states out of eight.
- **"They started it last week."** — Started is three states out of eight. Was the PFC done?
- **"Functional testing went fine."** — Did the system get integrated tested with everything it touches?
- **"The training is on the schedule for next week."** — Will the right operators attend? Will it be recorded?
- **"We turned over the manuals."** — Manuals delivered is not turnover. Verified, accepted, signed off is turnover.

How to Do It — Track the Progression

Build the System Readiness Board within the first 90 days. Eight columns. One row per major system.

In every weekly commissioning meeting, walk the board. Update the state of every system.

When status is asked for, give the state — not a vague summary.

When a system has not advanced in two weeks, treat it as a blocked card. Identify the blocker and clear it.

Train your project engineers and assistant supers to speak in the eight states. It changes how they think.

Part 2 — The Level 0 to Level 6 Framework

The procedural spine. Seven gates between intention and operation.

Many MEP-heavy environments — data centers, hospitals, laboratories, advanced manufacturing facilities, high-rise buildings, and complex commercial projects — organize commissioning into levels. The labels can vary between firms (some use Levels 1-5, some 0-6), but the underlying logic is the same: we move from intention to verification, from design to delivery, from individual components to integrated systems, from contractor control to owner confidence.

This part walks all seven levels from a superintendent's perspective. Each chapter ends with a step-by-step procedure you can follow to lead that level. The progression matters: weakness at one level becomes pain at the next. If Level 2 is rushed, Level 3 becomes rework. If Level 4 is incomplete, Level 5 becomes chaos. The superintendent who protects each level is the one whose project lands on time.

The Seven Levels at a Glance

Level 0: Plan it. Level 1: Test it before it ships. Level 2: Verify it on site. Level 3: Start it up. Level 4: Test each system. Level 5: Test all systems together. Level 6: Turn it over and support operations.

Chapter 6 — Overview of the Levels

How the levels connect.

Analogy: A Series of Locks on a Canal

On a canal, a boat does not climb from sea level to mountain level in one motion. It moves through a series of locks. Each lock raises the boat to the next height in a controlled way. You cannot skip a lock. You cannot raise the boat in two locks instead of seven. Every lock is a gate that must be opened, passed through, and closed before the next can be entered.

Commissioning levels work the same way. Each level lifts the project to the next stage of readiness in a controlled way. Each one has a gate. Each gate must be honored. The temptation is always to skip a lock — to argue that the boat can rise faster, that the next lock is not really necessary, that the previous lock was "close enough." Every time a project gives in to that temptation, the back half of the project pays for it.

Why Each Level Exists

Level	Name	The Question It Answers
0	Plan It	Do we know what success means?
1	Factory Acceptance	Can we verify quality before equipment ships?
2	Site Verification	Is the installation actually ready?
3	Startup	Can the equipment start and operate safely?
4	Functional Performance	Does the system perform as designed?
5	Integrated Systems	Do all systems work together under real conditions?
6	Turnover & Operations	Can the owner operate and maintain what we built?

What Each Level Costs If You Skip It

Skipping levels does not save time. It pushes the cost downstream, where it is more expensive and more visible. The progression below is what actually happens when each level is weak:

- **Weak Level 0** — factory testing misses the point. No one knows what to look for.
- **Weak Level 1** — field startup becomes discovery. Manufacturing defects show up at the worst possible time.
- **Weak Level 2** — startup becomes rework. Equipment is energized before installation is verified.

- **Weak Level 3** — functional testing becomes troubleshooting. Each test stops to diagnose a startup problem.
- **Weak Level 4** — integrated testing becomes chaos. Systems fail in front of the owner.
- **Weak Level 5** — turnover becomes a gamble. The building works in pieces but no one has seen it work as a whole.
- **Weak Level 6** — the owner does not know what they have. Calls start in the first week of occupancy.

That is the cost. Every level that is honored prevents the next level from absorbing its work.

The Most Important Sentence in This Manual

If you do not have time to do Level 2 properly, you will find time to fix it during Level 3, 4, and 5 — and the fix will cost ten times as much. The levels are not optional gates. They are insurance against rework.

Chapter 7 — Level 0: Plan It

The quality of the end is determined by the clarity of the beginning.

What Level 0 Is

Level 0 is where commissioning begins, long before any equipment is delivered. It is the planning and design-intent stage. It is where the owner's project requirements are defined, the basis of design is captured, the commissioning specifications are written, the system matrix is built, and the success criteria for the whole project are documented.

Level 0 is not glamorous. It is not the part of the project people take pictures of. But it may be the most important level of all, because every test in every later level traces back to a decision made at Level 0.

What Lives at Level 0

- Owner's Project Requirements (OPR)
- Basis of Design (BOD)
- Commissioning specifications
- Commissioning plan
- Testing standards and acceptance criteria
- Sequence of operations review
- Controls strategy review
- Critical equipment identification
- Roles and responsibilities
- Documentation requirements
- Training requirements
- Turnover expectations

Why the Superintendent Must Be Present at Level 0

Commissioning cannot be left only to designers, consultants, or late-stage testing teams. The field must understand the commissioning strategy early enough to plan for it. If Level 0 is not tied to the schedule, the project will drift. If the commissioning plan is not tied to work packaging, the field will improvise. If testing requirements are not understood early, the team will discover them too late.

Level 0 is the leader's chance to make commissioning visible before it becomes urgent.

Step-by-Step: How to Run Level 0 as a Superintendent

1. **Read the OPR cover to cover.** Within the first two weeks of pre-construction. If it is not yet written, ask who owns it and when it will be.
2. **Read the BOD cover to cover.** Highlight every system, sequence, and acceptance criterion. Note anything that is unclear.
3. **Read the commissioning specifications.** Note testing requirements, witness expectations, and documentation deliverables.
4. **Read the commissioning plan.** It will be long and dense. Read it anyway.
5. **Build the system matrix.** A simple table: every system that will be commissioned, what levels apply, who owns each, what prerequisites are required.
6. **Walk the commissioning specifications with the CxA.** One-on-one. Ask: what concerns you about this project? What have we missed?
7. **Identify the critical systems.** On most projects, three to five systems will dominate the back half of the schedule. Name them. Track them differently.
8. **Map commissioning onto the Takt plan.** Place named milestones for each level on the macro Takt plan. Refine quarterly.
9. **Run a Level 0 review meeting.** Before the end of the first third of the schedule, hold a meeting with the owner, CxA, design team, and key trades. Walk the system matrix. Confirm everyone has the same understanding.
10. **Set the documentation cadence.** From Level 0 forward, every test, walk, and signoff will produce evidence. Decide where it lives, who owns it, and how it flows to turnover.

The Six-Month Question

At Level 0, ask the question that turns planning into action: "What has to be true six months from now for commissioning to flow?" Then work backward from that answer.

How to Do It — Level 0 Checklist

OPR read and understood. Questions logged with the owner.

BOD read and understood. Questions logged with the design team.

Commissioning specifications read. Witness requirements identified.

Commissioning plan read. Schedule extracted onto the Takt plan.

System matrix built and posted in the trailer.

Critical systems named and tracked separately.

Documentation flow decided and owners assigned.

Level 0 review meeting held with owner, CxA, design team, and key trades.

Chapter 8 — Level 1: Test It Before It Ships

Factory Acceptance Testing. Find the problems where they are cheapest to fix.

What Level 1 Is

Level 1 is Factory Acceptance Testing — FAT — and it happens at the equipment manufacturer's facility before the equipment ships to your project. The purpose is to verify that equipment has been built correctly, configured properly, and tested against the project requirements before it leaves the factory.

A factory is a much better place to fix manufacturing defects, configuration errors, programming issues, missing components, or performance problems than a crowded job site with cranes, constraints, access issues, and schedule pressure. Every problem found at the factory is a problem that never reaches you.

Equipment That Typically Gets FAT

- Generators
- Switchgear and motor control centers
- Transformers
- UPS systems
- Chillers
- Boilers
- Air handling units (especially custom or large)
- Pumps (especially large, complex, or pre-packaged)
- Controls panels
- Variable frequency drives
- Packaged mechanical or electrical equipment

What Happens at a FAT

Depending on the equipment, FAT may include visual inspection, point verification, load testing, controls simulation, documentation review, alarm testing, sequence verification, and review of spare parts or accessories. The exact procedure is in the equipment specification and the commissioning plan.

The Mistake to Avoid

The biggest mistake teams make is treating factory testing as a formality. Someone gets sent to witness a test, collects a report, and moves on. That is not the value of Level 1. The value is in

learning early. FAT can reveal issues that affect installation, startup, commissioning, access, clearances, controls, maintenance, spare parts, or training. A real FAT changes the project.

Step-by-Step: How to Run Level 1 as a Superintendent

1. **Identify which equipment requires FAT.** Walk the specifications and the commissioning plan. Build a FAT list.
2. **For each FAT, identify the witness.** Owner, CxA, controls contractor, engineer, the trade. Confirm in writing who will attend.
3. **Get the test scripts in advance.** The manufacturer should provide test procedures and acceptance criteria. Have the CxA review them before the test.
4. **Confirm project-specific sequences.** The manufacturer's standard test may not cover your project's sequence of operations. Make sure project-specific scenarios are included.
5. **Hold a pre-FAT call.** A week before each FAT, hold a 30-minute call with the manufacturer, CxA, and witnesses. Confirm scope, scripts, and logistics.
6. **Send the right person.** For a chiller FAT, send the mechanical superintendent and the CxA. For switchgear, the electrical super. Do not send a coordinator who cannot evaluate the test.
7. **Capture deficiencies and corrective actions.** Document every issue, who owns the fix, and when the fix will be verified.
8. **Do not allow shipment until issues are closed.** If a FAT exposes problems, the equipment does not ship until they are corrected and re-verified.
9. **Debrief the field team.** The witness returns to the project and walks the team through what was learned. Lessons that affect installation, startup, controls, or training go to the right people immediately.

FAT Is a Planning Activity, Not a Procurement Activity

Treat FAT as part of your production plan, not as a line on a procurement log. A FAT that exposes a controls error saves three weeks of field debugging later. A FAT that is treated as paperwork saves nothing.

How to Do It — Level 1 Checklist

FAT list built from specifications and commissioning plan.

Witnesses identified and confirmed in writing for each FAT.

Test scripts received and reviewed by the CxA in advance.

Project-specific sequences confirmed in each FAT scope.

Pre-FAT call held one week before each test.
The right field person attends — someone who can evaluate.
Deficiencies captured, assigned, and verified before shipment.
Field team debriefed; lessons routed to installation, startup, controls, and training owners.

Chapter 9 — Level 2: Verify It on Site

Static checks. The level where the superintendent must be relentless.

What Level 2 Is

Level 2 begins when equipment arrives on site and is installed. The level is about verifying that the physical installation is correct before startup. The word "static" matters because the systems are not running yet. We are checking that the system is ready to be energized, filled, started, or tested.

Level 2 is where the superintendent must be relentless. Startup should not be the moment a project discovers the installation is incomplete. Startup should not be used as a quality inspection. Startup should be the result of a controlled process where installation quality has already been verified at Level 2.

What Lives at Level 2

- Equipment delivery inspection and damage check
- Storage and protection verification
- Nameplate verification against the submittal
- Installation per drawings and manufacturer instructions
- Anchoring and housekeeping pads
- Piping connections complete and labeled
- Duct connections complete, sealed, and insulated
- Electrical terminations torqued and labeled
- Grounding and bonding verified
- Valve positions correct and tagged
- Labeling and tagging per spec
- Access and clearance per manufacturer requirements
- Filters installed (critical for protecting coils during construction)
- Belt and coupling alignment
- Lubrication per manufacturer
- Torque verification on critical fasteners
- Megger testing on electrical equipment
- Pressure testing on piping
- Flushing and cleaning of piping systems
- Controls wiring complete

- Point-to-point checks on controls
- Pre-startup checklists complete

The Truth a Superintendent Must Defend

There will always be pressure to skip Level 2 and "make up the time during startup." That is fake progress. It may look faster on the schedule, but it almost always creates more delay later.

If you do not have time to check it before startup, you will find time to fix it during commissioning. And that time will be more expensive, more chaotic, and more visible to the owner.

Step-by-Step: How to Run Level 2 as a Superintendent

1. **Define "installed."** For every major system, write down what "installed" actually means. A pump is not installed until it is anchored, piped, wired, lubricated, labeled, and clear.
2. **Build a system-by-system installation verification checklist.** The CxA or your team writes one per system type. Trades use them as they install.
3. **Walk every install with the trade.** Not just spot-checks — walk it. Every piece of equipment. Every termination. Every label.
4. **Use a visual readiness board.** Every piece of equipment in your trailer has a status: delivered, installed, inspected, ready for startup.
5. **Run pre-startup walks.** Before any equipment is energized, walk it with the trade, the CxA, and the manufacturer if applicable. Sign off on readiness.
6. **Verify protection.** During Level 2 the equipment is exposed to construction. Filters, coil protection, debris control, water intrusion — these all matter.
7. **Track point-to-point readiness on controls.** Controls wiring is part of Level 2. Verify it is complete and tested floor by floor.
8. **Do not allow Level 3 to begin until Level 2 is complete.** This is the gate. Defend it.

Visual Status, Not Verbal Status

Every piece of equipment should have a clear status. Every room should have a readiness condition. Every system should have a path from installed to inspected to ready for startup. "How's the AHU?" gets answered by a board, not by a guess.

How to Do It — Level 2 Checklist

Installation verification checklists exist for every major system type.

Trades execute the checklists as they install — not at the end.

The superintendent walks every install with the trade.
Visual readiness board on the trailer wall. Every system has a status.
Pre-startup walks held before any energization. CxA and trade present.
Equipment protection (filters, coil covers, debris control) verified.
Controls wiring and point-to-point checks complete.
Level 2 signed off as a gate before Level 3 begins.

Chapter 10 — Level 3: Start It Up

Startup is choreography. It must be planned like a production sequence.

What Level 3 Is

Level 3 is where equipment and systems are started. Individual pieces of equipment are energized, started, adjusted, calibrated, and checked for basic operation. The purpose is to verify that each component or system can operate safely and basically as intended before more advanced functional testing begins.

What Lives at Level 3

- Energization of electrical equipment
- Rotation checks on motors
- Bump tests to confirm direction and basic operation
- Controls point verification (live, not just wired)
- Sensor calibration
- Safety interlock testing
- Alarm verification
- Pressure, flow, temperature readings
- Voltage and amperage checks
- VFD setup
- BAS point mapping (live)
- Manufacturer startup reports
- TAB readiness checks
- Pre-functional checklists (PFCs)

Where Level 3 Goes Wrong

Startup is where many projects fragment. The manufacturer starts one piece of equipment. The electrician energizes another. The controls contractor checks points. The mechanical contractor fixes an issue. The TAB contractor waits for stable operation. The commissioning agent asks for documentation. The superintendent asks why testing is not moving. Everyone is busy, but the process is not flowing.

Level 3 requires choreography. It must be planned like a production sequence — not a casual activity.

The Prerequisite Web

You cannot start an air handling unit properly if any of the following are missing:

- Permanent power
- Filters installed
- Ductwork complete
- Fire smoke dampers operational
- Controls mapped and live
- Hydronic systems flushed
- TAB ready to coordinate
- Access panels unblocked
- BAS graphics functional

Everything connects. That is why Level 3 must be protected by a complete Level 2. The better the installation verification, the smoother the startup.

Step-by-Step: How to Run Level 3 as a Superintendent

1. **Build the startup plan.** System by system. Sequence the startups. Identify prerequisites for each.
2. **Schedule manufacturer involvement.** For each major piece of equipment, the manufacturer's startup tech must be scheduled in advance and supported in the field.
3. **Confirm trade support.** Each startup needs the right trades on standby — electrical, controls, mechanical, TAB.
4. **Plan safety.** Lockout/tagout, energization permits, hot work, confined space. All handled before the startup window opens.
5. **Verify temporary conditions.** Temporary power, temporary water, temporary cooling, whatever the startup requires.
6. **Set documentation expectations.** Startup forms, calibration records, point-mapping verification, deficiency tracking, retest process.
7. **Run the startup huddle.** Daily during Level 3. What is being started today. What prerequisites are met. What is blocking.
8. **Walk every startup.** The superintendent attends or sends a senior person who can make decisions. Not a coordinator who can only take notes.
9. **Track every deficiency to closure.** A startup deficiency becomes a Level 4 blocker if it is not closed.

The Level 3 Mindset

We are not trying to look ready. We are proving readiness. Every startup is evidence that this system can be trusted in the next level.

How to Do It — Level 3 Checklist

Startup plan written, system by system, with prerequisites listed.

Manufacturer startup techs scheduled and confirmed.

Trade support scheduled and confirmed for each startup.

Safety plan complete: lockout/tagout, permits, hot work, energization.

Temporary utilities verified.

Documentation expectations set: forms, calibration, point-mapping, retests.

Daily startup huddle running.

Superintendent or senior delegate walks every major startup.

Deficiencies tracked to verified closure.

Pre-functional checklists complete on every system before Level 4.

Chapter 11 — Level 4: Test the System

Not "can it turn on?" — but "does it function correctly under the required operating conditions?"

What Level 4 Is

Level 4 is functional performance testing — FPT. Individual systems are tested against the design intent and sequence of operations. The question is no longer whether the equipment can be turned on. The question is whether the system performs as designed across every operating mode it was specified for.

What FPT Actually Asks

- Does the air handling unit respond correctly to temperature changes?
- Does the chiller stage on and off as intended?
- Do pumps lead, lag, and alternate correctly?
- Do alarms appear at the BAS as designed?
- Do safeties shut equipment down properly?
- Does the generator start when called?
- Does the UPS carry the load as intended?
- Do smoke dampers close on command?
- Does the lighting control system respond to schedules and occupancy?
- Does the domestic hot water system maintain temperature under load?

Level 4 is not about checking boxes. It is about proving behavior. The sequence of operations becomes real. The words on the drawing must become action in the building.

Where Weak Planning Gets Exposed

If the sequence is unclear, Level 4 becomes debate. If the controls are not complete, Level 4 becomes programming. If TAB is not finished, Level 4 becomes adjustment. If startup documentation is missing, Level 4 becomes detective work. If installation issues remain, Level 4 becomes rework.

Functional testing should not be where the team discovers the building for the first time. It should be where the team verifies what it already prepared.

The Pit Crew Job

During Level 4, the CxA is the driver. The trades, controls contractor, and field team are the pit crew. The only thing that matters is that every second the CxA needs something, they get it

instantly. Fix, document, procedure, software update, graphics, sequence change, anything. The CxA's productivity is the project's bottleneck.

Step-by-Step: How to Run Level 4 as a Superintendent

1. **Walk the prerequisites two weeks before FPT begins.** Building enclosed. Building clean. Filters in. Vertical controls connectivity. Permanent power. TAB complete. PFCs complete. Walk every one of them.
2. **Review the test scripts.** The CxA writes the FPT scripts. Read them before the tests begin. Make sure pass/fail criteria are clear.
3. **Confirm calibrated instruments.** The CxA's gauges, thermometers, and flow meters must be calibrated and documented.
4. **Set up the trade response system.** Every CxA request needs an owner and a same-day response window. Use a visible board.
5. **Schedule the witnesses.** Owner, engineer of record, AHJ for life safety. Schedule in advance, not the night before.
6. **Run the daily standup.** Morning, 15 minutes, with CxA, controls contractor, MEP coordinator, and superintendent. What was tested yesterday. What is testing today. What is blocked.
7. **Document every deficiency.** Photo, location, system, owner, due date, retest required. Tracked on the issues log.
8. **Verify every retest.** A deficiency is not closed when someone says it is fixed. It is closed when the correction is verified by the CxA.
9. **Protect the test.** There will be pressure to rush. "We already know it works." Maybe. But commissioning is not based on opinion. It is based on evidence. Level 4 creates that evidence.
10. **Sign Level 4 off as a gate before Level 5.** Every system that will be integrated tested must first pass FPT individually.

Why Documentation Is Not Optional Here

Each Level 4 test produces evidence: the system performed under this mode, with these conditions, in this way. That evidence becomes the foundation of every Level 5 test and the final commissioning report. If documentation is weak at Level 4, Level 5 has no ground to stand on.

How to Do It — Level 4 Checklist

All prerequisites walked two weeks before FPT begins.

Test scripts read and confirmed with CxA. Pass/fail criteria clear.
Calibrated instruments confirmed.
Trade response board active. Same-day response window agreed.
Witnesses scheduled: owner, engineer of record, AHJ as needed.
Daily FPT standup running.
Issues log live; every deficiency has owner, due date, retest plan.
Every retest verified by the CxA before closure.
Level 4 signed off as a gate before Level 5 begins.

Chapter 12 — Level 5: Test the Building

Integrated Systems Testing. The building is no longer tested as separate parts — it is tested as a whole.

What Level 5 Is

Level 5 is Integrated Systems Testing — IST. It verifies that multiple systems work together under normal, abnormal, emergency, and recovery conditions. Each system passed Level 4 individually. Now the question is whether the building responds correctly as a single living system.

A Worked Example: Loss of Utility Power

A simulated loss of utility power requires the team to verify all of the following together:

- Loss of normal power detected
- Automatic transfer switch operates
- Generator starts and stabilizes
- Emergency power distribution comes online
- UPS systems respond and carry load
- Critical cooling responds and maintains setpoint
- BAS alarms communicate correctly
- Fire alarm interface remains functional
- Security system responds appropriately
- Elevators behave correctly (recall, emergency power)
- Lighting responds correctly (emergency lighting, egress)
- Equipment restart sequence executes when power is restored
- Return to normal power happens cleanly
- System recovery is complete and documented

Each of those passed Level 4 in isolation. Level 5 asks whether they work together.

Where Hidden Disconnects Appear

This is the level where projects discover timing issues, programming conflicts, alarm failures, reset problems, load issues, access issues, sequence gaps, and human-response problems. The generator works. The switchgear works. The UPS works. The BAS works. The cooling system works. But when they must all work together, the project finds the gap between systems that nobody owned.

Leadership in the Control Room

Level 5 is not a place for improvisation. When you are intentionally failing systems, transferring power, activating alarms, shutting down equipment, or simulating emergency conditions, the team must know exactly what is happening and who is in charge.

The best commissioning leaders create calm. They do not let the room become a shouting match. They do not let every trade run off in a different direction. They do not allow undocumented changes. They do not let people troubleshoot randomly without protecting the test procedure.

They slow the room down. They clarify the condition. They document the issue. They assign ownership. They retest with discipline.

Step-by-Step: How to Run Level 5 as a Superintendent

1. **Write the IST scripts with the CxA.** Normal operating scenarios. Failure scenarios. Recovery scenarios. Each script names every system involved and what success looks like.
2. **Plan safety first.** IST means deliberately failing systems. Risk assessment, stop-work criteria, and emergency overrides are in writing before any test runs.
3. **Identify the test lead.** One person calls the test. They run the comms protocol. They start, pause, and end every scenario.
4. **Set up the command center.** A physical room or area where the test lead, CxA, controls contractor, and key trades convene. Radios or headsets for distributed teams.
5. **Confirm trade coverage in every room that matters.** Switchgear room. Generator yard. UPS room. Mechanical room. Fire pump room. Elevator room. BAS station. Everyone is positioned and on comms.
6. **Schedule the witnesses.** Owner, engineer of record, AHJ. Walk the scenario with them in advance.
7. **Notify the building and adjacent operations.** IST often produces noise, alarms, and visible changes. Notify security, neighbors, and occupants if applicable.
8. **Run the scenario.** Test lead calls it. Comms protocol is followed. Every observation is logged in real time.
9. **Stop the test if safety or scope drifts.** The stop-work criterion is the test lead's. Do not let troubleshooting run wild during a live IST.
10. **Debrief immediately after each scenario.** What happened. What was expected. What was the gap. Who owns the fix. When is the retest.
11. **Retest with the same discipline.** The same scripts, the same lead, the same comms protocol.

The Level 5 Truth

It is better to find the problem during a controlled test than during a real emergency. That is what makes Level 5 one of the highest acts of respect-for-people on the whole project. It protects the owner, the operators, the occupants, and the trades from chaos later.

How to Do It — Level 5 Checklist

IST scripts written with the CxA. Normal, failure, recovery scenarios all included.

Safety plan complete: risk assessment, stop-work criteria, emergency overrides.

Test lead identified and briefed.

Command center established. Comms protocol agreed.

Trade coverage confirmed in every key room.

Witnesses scheduled and walked through scenarios in advance.

Building and adjacent operations notified.

Every scenario logged in real time.

Stop-work authority respected.

Debriefs immediate. Deficiencies owned and dated.

Retests with the same discipline as initial tests.

Level 5 signed off as a gate before Level 6.

Chapter 13 — Level 6: Turn It Over

Do not hand the owner hope. Hand them confidence.

What Level 6 Is

Level 6 is the bridge from construction to operations. The building is turned over to the owner, but not abandoned. The level includes final documentation, training, seasonal testing, warranty support, lessons learned, and operational readiness.

What Lives at Level 6

- Final commissioning report
- O&M manuals delivered and organized
- As-built drawings
- Training sessions
- Training videos (recorded for future use)
- Systems demonstrations
- Spare parts turnover
- Attic stock turnover
- Warranty documentation activated
- Preventive maintenance requirements explained
- Emergency procedures walked
- Seasonal testing planned (deferred tests at the right season)
- Open issue tracking continued through warranty
- Deferred testing scheduled
- Owner signoff
- Post-occupancy support plan

Why This Matters

A building can pass tests and still fail the owner if the operations team is not ready. The owner's facilities team needs more than binders. They need understanding. They need confidence. They need to know how systems operate, how to respond to alarms, what normal looks like, what abnormal looks like, how to maintain equipment, and who to call when something goes wrong.

Too many projects treat training as a meeting. Real training is not a meeting. It is knowledge transfer.

What Real Training Looks Like

Strong Level 6 training is practical. It happens in the rooms where the equipment lives. It includes the people who will actually operate the building. It is recorded when possible. It is organized by system. It includes emergency scenarios. It connects documentation to reality.

Real training answers every operator's seven questions:

1. What is this system?
2. What does it serve?
3. How does it operate normally?
4. What are the critical alarms?
5. What are the common failure modes?
6. What maintenance is required?
7. What should the operator never do?

Add an eighth as a forcing question for the trainer: "What should the operator check first when there is a problem?"

Step-by-Step: How to Run Level 6 as a Superintendent

1. **Build the turnover deliverable list at Level 0.** Documents, manuals, attic stock, spare parts, warranties, training. The list does not appear at the end — it lives from day one.
2. **Compile the systems manual as you go.** OPR, BOD, sequences, as-builts, O&M, test results. Folded in continuously, not assembled at the end.
3. **Confirm the operations team.** Names. Roles. Schedules. The right people must attend training. Get them on the project before turnover — preferably during Level 5.
4. **Design the training by system.** One session per major system. In the room where the equipment lives. Owner's operators present.
5. **Record the training.** Video and audio when allowed. The operations team will lose people in the first year of warranty. The recording matters.
6. **Walk the building with the operations team.** Room by room. Not a slide deck. A walking conversation. Where things are, what they do, how to access them.
7. **Teach emergency procedures.** Power loss. Fire alarm. Water leak. The operators must know what to do before the first emergency.
8. **Hand over with confirmation, not assumption.** The owner signs that manuals were received, training was delivered, attic stock was confirmed, warranties were activated.
9. **Set the post-occupancy cadence.** Weekly support for the first month. Bi-weekly for the next two. Monthly through the warranty period. Define who calls whom.

10. **Schedule seasonal testing.** A summer commissioning project still needs winter testing. Put it on the warranty calendar.

Honoring the Owner

Level 6 is where we honor the owner's team. We do not just toss them the keys and disappear. We walk with them. We teach them. We support them. We make the building understandable.

How to Do It — Level 6 Checklist

Turnover deliverable list built at Level 0 and tracked throughout.

Systems manual compiled continuously, not at the end.

Operations team identified. Right people scheduled for training.

Training designed by system, held in the rooms where equipment lives.

Training recorded.

Building walked with the operations team — room by room.

Emergency procedures taught and confirmed.

Turnover signed with confirmation: manuals, training, attic stock, warranties.

Post-occupancy support cadence set and named.

Seasonal and deferred testing scheduled on the warranty calendar.

Part 3 — Field Systems That Make Commissioning Flow

Nine practical systems the superintendent must build, run, and defend.

The mindset puts commissioning at the center of the project. The Level 0-6 framework gives you a procedural spine. But neither one operates by itself. Both rely on a set of field systems that the superintendent has to build, run, and defend. The chapters in this part are those systems.

Read them in order if this is your first project leading commissioning. Jump to the one you need if you are mid-build. Each one ends with a step-by-step procedure that can be applied as written.

Chapter 14 — Visualizing HVAC Before It Is Installed

Eat the frog. Do not delegate the most complex part of the project.

Analogy: The Frog on the Plate

Folk wisdom: if you have to eat a frog today, eat it first. Do not sit and stare at it. The hardest thing on the list gets done first, before the day's energy is spent. On a construction project, MEP and commissioning are the frog.

This is why the project superintendent should never delegate the MEP and commissioning process. Not to an MEP superintendent, not to an assistant superintendent, not to anyone. The most difficult part of the project is the one that requires the most senior judgment. Own it personally, with the project manager beside you, from day one.

How to Visualize the System Before It Exists

Before a single foot of duct is hung, you should be able to walk anyone — your owner, your CxA, your team — through how this building gets commissioned. The visualization has four moves, in this order: utilities to the building, utilities into the entry rooms, services up the building, and air handlers fed and connected.

Step 1 — Utilities to the Building

Off-site utilities come into the project and are typically stubbed about five feet from the building line. The list is: water, sewer, storm drain, power, communications, and gas if applicable. This step looks bureaucratic and slow because it is. You may be dealing with a power supplier whose timeline does not care about yours, a comm provider who wants months of lead time, a road upgrade to reach the sewer, or a complex tie-in to potable water.

If you do not have a confirmed plan for permanent power, communications, water, sewer, and storm drain by the time you finish foundations, you are already in trouble. Track every point of connection on your production plan as aggressively as you track the structure.

Step 2 — Utilities Into the Entry Rooms

From the points of connection outside, utilities come into the building's entry rooms. Water lands in the fire pump room and mechanical room (and irrigation if applicable). Sewer ties to the sanitary system. Storm drain ties to the storm system. Power enters at the service entry section. Communications land in the main distribution frame (MDF). Gas enters wherever the design calls for, typically the mechanical room.

Step 3 — Services Up the Building

Now the orchestrated dance begins. You are bringing power, communications, duct, hydronic piping (heating hot water, chilled water, domestic water), and any other vertical infrastructure up through chases, electrical rooms, and independent distribution frame (IDF) rooms. This work has to be tracked floor-by-floor and is often happening at the same time as your superstructure and exterior.

Step 4 — Air Handlers Fed, Connected, and In Hand

Once the roof is on, you fly the air handlers. From there, the work converges: power up, controls up, water up, ducts up. Once dry-side and wet-side hookups, power, and controls are connected, the manufacturer's startup runs and the air handlers go "in hand" — meaning they can be operated manually, blowing warm or cool air through the building, before the permanent building automation system is online.

Path of Critical Flow

Utilities to the building → entry rooms → up the building → air handlers fed and connected. Every other flow on the project is secondary to this one. Visualize it. Print it. Walk it.

The Milestones You Personally Track

Three milestones in this chain are critical enough to be tracked as named project milestones in every meeting: the air handlers landed, the building enclosed and clean, and permanent power energized. If those three slip, commissioning slips with them.

How to Do It — Visualization Discipline

Print the one-line diagram and the HVAC flow diagram and pin them on the trailer wall. Walk them weekly with the MEP coordinator.

Build a simple flow chart of the path of critical flow: utilities → entry → up → air handlers. Use it in every commissioning meeting for the first six months.

Hold a standing weekly walk with the MEP superintendent and CxA from foundation through air handler landing.

When in doubt, ask: "What feeds this? What does this feed?"

Chapter 15 — Scheduling Commissioning in a Construction Timeline

A vague bar at the end of the schedule called "commissioning" is a lie with a date attached.

Analogy: The Rails Before the Train

You would not run a train without first laying the rails. Commissioning runs on the rails laid by your production plan. If those rails are not laid early — if the schedule treats commissioning as a wedge at the end — the train does not run. It crashes.

CPM scheduling tends to crush commissioning into a thin band at the back of the project. Takt planning, by contrast, treats commissioning as a sequence of zones and milestones with rhythm. That rhythm is what gives the CxA, the controls contractor, and the trades a chance to actually finish on time.

Real Schedule Logic, Not a Vague Bar

A commissioning schedule must include real logic. At a minimum, the following must each have their own activities, durations, and predecessors:

- Permanent power
- Mechanical completion (system by system)
- Controls readiness
- TAB prerequisites
- Fire alarm testing (by floor and whole-building)
- Elevator inspections
- Utility releases
- Equipment startup (Level 3)
- Pre-functional testing
- Functional testing (Level 4)
- Integrated testing (Level 5)
- Owner training
- Documentation
- Retesting
- AHJ inspections
- Occupancy requirements

Commissioning is not one activity. It is a sequence of handoffs.

Two Levels of Takt Plan

The Macro Takt Plan

The backbone. For a typical commercial building, it is site work, foundations, structure, interiors, exteriors, site work finishes, and commissioning — laid out in a time-by-location format. The macro plan does not show every commissioning activity. It shows the path of critical flow, the convergence milestones, and the overall commissioning duration at the end.

The Norm Takt Plan

The detail. For each floor and zone, the norm plan shows overhead rough-in, in-wall rough-in, drywall, paint, then dry-side and wet-side hookups, power, controls, pre-functional checklist, and point-to-point testing. Every floor has its own pre-functional sequence; the norm Takt plan is where it lives.

The Commissioning Pull Plan

In addition to the Takt plans, build a commissioning pull plan. The pull plan is a backward-planned wall of stickies starting from substantial completion and walking back to the present. Every test, walk, signoff, inspection, and training session is a card. The cards are pulled by the trades, CxAs, and AHJ — not pushed by the schedule. This is where the team aligns on what must be true before each milestone.

The commissioning pull plan should be built at the two-thirds point of the schedule at the latest. Held in the trailer. Walked weekly. Updated whenever a card moves.

How to Do It — Scheduling Discipline

Build the macro Takt plan in a time-by-location format. Mark four named milestones: utilities into entry rooms, air handlers in hand, building enclosed and clean, permanent power.

Build the norm Takt plan for the interiors. Pre-functional checklists and point-to-point at every floor or zone.

Build the commissioning pull plan by the two-thirds milestone. Every test, walk, signoff, inspection, training as a card.

Build a flow-chart-style commissioning activities map (outside the Takt plan). Pin it on the wall.

Chapter 16 — System Readiness Planning

"Installed" is not "ready." Define ready for every system.

Why This Chapter Exists

An air handling unit is not ready just because it is installed. It may need permanent power, a disconnect labeled, controls wired, dampers installed, filters installed, ductwork complete, fire/smoke dampers functional, piping flushed, valves tagged, access clear, BAS points mapped, safety devices tested, the startup vendor scheduled, and a TAB path ready.

Every system has its own definition of ready. If you do not write that definition down, the team will improvise it. Improvised definitions cause every common commissioning failure in this manual.

The Readiness Definition

For each major system, write a readiness checklist that lists every prerequisite for startup. The checklist becomes the gate between Level 2 and Level 3 for that system. No system advances to startup until its readiness checklist is fully checked.

Common Readiness Checklists by System Type

Use these as starting frames. Adapt to your project's specifications, manufacturer requirements, and AHJ. Full system-by-system checklists are in Appendix D.

Air Handling Unit (AHU)

- Equipment delivered, inspected, anchored to housekeeping pad.
- Permanent power to disconnect. Disconnect labeled.
- Ductwork connected (supply, return, exhaust). Sealed. Insulated.
- Fire/smoke dampers installed and operational.
- Hydronic piping connected. Flushed. Pressure-tested. Valves tagged.
- Filters installed (correct rating per specification).
- Coils protected; no debris.
- Belt and coupling alignment verified.
- Lubrication per manufacturer.
- Controls wiring complete and terminated.
- BAS points mapped and verified.
- Safety interlocks tested.
- Access panels unblocked; manufacturer clearances met.

- Manufacturer startup tech scheduled.
- TAB path ready (downstream terminal units in place; outlets installed).

Generator

- Equipment delivered, inspected, on pad.
- Fuel system connected and filled. Day tank verified.
- Exhaust system installed and routed per spec.
- Cooling system complete (radiator, ventilation, jacket water heater).
- Output cabling connected to ATS or distribution.
- Battery charger connected and active.
- Controls panel powered and active.
- BAS interface complete.
- Fire alarm interface complete.
- Load bank scheduled (if rented for testing).
- Manufacturer startup tech scheduled.
- Safety systems verified: ventilation, gas detection, emergency shutdown.

Switchgear / Electrical Equipment

- Equipment delivered, inspected, anchored.
- Conduits and terminations complete. Torque verified.
- Grounding and bonding verified.
- Megger testing complete and documented.
- Phasing verified.
- Breaker testing complete (primary injection or secondary injection per spec).
- Relay settings per coordination study.
- Labels and arc flash stickers installed.
- Doors closed; safeties active.
- Manufacturer startup tech scheduled.

Fire Alarm System

- Devices installed per drawings.
- Wiring complete and tested.
- Panel programmed.
- BAS interface complete.
- Smoke control interface complete.

- Elevator recall interface complete.
- HVAC shutdown interface complete.
- Generator interface complete (if applicable).
- AHJ pre-test walked.
- Test schedule built — by floor and whole-building.

BAS / Controls

- Field devices installed and calibrated.
- Panels installed; power connected.
- Network cabling complete (vertical and horizontal).
- Internet connectivity to the building active.
- Graphics built and reviewed.
- Sequences programmed per BOD.
- Point-to-point tested at each device.
- Alarms configured.
- Trend logs configured.
- Overrides removed.
- Setpoints per specification.

The Readiness Discipline

Build a one-page readiness checklist for every system the project commissions. Print them. Sign them. The signed checklist is what releases the system to Level 3.

How to Do It — System Readiness

By the one-third milestone: build a readiness checklist for every major system to be commissioned.

Review every readiness checklist with the responsible trade and the CxA.

Track readiness on a visual board: every system has a row, every checklist item has a column.

No system advances to Level 3 (startup) without a signed readiness checklist.

Update Appendix D of your project manual with your project-specific readiness checklists for handover.

Chapter 17 — MEP Rooms as Production Control Points

The building cannot come alive if the rooms that feed it are not ready.

Why MEP Rooms Are Different

Mechanical rooms, electrical rooms, fire pump rooms, generator yards, IDF and MDF rooms, and roof equipment zones are not just rooms. They are production control points. If those rooms are late, dirty, crowded, uncoordinated, or inaccessible, commissioning suffers. If they are early, clean, organized, and protected, commissioning has a place to run from.

Most projects under-resource MEP rooms in the first two thirds of the schedule and then panic over them in the last third. The reverse is the right approach: prioritize them early, finish them clean, and protect them through to turnover.

The MEP Room Standard

Every MEP room on your project should meet a standard you can name and walk. The standard includes:

- **Early access** — the room is reachable for trades when they need to install.
- **Dedicated logistics** — material staging is planned, not improvised.
- **Cleanliness standards** — swept daily, no construction debris, no unrelated trades using the space.
- **Trade stacking prevention** — only the right trades are in the room at the right time.
- **Layout control** — equipment is set per drawings; clearances are protected.
- **Lighting** — permanent or temporary, but adequate for installation and inspection.
- **Housekeeping pads** — formed, poured, leveled, finished before equipment is set.
- **Labeling** — every panel, valve, breaker, and device labeled per spec.
- **Clearance verification** — door swings, code clearances, working space, maintenance access.
- **Door and hardware readiness** — locks, closers, keying coordinated for security and access.
- **Permanent power** — to the room, on the schedule the room needs it.
- **Environmental protection** — temperature, humidity, dust control.
- **Security** — keyed, restricted, controlled.

Rooms to Prioritize

- **Service Entry Section** — power lands here first. Finish it early.
- **Main Distribution Frame (MDF)** — comms backbone. Finish before vertical comms pulls.
- **Fire Pump Room** — water lands here. Mechanical milestone.
- **Mechanical Room (each)** — equipment-dense. Often constrained.
- **Electrical Rooms (per floor)** — feed the floor's equipment.
- **IDF Rooms (per floor)** — comms and controls.
- **Generator Yard** — outside but treated as a room. Fuel, exhaust, ventilation.
- **Roof Equipment Zone** — air handlers, exhaust fans, condensers.
- **BAS Control Room** — sometimes a closet, sometimes a full room. Critical for commissioning.

How to Do It — MEP Room Discipline

By the end of the first third: walk every MEP room with the MEP coordinator and assign a target completion date for each.

Build a MEP room readiness tracker. Every room. Every readiness criterion. Visible.

Lock the rooms once finishes are complete. Only authorized commissioning and trade access from then on.

Walk every MEP room weekly with the MEP coordinator through the back half of the project.

When a MEP room slips, raise it as a project-level constraint immediately. Do not let it slip quietly.

Chapter 18 — Controls Is Not a Finish Trade. Controls Is a Commissioning Trade.

Controls are the nervous system of the building.

Why This Chapter Has a Strong Title

Many projects treat controls as a finish trade — a late-stage contractor who shows up after the mechanical and electrical work is done to "tie it all together." That framing is the source of more late commissioning efforts than almost any other single decision.

Controls are not a finish trade. Controls are a commissioning trade. The controls contractor's productivity determines whether Level 4 functional testing happens on time. The controls contractor's graphics determine whether the BAS is usable for testing. The controls contractor's programming determines whether the sequence of operations runs correctly. Treat the controls contractor like a critical-path partner, not a late-stage accessory.

Common Controls Failures (and Where They Originate)

Failure	Where It Originates
Points not mapped	Late field walks; rushed point-to-point
Graphics incomplete	Controls contractor brought in too late
Sensors mislabeled	No labeling standard; no field verification
Sequences not programmed	BOD unclear; no early sequence review
Alarms not configured	Alarm matrix never built
Trend logs not available	Trend list never requested by CxA
Fire alarm interfaces not complete	Coordination meeting between FA and BAS skipped
Overrides left in place	No commissioning closeout discipline
Setpoints wrong	BOD setpoints not transcribed; field calibration shortcut
Devices not calibrated	Calibration not scheduled; no documentation
Network communication issues	Vertical connectivity left to end; no temp cabling

What the Superintendent Owns on Controls

- **Early engagement** — controls contractor is in pre-construction, not just construction.
- **Graphics review schedule** — graphics drafts reviewed by the CxA, owner, and field early.
- **Vertical connectivity** — paid for whether permanent or temporary; in by the air handler milestone.
- **Point-to-point coordination** — schedule of every floor's point-to-point on the norm Takt plan.
- **Sequence walk-through** — a meeting where the controls contractor walks every sequence in the BOD with the CxA and the owner.
- **Alarm matrix** — built with the controls contractor, CxA, and operations team.
- **Trend log list** — built with the CxA for FPT evidence.
- **Closeout discipline** — overrides removed, setpoints verified, graphics complete before turnover.

How to Do It — Controls Discipline

At Level 0: confirm the controls contractor will be on board by the end of the first third — not later.

Schedule a sequence walk-through meeting in the middle third with the BOD, CxA, controls contractor, and owner.

Track BAS graphics completion as a milestone — not as a closeout chore.

Pay for temporary vertical controls cabling if permanent is not ready by the air handler milestone.

Before turnover: walk the BAS with the CxA and the owner. Confirm no overrides, no missing alarms, no missing trends.

Chapter 19 — TAB: Measurement, Not Magic

TAB does not fix bad installation, bad design, or incomplete controls. TAB exposes what the project actually built.

What TAB Is

Test and Balance — TAB — is the discipline of measuring and adjusting air and water flows in HVAC systems to match design values. TAB is performed by a specialized contractor, often certified by AABC or NEBB. The TAB report is required for the preliminary balancing report, which is required for substantial completion.

What TAB Cannot Do

TAB is measurement, not magic. TAB cannot fix:

- Bad installation (leaking duct, wrong dampers, missing flex connections)
- Bad design (undersized fan, wrong coil, wrong piping)
- Incomplete controls (sequences not running, sensors not calibrated)
- Missing access (cannot reach a damper)
- Closed-up systems (ceiling tiles in before TAB)
- Unstable conditions (variable load, fluctuating supply temperature)

When TAB exposes a problem, the project must fix the problem. That is not a TAB failure — it is the system working as intended.

Prerequisites TAB Needs From the Field

- Equipment installed and started
- Ductwork complete and sealed
- Outlets installed
- Piping flushed and pressure-tested
- Valves tagged and accessible
- Filters installed
- Access panels unblocked
- Ceiling tiles open enough for measurement
- Controls stable enough for measurement
- VFDs commissioned to manufacturer minimums
- Building enclosed (to hold pressure)
- Smoke dampers open (not actively in fire alarm test)

The Worst TAB Conflict

Never schedule TAB and fire alarm testing at the same time. Fire alarm testing slams smoke dampers shut. You cannot balance air through a damper that has been closed by a test on another system. Separate them on the yellow brick road.

How to Do It — TAB Discipline

At Level 0: confirm TAB scope, schedule, and certification requirements in the specifications.

Two months before TAB begins: walk every prerequisite with the TAB contractor and the CxA.

Schedule TAB explicitly. Do not assume it fits.

Plan two to eight weeks for TAB — the preliminary balancing report is required for the temporary certificate of occupancy.

Separate TAB from fire alarm testing on the schedule. Do not overlap.

Verify the TAB report against random spot-checks. The CxA may do this; if not, you do.

Chapter 20 — Life Safety and AHJ Coordination

Life safety cannot be crammed. It must be sequenced.

What Life Safety Includes

Life safety is the cluster of systems that protect occupants in an emergency. On most commercial projects, life safety includes:

- Fire alarm
- Fire sprinkler
- Smoke control
- Emergency lighting
- Exit signs
- Elevators (recall, emergency operation)
- Fire and smoke dampers
- Stair pressurization
- Fire pump
- Generator emergency power
- Egress paths

Why Life Safety Is Different

Three things make life safety different from other commissioning work. First, the testing requires the authority having jurisdiction (AHJ) — usually a fire marshal or inspector. AHJ schedules are not flexible. Second, integrated tests cross multiple trades simultaneously. Third, the consequences of getting it wrong are not just schedule consequences. They are human safety consequences.

Life safety cannot be crammed. It must be sequenced.

What the Superintendent Owns on Life Safety

- **AHJ relationship** — meet your fire marshal early. Walk the project together. Understand their requirements.
- **Test schedule alignment** — fire alarm testing by floor and whole-building cannot conflict with TAB or other testing.
- **Yellow brick road for each life safety system** — fire alarm, fire sprinkler, smoke control, elevator recall, fire pump, stair pressurization.

- **Final acceptance scheduling** — the AHJ's final witness must be on the calendar weeks in advance.
- **Temporary certificate of occupancy strategy** — what is required to get the TCO? Map it backward from substantial completion.

The AHJ Discipline

An AHJ inspector who knows your project, trusts your process, and respects your schedule is one of the most valuable relationships on the entire job. Build it deliberately. Do not show up at the end and ask for favors.

How to Do It — Life Safety Discipline

By the one-third milestone: meet the AHJ. Walk the project. Confirm their requirements and expected schedule.

By the two-thirds milestone: build the yellow brick road for every life safety system.

Three months before substantial completion: schedule final acceptance with the AHJ in writing.

Avoid scheduling fire alarm testing during TAB. Separate the windows on the yellow brick road.

Walk the AHJ through pre-tests before formal witnessed tests. Surface issues before the inspection.

Chapter 21 — Documentation as Evidence

If it is not documented, it is not proven.

Why Commissioning Documentation Is Different

Most field builders develop a justified suspicion of paperwork. A lot of field paperwork is waste — forms filled out because someone requires them, with no purpose beyond compliance. Commissioning documentation is different when done correctly. It is not paperwork. It is evidence.

Each test, walk, signoff, and inspection produces evidence. The evidence is what gives the owner confidence after we leave. The evidence is what supports warranty claims. The evidence is what the AHJ relies on. The evidence is what protects the project team when something goes wrong in operation.

The Documents That Matter

- **Startup forms** — for every piece of equipment, signed by the manufacturer or installing trade.
- **Pre-functional checklists** — signed and dated by the trade and the CxA.
- **Functional test scripts and results** — every test, every mode, every pass/fail.
- **Deficiency logs** — every issue, owner, due date, retest, closure.
- **Calibration records** — every sensor and instrument.
- **TAB reports** — air and water flows per design.
- **Factory test reports** — every FAT witnessed and documented.
- **Equipment manuals** — collected as equipment arrives, not at the end.
- **Warranties** — activated at the right milestone, not at the end.
- **As-built drawings** — updated continuously.
- **Training records** — attendance, content, recordings.
- **Integrated test reports** — scenarios, observations, outcomes.
- **Final commissioning report** — the CxA's summary of the whole effort.

Fake Documentation

Documentation should support truth, not hide problems. Watch for and reject:

- Pencil-whipped checklists.
- Copied forms across different equipment.
- Missing signoffs.

- Incomplete test reports.
- Vague deficiency closures ("fixed" with no description).
- "Done" without verification by the CxA.

If the team produces fake documentation, the team has not done commissioning. The team has done compliance theater. The owner will discover the difference in the first ninety days of occupancy.

How to Do It — Documentation Discipline

At Level 0: decide where commissioning documentation lives. One project drive or platform — not scattered.

Assign one owner of the documentation. Often a project engineer with administrative discipline.

Review documentation weekly. What is missing? What is incomplete?

Reject fake documentation immediately. Make it known that pencil-whipped forms get sent back.

At substantial completion: every system has a complete file. No gaps. The systems manual is the assembled result.

Chapter 22 — The Deficiency Log

A deficiency is not closed when someone says it is fixed. It is closed when the correction is verified.

Why the Log Either Becomes a Control System or a Junk Drawer

Every commissioning effort produces deficiencies. Hundreds of them. The list is unavoidable. What is avoidable is the list becoming a junk drawer — a place where items go to disappear, get rediscovered too late, or get "closed" without verification.

The deficiency log is either the project's most important control system or its biggest source of risk. The difference is discipline.

What Every Deficiency Needs

- **Issue description** — what is wrong. Specific.
- **Location** — building, floor, room, equipment.
- **System** — which commissioned system the issue belongs to.
- **Responsible party** — by name, not just by trade.
- **Priority** — critical, high, medium, low.
- **Date identified** — the day it was logged.
- **Required correction** — what specifically must be done.
- **Due date** — the day the correction is expected.
- **Retest requirement** — what must be retested after the correction.
- **Closure evidence** — what proves the correction was made and verified.
- **Owner / CxA acceptance** — the signoff.

The Superintendent's Job on the Log

- **Keep it moving** — review daily during heavy testing. Weekly always.
- **Reject vague closures** — "fixed" with no description is not closed.
- **Verify high-priority items personally** — walk them with the CxA when they are resolved.
- **Track aging** — items older than two weeks need a reason.
- **Use the log as the agenda** — daily standups and weekly meetings start with the log.

The Phrase That Matters

"It's fixed" is not closure. "It's fixed, retested by the CxA on this date, and signed off" is closure. Train your team to use the second phrase from day one.

How to Do It — Deficiency Log Discipline

Pick the log platform at Level 0. The CxA's preferred platform is usually fine.

Train the trades on what each field means.

Review the log daily during Level 3-5.

Reject closures that lack retest verification.

Walk the high-priority items personally with the CxA when they are resolved.

At substantial completion: every deficiency is closed or formally deferred with owner agreement.

Part 4 — The People Side

Commissioning is technical, but it is also deeply human.

Every level in this manual depends on human cooperation. The CxA must trust you to support their work. The trades must trust each other to deliver clean handoffs. The owner must trust the team enough to let them turn on equipment, fail systems, and surface problems early. The operations team must trust that they will be taught well enough to run the building.

This part covers the five places where the people side becomes operational. Kickoff. The CxA partnership. Owner training. The Lean construction connection. And how Takt planning extends from installation through commissioning.

Chapter 23 — The Commissioning Kickoff Meeting

A relationship-building meeting that looks like an agenda meeting.

Analogy: Warm Bath, Not Cold Shower

A bad commissioning kickoff feels like a cold shower — somebody walks in and announces that on October 15 we are turning on the air handlers, full stop. The CxA gets defensive. The owner's facilities rep digs in. The mechanical foreman crosses his arms. By the end of the meeting, every party has reasons why what you want is impossible.

A good commissioning kickoff feels like a warm bath. You walk into the room, do introductions, talk through roles and responsibilities, work through the commissioning plan, and then — gently — turn the conversation to schedule. You name the milestones the project must hit, frame them as the team's milestones, and invite the conversation about how to get there together.

Same meeting. Same agenda. Same milestones. Different temperature.

What Actually Happens at Kickoff

In nearly every commissioning kickoff, the owner and the commissioning agent run the meeting. They send the invite, set the agenda, do introductions, walk through the commissioning plan and schedule, and open it up for questions. The structure is usually:

1. Introductions and key roles.
2. Walk-through of the commissioning plan.
3. Walk-through of the commissioning schedule.
4. Q&A.

It is a stuffy meeting by default. Your job is to make it productive.

The Two Things You Must Bring Up

1. The Schedule (Because It's Already Late)

Every commissioning effort is behind by the time of kickoff. The schedule that lives in the commissioning plan is six weeks late, sometimes six months. The kickoff is your first formal chance to surface this without surprising anyone.

Bring up the milestones that matter — functional performance testing, floor-by-floor commissioning, air handler energized dates, controls graphics ready — and ask the question: "Where does our team need to be aligned for these to land?" That phrasing matters. It is the team's milestones, not your demands.

What not to do. Do not walk in and say: "By this date I need this, by that date I need that." That works once, makes everybody angry, and costs you the next twelve months of cooperation.

2. How You Will Support the Team

The second message is just as important. Tell the team how you, as the project delivery group, will support the entire commissioning effort. Talk about your weekly cadence, your tracking, your responsiveness to issues, your willingness to remove obstacles, your commitment to the yellow brick road documents. Build connection before milestones.

If somebody pushes back on a milestone — "You're not starting the air handlers" — do not argue. Respond: "I hear you. Let me come back with options for how we can deliver what the team needs."

How to Do It — Kickoff Step by Step

Two weeks before the meeting: read the commissioning plan and walk the schedule.

One week before: identify the five milestones you most need to pull forward.

Day of: lead with introductions, walk the plan, frame milestones as team milestones.

Day of: name the support you will provide.

Day of: if pushed, respond "I hear you, let me come back with options." Do not argue.

Within 48 hours: have lunch one-on-one with the CxA.

Within 48 hours: distribute a clean follow-up summary in collaborative language.

Chapter 24 — What to Expect From Your Third-Party CxA

If you partner well with your commissioning agent, you are home free.

Analogy: The Friendly Antagonist

Think of the CxA the way a defense attorney thinks of a prosecutor. They are professionals on the other side of the table, doing exactly the job they are paid to do — and their job is to find what does not work. That is not an obstacle. It is a service to the owner that, if you use it well, becomes a service to you.

The Three-Thirds View

First Third — Setup

By the end of the first third, you should have a commissioning plan, a commissioning schedule, an identified commissioning team, and an initial kickoff complete. The controls contractor should be starting on graphics. Pre-functional checklists should be drafted or in progress. Take the CxA to lunch. Walk the project with them. Show them you have a plan and intend to support theirs.

Middle Third — Engagement

By the middle third, the official kickoff has happened (or will happen here). Pre-functional checklists are being executed on installed equipment. The exterior commissioning agent (a separate role) is doing inspections and windows testing. The controls contractor is finalizing graphics. The pattern is reports, feedback, meetings — week after week. Respond to issues quickly. Keep walking the project with the CxA.

Final Third — The Yellow Brick Road

This is the most critical part. The CxA shifts into functional performance testing, integrated systems testing, and final acceptance testing. The risk is no longer about installation — it is about whether tests fit in the calendar.

This is where the Yellow Brick Road documents come in. The yellow brick road is a calendar-format document — picture a fridge calendar with 30 days — mapped for each critical commissioning component. One yellow brick road for elevators. One for fire sprinklers. One for fire alarm by floor. One for fire alarm whole-building. One for fire smoke dampers. One for test and balance. One for engineers' walks. One for state elevator inspection. Each shows the dates when each test, walk, and inspection happens, and what enables them.

How to Do It — CxA Partnership

End of first third: commissioning plan in hand, schedule reviewed, team identified, kickoff complete. CxA invited to walk.

Through the middle third: weekly reports and feedback. Respond to every issue within the next working day.

Entering the final third: build a yellow brick road for every critical component. Calendar format. One per system. Reviewed weekly.

Exterior commissioning is a separate effort and starts earlier. Performance mockups, not just material mockups.

Chapter 25 — Owner Training and Turnover

We are not done when we understand the building. We are done when the owner understands the building.

Why Training Deserves Its Own Chapter

Too many projects treat owner training like a checkbox. A meeting is scheduled. Slides are presented. Manuals are handed out. The team leaves feeling like training happened. The operations team leaves with notes they cannot apply.

That is not training. That is a meeting.

Real training is not a meeting. It is knowledge transfer. The difference shows up in the first ninety days of occupancy, when the building either runs smoothly or starts generating calls.

Who Should Attend

Training is for the people who will actually operate the building. Not the head of facilities. Not the development team. The operators. The maintenance staff. The night shift. The people who will respond to alarms at 2 a.m.

Get them on the project list weeks before training is scheduled. Get them walking the building during Level 5 if possible. By the time of training, they should not be meeting the building for the first time.

When Training Should Happen

Training should happen when the systems are ready to be demonstrated — not before. A training session that walks through diagrams on a screen is half a training session. A training session that walks through diagrams in the room where the equipment lives, with the equipment running, is the real thing.

Typical timing: training happens in the weeks before substantial completion, after Level 4 is largely complete, while Level 5 is finishing. Seasonal systems may need deferred training when the season arrives.

Where Training Should Happen

In the room where the equipment lives. Not in the conference trailer.

How to Structure Each Session

Each session covers one system or one closely related group of systems. Each session answers eight questions:

1. What is this system?
2. What does it serve?
3. How does it operate normally?
4. What are the critical alarms?
5. What are the common failure modes?
6. What maintenance is required?
7. What should the operator never do?
8. What should the operator check first when there is a problem?

Recording

Record every training session when allowed. The operations team will lose people in the first year of warranty. A new operator who can watch the original session is a saved phone call to your project team.

Honoring the Owner

Level 6 is where we honor the owner's team. We do not just toss them the keys and disappear. We walk with them. We teach them. We support them. We make the building understandable.

How to Do It — Training Discipline

At Level 0: confirm training requirements and document deliverables in the commissioning plan.

Middle third: get the operations team's names. Block their calendars in advance.

Two months before substantial completion: schedule training sessions one per system, in the room where equipment lives.

Day of each session: have the equipment running. Walk through the eight questions.

Record sessions when allowed.

Walk the building with the operations team — room by room — before they get the keys.

Teach emergency procedures: power loss, fire alarm, water leak. Before the first emergency.

Chapter 26 — Commissioning and Lean Construction

Commissioning is one of the clearest tests of whether the project actually practiced Lean.

The Connection Most Teams Miss

Lean construction is sometimes treated as a planning discipline that ends when installation is done. That is a mistake. Commissioning is Lean when it is done right. It creates quality at the source. It reveals constraints. It reduces rework. It protects the customer. It creates learning. It forces the team to stabilize the system before handoff.

Commissioning is not separate from Lean. Commissioning is one of the clearest tests of whether the project actually practiced Lean.

Mapping Lean Principles to Commissioning

Lean Principle	How It Shows Up in Commissioning
Respect for people	Owner gets a building that works; operators get real training; trades get clear processes
Flow	Commissioning has rhythm; tests do not stack at the end
Pull planning	Each test pulls its prerequisites; pull plan built backward from substantial completion
Make-ready planning	Six-week lookahead includes readiness gates for each level
Constraint removal	Daily standups identify and clear blockers within the day
Visual management	System Readiness Board; yellow brick roads; deficiency log on the wall
Built-in quality	Readiness checklists, PFCs, calibration records; quality is verified at every gate
Standard work	Same readiness checklist used every time; same FAT process; same training format
Stop and fix	Failed tests stop the line until the issue is fixed and retested
Learning cycles	Debriefs after every IST scenario; lessons captured for the next project
Reliable promises	Test schedules committed in writing; deficiency due dates owned by name

Lean Principle	How It Shows Up in Commissioning
Handoffs	Eight-state progression: every system handed off cleanly between levels
Continuous improvement	Issues log feeds back into design and installation lessons

How to Do It — Lean Commissioning

Make commissioning visible: visual boards, yellow brick roads, system readiness boards.

Pull plan commissioning at the two-thirds milestone.

Run daily standups during Level 3-5. 15 minutes. What was tested, what is testing, what is blocked.

Stop and fix discipline: failed tests are not waived. They are fixed and retested.

Debrief every IST scenario. Capture lessons for the next project.

Chapter 27 — Commissioning and Takt Planning

Takt is not just for installation. Takt can organize the path from installed to operational.

Why Takt Extends Naturally Into Commissioning

Most teams think of Takt planning as an installation tool — a way to organize trades through zones with predictable rhythm. The connection most teams miss is that commissioning needs the same discipline. Sequence. Stability. Visual control. Reliable handoffs. Repeatable cycles. All Takt principles.

Commissioning maps onto Takt naturally when you think in commissioning zones, system-based Takt, area readiness, and progressive turnover.

Commissioning Zones

On every project, certain zones can be commissioned independently of others. A floor of an office building. A pod of a data center. A wing of a hospital. A section of a hotel. These zones become Takt units for commissioning — each one moves through pre-functional, point-to-point, and verification on a repeatable rhythm.

System-Based Takt

Some systems lend themselves to system-based Takt. Air handling units commissioned one per week. VAV boxes commissioned twenty per week. Switchgear sections commissioned in sequence. The repeated rhythm reduces variation and exposes constraints early.

Progressive Turnover

On many projects, the owner can take occupancy of one zone or floor while later zones are still being commissioned. Progressive turnover requires careful Takt design — life safety must be complete in the occupied zone, isolation must be possible, and the handoff cannot disrupt later commissioning. When designed well, progressive turnover creates revenue for the owner earlier and reduces the crash-landing risk at substantial completion.

Questions to Ask

- What are the commissioning zones?
- What systems must be completed first to release downstream commissioning?
- What rooms are required for startup?
- What sequence of areas best supports testing?
- What equipment must be ready to support downstream work?

- What turnover batches make sense?
- What areas can be completed, tested, and accepted in flow?
- What constraints will block commissioning if not removed early?

How to Do It — Takt for Commissioning

At the macro Takt plan: identify commissioning zones. Map them across the plan.

At the norm Takt plan: build system-based Takt where rhythms can be set. PFCs at a steady weekly rate, for example.

If progressive turnover is possible: design it explicitly. Life safety isolation, handoff sequence, owner acceptance per zone.

Walk the commissioning Takt plan weekly with the MEP coordinator and CxA.

Part 5 — The Superintendent's Playbook

Step-by-step procedures the superintendent runs in person.

The chapters in Part 5 are the playbook. Each one is a tactical procedure a superintendent can run as written. Use these when you need to know exactly what to do next.

Chapter 28 — Daily and Weekly Commissioning Rhythms

Commissioning moves when it has rhythm. Without rhythm, it becomes reaction.

Two Rhythms

Every commissioning effort needs two rhythms working at the same time: a daily commissioning huddle and a weekly commissioning meeting. The huddle is tactical — what is happening today. The meeting is strategic — what is happening this week, what is happening next week, what is blocking the level we are in.

Daily Commissioning Huddle

When

Every morning during Level 3 through Level 5. Fifteen minutes. Stand-up, not sit-down. Held in the trailer, in front of the visual boards.

Who

Superintendent, MEP coordinator, controls contractor lead, CxA, key trade leads (mechanical, electrical, controls, fire alarm, TAB as relevant).

Agenda

1. What systems are being tested today?
2. What prerequisites are missing for those tests?
3. What deficiencies are blocking progress?
4. What trades are needed?
5. What safety controls are required?
6. What owner or CxA witnesses are expected?
7. What gets retested today?

Output

Updated deficiency log. Updated readiness board. Today's owners and times confirmed. Issues escalated.

Weekly Commissioning Meeting

When

Same time, same day, every week, from NTP through handover. One hour. In the trailer, with the visual boards.

Who

Superintendent, project manager, MEP coordinator, controls contractor lead, CxA, project engineers responsible for documentation, exterior commissioning agent if applicable, owner's rep if available.

Agenda

1. Level status by system (eight-state progression review).
2. Constraint log: what is blocking each level.
3. Startup schedule for the next two weeks (Level 3).
4. Functional testing schedule for the next two weeks (Level 4).
5. Integrated testing readiness (Level 5).
6. Documentation status: what is complete, what is missing.
7. Owner training plan: where it stands.
8. AHJ inspection readiness.
9. Yellow brick road review: this week and next.
10. Risks and decisions needed.

Output

Updated weekly action log. Owners and dates assigned to every open item. Constraints escalated to the project manager or owner if needed.

How to Do It — Rhythm Discipline

Schedule both rhythms by the end of the first third — earlier if possible.

Do not skip the daily huddle during Level 3-5. Even on light days, hold it.

Hold the weekly meeting at the same time every week. Do not drift it.

Walk the visual boards during both meetings. Do not skip the boards in favor of slides.

If the room fills with finger-pointing, slow it down. Identify the condition. Name the owner. Move on.

Chapter 29 — How to Run a Startup Readiness Walk

The walk that releases a system to Level 3.

Why This Walk Matters

Before any equipment is energized, a startup readiness walk is held. The walk is the formal gate between Level 2 (installation verified) and Level 3 (startup). Skipping it is the single most common cause of startup chaos.

Step-by-Step Procedure

1. **Schedule the walk three days in advance.** Confirm attendees: the responsible trade, the MEP superintendent, the CxA, and the manufacturer's startup tech if applicable.
2. **Confirm the readiness checklist is complete.** The trade should have completed and signed the readiness checklist before the walk. The walk verifies, not creates.
3. **Walk the equipment physically.** Touch it. Open the access panels. Check the labels. Look at the wiring. Look at the piping. Look at the duct.
4. **Verify each checklist item.** Item by item. Do not skim.
5. **Check protection.** Filters in. Coil protection. Debris removed. Environmental conditions acceptable.
6. **Confirm safety.** Lockout/tagout status. Energization permits. Hot work permits if applicable. Confined space if applicable.
7. **Identify deficiencies.** If any item is incomplete, document it on the spot. Decide: can we proceed and fix in parallel, or must we stop?
8. **Decide go / no-go.** The CxA and superintendent decide. If go, the equipment is released to Level 3. If no-go, list the items required for re-walk.
9. **Document the walk.** Photo of signed checklist. Names of attendees. Date. Decision.
10. **If go: schedule the startup.** Confirm trade support, manufacturer tech, safety conditions, and witnesses for the startup itself.

How to Do It — Startup Readiness Walk

Build the readiness checklist for each system type at Level 0.

Trade signs the checklist before requesting the walk.

Walk physically. Touch the equipment. Verify each item.

Decide go / no-go on the spot. Document the decision.

If go, schedule startup with trade support, manufacturer, safety, and witnesses confirmed.

Chapter 30 — How to Prepare for Functional Testing

Two weeks before FPT begins, the prerequisites should be walked, not discovered.

The Two-Week Window

Functional performance testing requires extensive prerequisites. The two weeks before FPT starts are the highest-leverage window of the entire commissioning effort. What you do during those two weeks determines whether FPT runs smoothly or grinds to a halt.

Step-by-Step Preparation

1. **Schedule the FPT prerequisite walk two weeks out.** Attendees: superintendent, MEP coordinator, CxA, controls contractor, key trades.
2. **Walk every prerequisite.** Building enclosed. Building clean. Filters in. Vertical controls connectivity confirmed. Permanent power energized. TAB substantially complete. PFCs complete on every system to be tested.
3. **List every gap.** Photographic and written. Owner assigned. Due date set. Verification required.
4. **Hold daily standups on the gaps.** From the prerequisite walk forward, the standup tracks gap closure.
5. **Review the FPT test scripts.** The CxA's scripts. Read them. Pass/fail criteria clear?
6. **Confirm calibrated instruments.** The CxA's tools must be calibrated and documented.
7. **Set up the trade response system.** Every CxA request needs an owner and a same-day response window. Visible board.
8. **Schedule witnesses.** Owner, engineer of record, AHJ as needed. Schedule in writing.
9. **Coordinate with TAB.** TAB results feed FPT. Confirm the handoff.
10. **Walk the building one more time at one week out.** Look for anything missed.
11. **Hold the FPT kickoff.** Day before FPT starts. Confirm scope, sequence, witnesses, comms protocol.

How to Do It — FPT Preparation

Two weeks out: walk every prerequisite with the CxA and trades.

List every gap with owner, due date, verification required.

Daily standup tracks gap closure.

Review scripts; confirm calibrated instruments.

Set up trade response board.

Schedule witnesses in writing.
One week out: walk the building again.
Day before FPT: hold the kickoff.

Chapter 31 — How to Prepare for Integrated Systems Testing

Level 5 is where leadership matters most. Plan it like a controlled emergency.

Why IST Preparation Is Different

Integrated systems testing intentionally fails systems to verify that the building responds correctly. That makes IST inherently risky. The preparation is not just about scheduling — it is about safety, comms, leadership, and the ability to stop the test if anything goes sideways.

Step-by-Step Preparation

1. **Write the IST scripts with the CxA.** Every scenario: normal, failure, recovery. Each script names every system involved, the expected response, and pass/fail criteria.
2. **Hold a risk assessment meeting.** For each scenario, identify what could go wrong. Identify mitigations. Identify stop-work criteria.
3. **Identify the test lead.** One person calls the test. They start, pause, and end every scenario. They have stop-work authority.
4. **Build the comms protocol.** Who calls whom. What channels. What language. Drill it before testing.
5. **Set up the command center.** A physical room where the test lead, CxA, controls contractor, and key trades convene. Radios or headsets for distributed teams.
6. **Confirm trade coverage.** Switchgear room, generator yard, UPS room, mechanical rooms, fire pump room, elevator room, BAS station. Everyone in position and on comms.
7. **Schedule witnesses.** Owner, engineer of record, AHJ. Walk each scenario with them in advance.
8. **Notify the building and adjacent operations.** IST often produces noise, alarms, and visible changes. Notify security, neighbors, and occupants if applicable.
9. **Hold an IST kickoff the day before.** Walk each scenario. Confirm comms protocol. Confirm stop-work criteria. Reaffirm safety.
10. **Run the scenarios.** Test lead calls each one. Comms protocol is followed. Every observation logged in real time.
11. **Stop if safety or scope drifts.** Stop-work authority is the test lead's. Do not let troubleshooting run wild during a live IST.
12. **Debrief immediately after each scenario.** What happened. What was expected. What was the gap. Who owns the fix. When the retest.
13. **Retest with the same discipline.** Same scripts. Same lead. Same protocol.

The Calm in the Room

The best commissioning leaders create calm. They do not let the room become a shouting match. They slow it down. They clarify the condition. They document the issue. They assign ownership. They retest with discipline.

How to Do It — IST Preparation

Scripts written. Risk assessment done. Stop-work criteria agreed.

Test lead identified. Comms protocol set. Drilled in advance.

Command center established.

Trade coverage confirmed in every key room.

Witnesses scheduled, walked through scenarios in advance.

Building and adjacent operations notified.

IST kickoff held day before.

Each scenario logged. Stop-work respected.

Debriefs immediate. Retests with same discipline.

Chapter 32 — How to Lead Owner Training

Training is delivered, not held.

The Difference

Training is held when slides are presented and manuals are passed out. Training is delivered when the operations team can run the building when the project leaves. The difference shows up in the first ninety days of occupancy.

Step-by-Step Procedure

1. **Identify the operators.** By name. The people who will respond to alarms, perform maintenance, and answer questions at 2 a.m. Not the head of facilities. The operators.
2. **Get them on the project two months before turnover.** Walking. Watching. Meeting the trades.
3. **Schedule training sessions by system.** One session per major system or related cluster. In the room where the equipment lives.
4. **Prepare the room for training, not for a meeting.** Equipment running. Drawings posted. Diagrams ready. Vendor representative present.
5. **Walk the eight questions in order.** What is the system? What does it serve? How does it operate normally? Critical alarms? Common failure modes? Maintenance? Never do? Check first?
6. **Demonstrate, do not just describe.** Show alarms. Show overrides. Show recovery. Let the operator try.
7. **Record the session.** Video and audio when allowed.
8. **Document attendance and content.** Names, date, system, what was covered.
9. **Confirm understanding.** Ask the operator to walk through the system without prompting. Listen for gaps.
10. **Schedule a second walk-through before turnover.** A different operator. A different time. Same content. Catches what was missed.
11. **Teach emergency procedures.** Power loss. Fire alarm. Water leak. The operators must know what to do before the first emergency.
12. **Set the post-occupancy support cadence.** Weekly support for the first month. Bi-weekly for two more months. Monthly through warranty. Define who calls whom.

How to Do It — Owner Training

Identify operators by name. Get them on the project two months before turnover.

Schedule training sessions by system. In the rooms where the equipment lives.
Walk the eight questions. Demonstrate, do not just describe.
Record sessions.
Confirm understanding. Walk a second time with different operators.
Teach emergency procedures. Set post-occupancy support cadence.

Chapter 33 — The Final Push: Your Close-Out Strategy

The final drive is not driving work in the field. It is getting documentation ready.

Analogy: The Runway, Not the Wall

Pilots do not slow down by hitting the wall at the end of the runway. They flare and touch down with the runway still ahead of them. The reason there is runway left is because they planned the descent long before they reached the airport.

Projects fail their close-out the same way pilots crash. Not because the runway ran out — because the descent was never planned. You should be planning the close-out from the two-thirds milestone, not from the last month.

Three Milestone Checkpoints

One-Third — Topped Out and Tied In

- Structure topped out (for a typical building).
- Building systems connections to entry rooms in place.
- Design complete for the major systems.
- Change orders initiated for known change-order work.
- Interior coordination well underway in BIM.
- Commissioning plan in hand, schedule reviewed, kickoff complete.
- System matrix posted in the trailer.
- Readiness checklists drafted for every major system.

Two-Thirds — The Pivot

- Solid plan for getting air on in the building.
- Permanent power energized or scheduled with confidence.
- Building systems coming together — vertical controls, internet, hydronics.
- Full commissioning plan with FPT, IST, and AT dates locked.
- Interiors on track on the norm Takt plan.
- Commissioning pull plan built.
- Yellow brick roads drafted.

The two-thirds point is when you pivot. You move the project engineers and project managers off coordination and onto close-out. You move trade partner submittals to a tracked

log. You start the warranty documentation. You start collecting manuals, attic stock, and training videos. The project team will resist. Pivot anyway.

Substantial Completion — The Landing

- Preliminary balancing report from TAB.
- Engineer sign-offs.
- Punch list issued by the architect.
- Inspector green tags.
- Fire sprinklers operational and inspected.
- Fire alarm testing complete (floor and whole-building).
- Elevators inspected and operational.
- All life safety systems operational.
- ADA walk complete, signage in place, egress confirmed.
- FPT substantially complete.
- Operations team trained.
- Systems manual delivered.

The Day-by-Day Map

After the two-thirds point, build a detailed day-by-day map for every remaining month. Five months, six months, ten months — however many remain. Each day shows what is being commissioned, what is being inspected, what is being delivered for close-out, and what is being tested. Print it. Walk it weekly.

Never Delegate the Systems Sequence

How you commission the floors ties into your overall commissioning. Permanent power ties into your air handlers. Your air handlers tie into the BAS. The BAS ties into fire alarm. Fire alarm ties into smoke control. This network has to be in one person's head — the superintendent's. Make it visual. Walk it weekly. Own it personally to the end.

How to Do It — Close-Out Discipline

At the two-thirds point: pivot the project engineers and PMs to close-out.

At the two-thirds point: build the day-by-day map.

Every weekly meeting in the final third: open with the close-out tracker.

Get aggressive on small items. The delayed fire-alarm device behind the delayed elevator install will hold up substantial completion if you let it.

Never delegate the systems sequence. Walk it weekly to the end.

Chapter 34 — Substantial Completion vs. Final Completion

Two doors, two dates, two punch lists. Know the difference before you sign the contract.

Analogy: The Door That Opens, the Door That Closes

Substantial completion is the door that opens. The building can be safely occupied for its intended use. The owner can move in. Workers can start doing what the building was built to do.

Final completion is the door that closes. The punch list is done. The building has been flushed. The last documents are filed. The warranty period has begun. The project is done.

These are not the same date and never should be.

Substantial Completion: What It Actually Means

Substantial completion means the building is substantially done and ready to be used for its intended use, where the occupant can safely occupy it. The exact wording and requirements live in your contract and in the local municipality's rules. Read both, on every job, before you sign.

Minimum Conditions for Substantial Completion

- All life safety systems operational — fire alarm, fire sprinklers, exits.
- Elevators operational and inspected.
- Fire sprinkler heads installed, inspected, hydrostatic test complete.
- Proper access and egress — ADA compliance, signage, way-finding.
- Architect's punch list issued.
- Engineers' sign-offs on systems of record.
- **Preliminary balancing report** — typically two to eight weeks of TAB work; required for temporary certificate of occupancy.
- Inspectors' green tags from the AHJ.
- Temporary or full certificate of occupancy.

The Preliminary Balancing Report Trap

Test and balance for an HVAC system typically takes two to eight weeks. The preliminary balancing report is required for temporary certificate of occupancy and therefore for substantial completion. If you do not plan for the TAB duration explicitly, you will reach the end of the project with the air balanced and no report yet — and substantial completion will slip while the paperwork catches up.

Between Substantial and Final — Application Time

- **Punch list completed.**
- **Building flush.** Running air through the building to clear off-gassing. Plan the duration explicitly.
- **Final functional performance testing.** Final passes after the preliminary balancing report.
- **Final documentation.** Systems manual finalized, O&M manuals delivered, attic stock confirmed, warranties activated.
- **Owner training** — recorded, documented, transmitted.
- **Post-occupancy monitoring.** Performance tracked, corrective actions issued, final commissioning report drafted.

Final Completion

Final completion means the building is done. Everything is operational. The punch list is closed. The building is turned over. The final commissioning report is delivered. Documentation is in the owner's hands. The warranty period has begun. Typically a month behind substantial completion. Sometimes six. Know yours.

How to Do It — Substantial Completion Discipline

Day one of pre-construction: read the substantial completion clause in the contract and the AHJ requirements. Map them backward into the Takt plan.

Six months out: confirm preliminary balancing report duration. Schedule the TAB work to deliver the report before the substantial completion target.

Three months out: build the substantial completion landing plan. Every required item mapped.

One month out: daily standing meeting with the punch list owner, the CxA, and the project superintendent. No new tests after this point — only closure.

Part 6 — Lessons from the Field

Common failures and the behaviors that prevent them.

Most commissioning failures are not technical surprises. They are planning and leadership failures that show up technically. The two chapters in this part name the most common failures and the behaviors that separate the supers whose projects land cleanly from the ones who crash.

Chapter 35 — Common Commissioning Failures (And How to Prevent Them)

Most commissioning failures are not surprises. They are predictable.

Failure 1: Starting Commissioning Too Late

Symptom: commissioning kickoff happens in month nine when it should have happened in month three. PFCs are released after equipment is installed. The CxA shows up to a building that is mostly built.

Cause: project team treats commissioning as a closeout activity. The commissioning plan is left to the CxA without field input. The Takt plan does not include commissioning until the final third.

Prevention — Day one moves. Read the OPR, BOD, and commissioning plan in the first month. Place commissioning on the Takt plan from the start. Hold the kickoff in the first third of the project.

Failure 2: Treating Checklists as Paperwork

Symptom: PFCs are signed without items actually being verified. The CxA finds the same problems on the field walk that the PFC was supposed to catch.

Cause: checklists are framed as compliance, not as quality gates. Trades are not trained on why each item matters.

Prevention — Treat PFCs as quality gates between Level 2 and Level 3. The trade walks the checklist with the CxA. Items not verified are not signed off. Pencil-whipped checklists are returned for re-verification.

Failure 3: Skipping Installation Verification

Symptom: startup becomes discovery. Equipment is energized before installation is verified. Issues that should have been caught at Level 2 surface at Level 3.

Cause: the project decides to "make up time" by starting early. Level 2 is treated as a soft gate.

Prevention — Defend Level 2 as a hard gate. Installation verification checklists complete and signed before any startup is approved.

Failure 4: Starting Equipment Before Prerequisites Are Complete

Symptom: equipment will not run cleanly. Startup tech keeps coming back. Each startup attempt exposes a different prerequisite that was not ready.

Cause: pressure to show progress overrides readiness. The startup is scheduled when the system was not ready.

Prevention — Readiness checklist signed before startup is scheduled. Walk the readiness with the trade and the CxA before scheduling the startup tech.

Failure 5: Not Prioritizing Controls

Symptom: graphics are incomplete at Level 4. Points are not mapped. Sequences are not programmed. FPT cannot run because the BAS is not ready.

Cause: controls is treated as a finish trade. Controls contractor brought in late. No early sequence walk-through.

Prevention — Treat controls as a commissioning trade. Controls contractor on board by the end of the first third. Sequence walk-through in the middle third. BAS graphics tracked as a named milestone.

Failure 6: Poor Documentation

Symptom: startup reports incomplete. Calibration records missing. Test results vague. CxA cannot certify systems.

Cause: no documentation owner. No platform. No discipline.

Prevention — Documentation owner assigned at Level 0. Single platform agreed on. Weekly review during the back half of the project. Fake documentation rejected.

Failure 7: Weak Communication During Integrated Testing

Symptom: IST becomes chaos. Trades run in different directions. Troubleshooting happens randomly during live tests. Stop-work authority is unclear.

Cause: no test lead. No comms protocol. No command center. No advance walk-through with witnesses.

Prevention — Test lead identified. Comms protocol drilled. Command center established. Witnesses walked through scenarios in advance. Stop-work authority clear.

Failure 8: Training the Wrong People Too Late

Symptom: the operations team is meeting the building for the first time at training. The actual operators are not in the room — only managers. Training is held in a conference trailer instead of in the equipment rooms.

Cause: training treated as a checkbox. Owner's actual operators not on the list.

Prevention — Operators identified by name. On the project two months before turnover. Training held in the rooms where the equipment lives. Recorded.

Failure 9: Ignoring Unresolved Deficiencies

Symptom: the deficiency log fills up. Items get "closed" without verification. The CxA refuses to certify systems with open items.

Cause: no discipline on closure. Vague descriptions like "fixed" accepted. No retest.

Prevention — A deficiency is not closed when someone says it is fixed. It is closed when the correction is verified by the CxA. Train the team to use that phrase from day one.

Failure 10: Confusing Substantial Completion With Operational Readiness

Symptom: the project passes substantial completion. The owner takes occupancy. Calls start within the first week. Systems do not work as expected. The operations team does not know what to do.

Cause: training was held but not delivered. IST was incomplete. Deferred items were not communicated. Post-occupancy support was not planned.

Prevention — Treat substantial completion as a date, not the goal. The goal is operational readiness: trained operators, working systems, complete documentation, defined post-occupancy support.

> **The Unifying Insight**
> Every failure on this list is a planning and leadership failure that shows up technically. Fix the planning and leadership and the technical failures stop happening.

Chapter 36 — What Great Superintendents Do Differently

The behaviors that separate the supers whose projects land cleanly.

They Own Commissioning Personally

Great supers do not delegate commissioning. They put their name next to it on the org chart. They sit in every commissioning meeting. They walk the MEP rooms weekly. They make the call on every readiness gate. They are the single point of accountability.

They Start on Day 1

Great supers do not wait for the building to be "close enough" to think about commissioning. They read the OPR and BOD in the first month. They take the CxA to lunch in the first month. They put commissioning on the Takt plan in the first month.

They Make Commissioning Visible

Great supers do not hide commissioning behind spreadsheets. They make it visual. System Readiness Boards on the trailer wall. Yellow brick roads pinned in the room. Daily standups in front of the boards. Visibility forces accountability.

They Defend the Gates

Great supers do not let the project skip levels. Level 2 is a hard gate before Level 3. Level 3 is a hard gate before Level 4. The readiness checklist is signed before the equipment is energized. The PFC is verified before the FPT script is run. The IST scenarios are scripted before the test is held.

They Walk the Building

Great supers walk the building every week. Not just the construction zones — the MEP rooms, the IDF closets, the roof, the generator yard. They touch the equipment. They look at the labels. They open the panels. They check the protection. They see what is real.

They Respond to Issues the Same Day

Great supers do not let the deficiency log age. Every issue gets an owner and a date the day it is logged. High-priority items get walked personally. Items older than two weeks raise a flag.

They Build the Relationship With the CxA

Great supers treat the CxA as a partner, not an adversary. They take them to lunch in the first month. They walk the project with them. They respond to their issues quickly. They invite them into Level 0 planning.

They Train the Operators, Not the Managers

Great supers identify the actual operators by name. They get them on the project two months before turnover. They train in the rooms where the equipment lives. They record sessions. They walk the building with the operators before turnover.

They Pivot to Close-Out at Two-Thirds

Great supers do not wait for the last month to think about close-out. They pivot the project engineers and PMs to close-out at the two-thirds milestone. They build the day-by-day map. They open every weekly meeting with the close-out tracker.

They Speak in Evidence, Not Opinion

Great supers do not say "it's fine." They say "it passed FPT on Tuesday, the CxA signed it off, the deficiency was closed and re-verified." They speak in evidence because they have built a process that produces evidence.

They Never Delegate the Systems Sequence

Great supers do not let anyone else carry the full picture of how the systems interconnect. They walk it weekly. They keep it visual. They own the result personally to the end.

The Final Promise

Commissioning is the disciplined act of proving the promise. It takes the building from installed to operational, from operational to integrated, and from integrated to trusted. The superintendent who internalizes that is the one whose buildings turn over with confidence.

How to Do It — The Last Page

Re-read this list once a month for your first three projects leading commissioning.

Pick the one behavior you do not yet do consistently. Build it into your week.

After substantial completion: review the project against the ten failures in Chapter 35. What did you do well? What is still on your list?

Teach the next superintendent. The best way to internalize this manual is to walk a younger super through it.

Appendices

Reference material for the field

Appendix A — Commissioning Activities Map

Every commissioning activity in one frame. Adapt to your project.

This is the activities map referenced throughout the manual — the flow chart that lives outside the Takt plan and on the trailer wall. Use it as a checklist of what must be networked together. Adapt to your specific building, but do not remove categories without a reason.

From the Street to the Entry Rooms

Activity	Inputs / Predecessors	Owner
Utility points of connection confirmed	Owner coordination with utility providers (power, comms, water, sewer, storm, gas)	PM / Owner
Water service to building	Permit, tap, plumbing rough	PM / Trade
Sewer / sanitary tie-in	Permit, road work if needed	PM / Trade
Storm drain connection	Site work coordination	PM / Trade
Permanent power feed to SES	Utility coordination, permits, switchgear delivery	PM / Trade
Communications feed to MDF	Provider coordination, conduit pull	PM / Trade
Gas service (if applicable)	Permit, design coordination	PM / Trade

From the Entry Rooms Up the Building

Activity	Inputs / Predecessors	Owner
Electrical rooms built out floor-by-floor	Concrete decks, framing, panels delivered	Super / Trade
IDF rooms built out floor-by-floor	Framing, drywall, dust control, racks	Super / Trade
Power feeders pulled up the building	Electrical rooms ready, conduit	Super / Trade
Vertical comms backbone	IDF rooms ready, conduit or cable tray	Super / Trade
Vertical controls cabling (or temporary)	Controls contractor coordination	Super / Trade

Activity	Inputs / Predecessors	Owner
Duct chases routed and clear	Structure complete, chases framed	Super / Trade
Heating hot water piping vertical	Chases clear, hangers in place	Super / Trade
Chilled water piping vertical	Chases clear, hangers in place	Super / Trade
Domestic water piping vertical	Chases clear, hangers in place	Super / Trade
Sanitary piping where required for drains	Chases clear, design coordination	Super / Trade

At the Roof / Mechanical Room

Activity	Inputs / Predecessors	Owner
Temporary roof on / dry-in	Decking complete, weather window	Super
Air handlers flown and set	Crane access, structural pads, openings	Super / Trade
Exhaust fans set	Structural openings, weather window	Super / Trade
Pumps installed and connected	Mechanical room ready, hydronics piped	Super / Trade
Manufacturer startup on air handlers	Power, controls, filters in	Trade / Mfr
Air handlers in hand (manual operation)	Manufacturer startup complete, filters	Super / Trade

On Each Floor

Activity	Inputs / Predecessors	Owner
Equipment installed	Rough-ins complete, drywall up	Trade
Dry-side hookup (duct)	Equipment set, duct routed	Trade
Wet-side hookup (hydronics)	Equipment set, piping routed	Trade

Activity	Inputs / Predecessors	Owner
Power connection to equipment	Panels live, conduit, devices labeled	Trade
Controls connection to equipment	Cabling routed, devices labeled	Trade
Bracing and seismic confirmed	Per spec and manufacturer	Trade
Pre-functional checklist executed	Equipment installed and connected	Trade / CxA
Point-to-point on the floor (to JACE)	PFC complete, controls live	Controls / CxA

Whole-Building Tests

Activity	Inputs / Predecessors	Owner
Vertical point-to-point (BAS sees building)	Every floor PFC complete; vertical controls live	Controls / CxA
Test and balance (TAB)	Building enclosed, filters in, BAS live	TAB / CxA
Functional performance testing (FPT)	PFCs complete, TAB done, prerequisites met	CxA / Trade
Fire alarm testing (floor)	Fire alarm devices installed and connected	Fire alarm / CxA
Fire alarm testing (whole building)	All floors complete, dampers in	Fire alarm / CxA
Integrated systems testing (IST)	Individual systems pass; cross-trigger ready	CxA / Trade
Acceptance testing (AT)	FPT and IST complete	AHJ / EOR
State elevator inspection	Elevator install and pre-inspection complete	Trade / State
Sprinkler hydrostatic test and green tag	Sprinkler installed, inspected	Trade / AHJ
ADA walk	Signage, fixtures, dimensions complete	Owner / Architect
Life safety walk	All life safety systems online	AHJ
Engineer sign-off walk	Punch list cleared in respective scope	EOR

Activity	Inputs / Predecessors	Owner
Preliminary balancing report issued	TAB substantially complete	TAB
Building flush	Air handlers in hand or commissioned, filters in	Super / Trade

Closeout

Activity	Inputs / Predecessors	Owner
Systems manual compiled	As-builts, sequences, O&M, test results	PM / CxA
Owner training (recorded)	Systems manual ready, equipment commissioned	PM / Trade / CxA
Attic stock collected and turned over	Per spec, per trade	PM / Trade
Submittal and transmittal log closed	All deliverables logged	PM / PE
O&M manuals delivered	All trades complete	PM / Trade
Warranty period documentation	Per contract	PM
Final commissioning report	IST and AT complete, post-occupancy monitoring	CxA
Final certificate of occupancy	All AHJ requirements met	PM / Owner / AHJ

Appendix B — Step-by-Step Field Checklist

By-milestone checklist. Print and walk.

Day 1 (Within 2 Weeks of NTP)

- Commissioning agent identified and named on the project org chart.
- Commissioning plan read cover to cover.
- Controls contractor identified.
- Standing weekly commissioning sync placed on the calendar (NTP through handover).
- Macro Takt plan includes commissioning as a named section.
- Air handlers, building enclosed, and permanent power named as project milestones.
- OPR and BOD read and understood.
- System matrix posted in the trailer.

End of First Third

- Commissioning plan, schedule, and team confirmed.
- Initial kickoff complete or imminent.
- CxA introduced and lunched.
- Controls contractor working on BAS graphics.
- Pre-functional checklists released or in progress.
- Readiness checklists drafted for every major system.
- Exterior commissioning agent engaged (if applicable) — performance mockups, not just material mockups.
- Long-lead items (elevators, curtain wall, switchgear) tracked in detail on the schedule.
- AHJ relationship established. Project walked together.
- FAT list built and witnesses confirmed.

End of Middle Third

- Official kickoff complete.
- PFCs being executed on installed equipment.
- Floor-by-floor commissioning happening on the norm Takt plan.
- Weekly reports, feedback, and meetings cadence locked.
- Issues log responded to within one working day.
- Air handlers landed and in hand.

- Vertical comms backbone live (temporary acceptable, paid for if needed).
- Path to air on, permanent power, and FPT mapped on the Takt plan.
- Sequence walk-through meeting held with BOD, CxA, controls contractor, and owner.
- Project engineers and PMs being pivoted to close-out at the two-thirds milestone.
- System Readiness Board live on the trailer wall.

Final Third / Pre-Substantial Completion

- Yellow brick road documents built for elevators, fire sprinklers, fire alarm (floor and whole-building), fire smoke dampers, test and balance, engineers' walks, state elevator inspection.
- Day-by-day map for the remaining months printed and walked weekly.
- Daily standup with CxA, controls contractor, MEP coordinator, superintendent.
- FPT prerequisites complete: building enclosed, clean, filters in, vertical controls connectivity, permanent power, TAB.
- FPT, IST, AT scheduled with no conflicts with fire alarm testing.
- Punch list owner identified.
- Systems manual being compiled in real time, not at the end.
- Attic stock collection underway.
- O&M manuals being collected.
- Operators identified by name. Scheduled to walk the building two months before turnover.
- Owner training scheduled by system. Recording plan in place.

Substantial Completion Gate

- Preliminary balancing report delivered.
- Engineer sign-offs collected.
- Architect's punch list issued.
- Inspector green tags from the AHJ.
- Fire alarm testing complete (floor and whole-building).
- Fire sprinkler system operational and inspected.
- Elevators operational and state-inspected.
- ADA walk complete; signage and egress confirmed.
- Life safety walk complete.
- FPT substantially complete.
- IST scenarios run and signed off.

- Operations team trained. Sessions recorded.
- Systems manual delivered.
- Temporary or full certificate of occupancy received.

Final Completion Gate

- Punch list closed.
- Building flush complete.
- Final FPT passes complete.
- Final commissioning report delivered.
- Systems manual finalized and turned over.
- Owner training delivered and recorded.
- Attic stock turned over.
- Warranties activated.
- Post-occupancy support cadence active.
- Seasonal and deferred testing scheduled.
- Final certificate of occupancy received.

Appendix C — Yellow Brick Road Document Template

One calendar per critical system. Plotted weekly with the CxA.

The Yellow Brick Road document is a calendar-format map for a single critical commissioning component. Imagine a fridge calendar — 30 days laid out in a grid — with the test and inspection dates plotted day by day, along with the prerequisites that enable each one. Each critical system gets its own.

Systems That Should Have a Yellow Brick Road

- Elevators (through state elevator inspection).
- Fire sprinklers (through green tag).
- Fire alarm — by floor.
- Fire alarm — whole building.
- Fire smoke dampers.
- Test and balance (TAB).
- Engineers' walks (per discipline).
- Architectural punch list walks.
- ADA walk.
- Life safety walk.
- Building flush.
- Integrated systems testing scenarios.
- Final acceptance testing with AHJ.

What Goes on Each Yellow Brick Road

- **The dates** — every test, inspection, or walk day.
- **The prerequisite for each date** — what must be true the day before.
- **The owner for each date** — name, not just role.
- **Cross-system conflicts highlighted** — "do not schedule TAB during this fire alarm window".
- **Sign-off field per date** — passed, failed, retest scheduled.

How to Use Them

1. Build them three months before substantial completion.
2. Walk them weekly with the CxA and MEP coordinator.

3. Reconcile conflicts with the Takt plan and other yellow brick roads.
4. Pin every yellow brick road on the trailer wall in the same room.
5. Mark progress visibly — passed dates struck through, failed dates re-scheduled in red.

Why the Calendar Format Matters

A list of tests with target dates does not force you to see conflicts. A calendar does. The instant two tests land on the same day, the conflict is visible to everyone in the room. The yellow brick road format is a forcing function for conflict resolution.

Appendix D — System Readiness Checklists by Equipment Type

Print one per system. Sign before startup.

These checklists are the Level 2-to-Level 3 gate for each major equipment type. The responsible trade completes the checklist as the equipment is installed. The CxA or superintendent verifies before startup is approved. Adapt to your project's specifications, manufacturer requirements, and AHJ.

Air Handling Unit (AHU)

- Equipment delivered, inspected for damage, nameplate matches submittal.
- Anchored to housekeeping pad per drawings and seismic requirements.
- Manufacturer clearances met; access panels unblocked.
- Permanent power to disconnect. Disconnect labeled. Phasing verified.
- Ductwork connected (supply, return, exhaust). Sealed. Insulated.
- Fire/smoke dampers installed and operational. Position verified.
- Hydronic piping connected. Flushed. Pressure-tested. Valves tagged.
- Filters installed (correct MERV rating per specification).
- Coils protected; no debris or construction material.
- Belt tension and coupling alignment verified per manufacturer.
- Lubrication per manufacturer.
- Drain pan installed; condensate drain trapped and tested.
- Controls wiring complete and terminated to manufacturer specifications.
- BAS points mapped, verified, and labeled.
- Sensors calibrated.
- Safety interlocks tested (high-static, freeze, smoke, fire).
- Variable frequency drive setup complete (if applicable).
- Outdoor air dampers operational; minimum position set.
- Economizer setup complete (if applicable).
- Manufacturer startup tech scheduled.
- TAB path ready: downstream terminal units installed, outlets in place.
- Trade signature, date. CxA verification.

Generator

- Equipment delivered, inspected, on pad per seismic requirements.
- Fuel system connected and filled. Day tank verified. Fuel polishing if specified.
- Exhaust system installed and routed per spec; supports correct.
- Cooling system complete (radiator, ventilation, jacket water heater).
- Output cabling connected to ATS or distribution per drawings.
- Battery charger connected and active.
- Block heater powered and operational.
- Controls panel powered and active.
- BAS interface complete and verified.
- Fire alarm interface complete (shutdown on alarm if specified).
- Load bank scheduled (if rented for testing).
- Manufacturer startup tech scheduled.
- Safety systems verified: ventilation, gas detection if applicable, emergency shutdown.
- Generator yard secured and signed per AHJ.
- Trade signature, date. CxA verification.

Switchgear and Electrical Distribution

- Equipment delivered, inspected, anchored, leveled.
- Conduits and terminations complete. Torque verified and stickered.
- Grounding and bonding verified per drawings and code.
- Megger testing complete and documented.
- Phasing verified at all panels.
- Breaker testing complete (primary or secondary injection per spec).
- Relay settings per coordination study.
- Arc flash labels installed.
- Panel schedules updated and posted.
- Doors closed; safety interlocks active.
- Manufacturer startup tech scheduled.
- Trade signature, date. CxA verification.

Automatic Transfer Switch (ATS)

- Equipment delivered, inspected, mounted per drawings.
- Normal and emergency feeds terminated and labeled.
- Controls wiring complete to generator and BAS.

- Time delays and transfer settings per specification.
- In-phase transition verified (if applicable).
- Manual transfer tested.
- Automatic transfer tested (with generator).
- Trade signature, date. CxA verification.

Uninterruptible Power Supply (UPS)

- Equipment delivered, inspected, on pad.
- Battery system installed, terminations torqued, ventilation per code.
- Input and output cabling terminated.
- Bypass circuit tested.
- Controls and monitoring connected to BAS.
- Battery temperature compensation set.
- Runtime test scheduled.
- Manufacturer startup tech scheduled.
- Trade signature, date. CxA verification.

Chiller

- Equipment delivered, inspected, on pad.
- Refrigerant charge verified or scheduled.
- Chilled water and condenser water piping connected, flushed, pressure-tested.
- Valves tagged and accessible.
- Power feed terminated. Disconnect labeled.
- Controls and BAS interface complete and verified.
- Safeties tested: low temp cutout, flow switch, high pressure.
- Insulation complete.
- Manufacturer startup tech scheduled.
- Trade signature, date. CxA verification.

Boiler

- Equipment delivered, inspected, on pad.
- Gas piping connected, leak-tested, regulator set.
- Water piping connected, flushed, pressure-tested.
- Combustion air supply per code.

- Flue and venting per manufacturer and code.
- Power feed terminated.
- Controls and BAS interface complete.
- Safeties tested: high-limit, low-water cutoff, gas pressure switches, flame failure.
- AHJ approval if required for fuel-burning equipment.
- Manufacturer startup tech scheduled.
- Trade signature, date. CxA verification.

Pumps

- Equipment delivered, inspected, on pad and aligned.
- Suction and discharge piping connected; strainers installed.
- Valves tagged and accessible (isolation, balancing, check).
- Power feed terminated. Rotation verified.
- VFD set up if applicable.
- Controls wired; lead/lag configured if applicable.
- Pressure gauges installed and zeroed.
- Trade signature, date. CxA verification.

Exhaust and Supply Fans

- Equipment installed; isolators correct.
- Ductwork connected, sealed, insulated as required.
- Backdraft dampers installed where required.
- Power and disconnect complete.
- Rotation verified.
- Belt and coupling alignment verified.
- VFD set up if applicable.
- Controls and BAS verified.
- Trade signature, date. CxA verification.

Fire Alarm System

- Devices installed per drawings.
- Wiring complete and tested.
- Panel programmed.
- BAS interface complete and verified.

- Smoke control interface complete and verified.
- Elevator recall interface complete and verified.
- HVAC shutdown interface complete and verified.
- Generator interface complete (if applicable) and verified.
- Battery backup test complete.
- AHJ pre-test walked.
- Test schedule built — by floor and whole-building.
- Trade signature, date. CxA verification.

Elevators

- Equipment installed; pit and hoistway inspections complete.
- Cab finishes complete.
- Power and controls connected.
- Fire alarm recall interface verified.
- Emergency power test scheduled (with generator).
- Door operation, sensors, leveling verified.
- Communications (emergency phone) tested.
- State inspection scheduled.
- Trade signature, date. CxA verification.

BAS / Controls

- Field devices installed and calibrated. Calibration records on file.
- Panels installed; power connected.
- Network cabling complete (vertical and horizontal).
- Internet connectivity to the building active.
- Graphics built and reviewed with owner.
- Sequences programmed per BOD.
- Point-to-point tested at each device. Records on file.
- Alarms configured per alarm matrix.
- Trend logs configured per CxA list.
- Overrides removed and documented.
- Setpoints per specification and posted.
- Operator access roles configured.
- Trade signature, date. CxA verification.

Domestic Water

- Piping pressure-tested and disinfected per code.
- Backflow preventers installed and tested.
- Hot water generator(s) installed; temperatures set.
- Mixing valves set and tested.
- Recirculation pumps operational.
- Fixtures installed and tested.
- Trade signature, date. CxA verification.

Smoke Control, Stair Pressurization, Fire Pump

- Smoke control sequence verified at the BAS and field.
- Stair pressurization fans operational; pressure verified.
- Fire pump installed, jockey pump set, churn test complete.
- Fire pump controller verified.
- Fire alarm interface verified.
- Generator backup verified.
- AHJ witness scheduled.
- Trade signature, date. CxA verification.

Use These as Starting Frames

These checklists are starting frames. Tailor each one to your project's specifications, manufacturer requirements, and AHJ. The signed checklist is what releases the system from Level 2 to Level 3.

Appendix E — Commissioning Responsibility Matrix

Who does what at each level. Adapt to your project.

This matrix is a starting template. Rows are major systems. Columns are the seven commissioning levels (0-6). Cells name the responsible party at each level. Customize with named individuals from your project.

Legend. PM = Project Manager. S = Superintendent. MEP = MEP Coordinator. T = Trade. CxA = Commissioning Authority. CC = Controls Contractor. TAB = Test and Balance. O = Owner. EOR = Engineer of Record. AHJ = Authority Having Jurisdiction. Mfr = Manufacturer.

Major Mechanical Systems

System	L0	L1	L2	L3	L4	L5	L6
Air Handlers	PM/S/CxA	S/Mfr/CxA	S/T/CxA	S/T/Mfr	CxA/T/CC	CxA/T	S/Mfr/O
Chillers	PM/S/CxA	S/Mfr/CxA	S/T/CxA	S/T/Mfr	CxA/T/CC	CxA/T	S/Mfr/O
Boilers	PM/S/CxA	S/Mfr/CxA	S/T/CxA	S/T/AHJ	CxA/T/CC	CxA/T	S/Mfr/O
Pumps	PM/CxA	—	S/T/CxA	S/T/CxA	CxA/T/CC	CxA/T	S/T/O
Exhaust Fans	PM/CxA	—	S/T/CxA	S/T/CxA	CxA/T/CC	CxA/T	S/T/O
VAV Boxes	PM/CxA	—	S/T/CxA	S/T/CC	CxA/CC/TAB	CxA/CC	S/CC/O

Major Electrical Systems

System	L0	L1	L2	L3	L4	L5	L6
Switchgear	PM/CxA/EOR	S/Mfr/CxA	S/T/CxA	S/T/Mfr	CxA/T	CxA/T	S/T/O
Generator	PM/CxA/EOR	S/Mfr/CxA	S/T/CxA	S/T/Mfr	CxA/T/AHJ	CxA/T/AHJ	S/Mfr/O
ATS	PM/CxA	S/Mfr/CxA	S/T/CxA	S/T/Mfr	CxA/T	CxA/T	S/T/O
UPS	PM/CxA	S/Mfr/CxA	S/T/CxA	S/T/Mfr	CxA/T	CxA/T	S/Mfr/O
Lighting Controls	PM/CxA	—	S/T/CxA	S/T/CC	CxA/CC	CxA/CC	S/CC/O

Life Safety Systems

System	L0	L1	L2	L3	L4	L5	L6
Fire Alarm	PM/CxA/AHJ	—	S/T/CxA	S/T	T/AHJ	CxA/T/AHJ	S/T/O
Fire Sprinklers	PM/CxA/AHJ	—	S/T/AHJ	S/T	T/AHJ	CxA/T	S/T/O
Fire Pump	PM/CxA/AHJ	S/Mfr/AHJ	S/T/CxA	S/T/Mfr	T/AHJ	CxA/T/AHJ	S/Mfr/O
Smoke Control	PM/CxA/AHJ	—	S/T/CxA	S/T/CC	CxA/T/CC	CxA/T/AHJ	S/CC/O
Elevators	PM/CxA/AHJ	S/Mfr	S/T/CxA	S/T/Mfr	T/State	CxA/T/State	S/Mfr/O

Controls and Communications

System	L0	L1	L2	L3	L4	L5	L6
BAS / BMS	PM/CxA/CC	—	S/CC/CxA	S/CC/CxA	CxA/CC	CxA/CC	S/CC/O
IT/Comms Network	PM/O	—	S/T	S/T	S/T/O	S/T/O	S/T/O
Security Systems	PM/O	—	S/T	S/T	S/T	CxA/T	S/T/O

Customize Before You Use It

This template is generic. Before using it on your project, replace every role abbreviation with the named individual responsible. The matrix only works when names are attached. Re-issue at every milestone change.

Appendix F — Daily Commissioning Huddle Agenda

Fifteen minutes. Stand-up. Same time, same place, every working day.

When

Every working morning during Level 3 through Level 5 — typically the back third of the project. Same time every day. Held in the trailer, in front of the visual boards (System Readiness Board, deficiency log, yellow brick roads).

Who

Required: Superintendent. MEP coordinator. Controls contractor lead. CxA. Mechanical, electrical, controls, fire alarm leads as relevant to today. TAB if active.

Optional but useful: project engineer responsible for documentation. PM if available.

Standing Agenda — Fifteen Minutes

Minute 1-2: Yesterday's Closure

- What was tested yesterday?
- Pass / fail / retest needed?
- Any deficiencies closed since yesterday's huddle?

Minute 3-6: Today's Tests

- What systems are being tested today?
- What prerequisites must be confirmed before each test starts?
- What trades are needed? Are they on site?
- What safety controls are required (LOTO, hot work, energization permits)?
- What CxA, owner, or AHJ witnesses are expected today?

Minute 7-10: Blockers

- What deficiencies are blocking progress?
- What materials are missing?
- What trades are not on site?
- What decisions need to be made today?
- Who needs to be pulled in from outside the room?

Minute 11-13: Retests

- What is retesting today?

- Is the original deficiency closure ready to be verified?
- Who is witnessing each retest?

Minute 14-15: Look-Ahead

- What tests are scheduled for tomorrow?
- What prerequisites must be in place by end of day today?
- Any safety controls or coordination needed for tomorrow that we set up now?

Output

- Updated System Readiness Board.
- Updated deficiency log.
- Today's owners and times confirmed.
- Any items requiring escalation are escalated immediately after the huddle.

The Discipline That Makes It Work

Start on time. End on time. Stand up. Walk the boards. Use names, not titles. If the conversation drifts into problem-solving, take it offline immediately. The huddle is for coordination — problem-solving happens after.

Appendix G — Weekly Commissioning Meeting Agenda

One hour. Same time, same day, every week, from NTP through handover.

When

Same time, same day, every week, from NTP through handover. One hour. In the trailer, with the visual boards present.

Who

Required: Superintendent. Project manager. MEP coordinator. Controls contractor lead. CxA. Project engineer responsible for commissioning documentation.

Often present: Exterior commissioning agent. Mechanical, electrical, fire alarm leads. TAB lead if active. Owner's representative as available.

Standing Agenda — Sixty Minutes

Minute 0-5: Open

- Attendance and any new participants introduced.
- Review action items from last week's meeting. Status.

Minute 5-15: Level Status by System

- Walk the System Readiness Board. For each major system: what state is it in (installed, inspected, started, PFC, FPT, IST, trained, turned over)?
- Any systems that have not advanced in two weeks? Why?
- Confirm the eight-state progression understanding across the team.

Minute 15-25: Constraint Log

- What is blocking each level?
- For each blocker: owner, due date, what changed this week.
- Escalate anything older than two weeks.

Minute 25-35: Two-Week Schedule

- Startup schedule for the next two weeks (Level 3).
- Functional testing schedule for the next two weeks (Level 4).
- Integrated testing readiness (Level 5).
- Confirm prerequisites for each scheduled test.

Minute 35-42: Documentation

- What documentation was completed this week?
- What is missing or incomplete?
- Systems manual status.
- Deficiency log: open count, aged items, closure rate.

Minute 42-48: Training and Turnover

- Owner training plan: where it stands, who is scheduled, when.
- Attic stock collection status.
- O&M manuals status.
- Warranty documentation status.

Minute 48-55: AHJ and Witnesses

- AHJ inspection readiness.
- Witnessed tests scheduled in the next two weeks.
- Yellow brick road review: any conflicts this week and next?

Minute 55-60: Risks and Decisions

- Risks raised this week.
- Decisions needed.
- Items requiring PM, owner, or external escalation.
- Action items: name, due date, output.

Output

- Updated weekly action log.
- Owners and dates assigned to every open item.
- Constraints escalated to the project manager or owner if needed.
- Documented attendance and decisions.

The Meeting That Becomes a Habit

Hold this meeting at the same time every week. Do not drift it. Do not skip it. Do not let it run over. The discipline of the meeting is what creates the discipline of the commissioning effort.

Appendix H — Common Failures Quick Reference

Field-card version of Chapter 35. Pin to the trailer wall.

Pin this on the trailer wall. Walk it monthly with the team. Each failure has a symptom, a cause, and a prevention. If the symptom shows up on your project, you know where to look.

#	Failure	Symptom	Prevention
1	Starting too late	Kickoff in month 9, not month 3	Day 1 moves. Commissioning on Takt plan from start.
2	Checklists as paperwork	Signed but not verified	PFCs are quality gates. Trade walks with CxA. Pencil-whipping returned.
3	Skipping installation verification	Startup becomes discovery	Level 2 as hard gate. Readiness checklists signed before any startup.
4	Starting before prerequisites	Equipment will not run cleanly	Readiness checklist signed before scheduling startup tech.
5	Controls deprioritized	Graphics incomplete; points not mapped	Controls is a commissioning trade. On board by end of first third.
6	Poor documentation	Vague test results; missing signoffs	Owner assigned at Level 0. Single platform. Weekly review.
7	Weak IST communication	Chaos during integrated tests	Test lead. Comms protocol. Command center. Stop-work authority clear.
8	Training the wrong people, too late	Operators meet building at training	Operators by name. On project two months early. In equipment rooms.
9	Ignoring unresolved deficiencies	Log fills; closures unverified	Closure = verified by CxA, not "someone said fixed."
10	Confusing substantial with operational	Calls in first week of occupancy	Substantial is a date. Goal is operational readiness.

The Unifying Insight

Every failure on this list is a planning and leadership failure that shows up technically. Fix the planning and leadership and the technical failures stop happening.

Commissioning is the disciplined act of proving the promise. It takes the building from installed to operational, from operational to integrated, and from integrated to trusted.