CONTROL PLAN TRAINING

HYSTER-YALE
MATERIALS HANDLING

TRAINING OBJECTIVE

1. Understand purpose & benefits of a Control Plan
2. Learn types of Control Plans (Prototype, Pre-launch, Production)
3. Understand key elements of a Control Plan
4. Learn linkage between PFMEA, Process Flow & Control Plan
5. Learn how to define Measurement & Reaction Plans
6. Understand how to maintain & update Control Plans

WHAT IS A CONTROL PLAN & ITS PURPOSES

WHAT IS A CONTROL PLAN?

A Control Plan is a written document that clearly describes how a product or process will be monitored and controlled during manufacturing.

It ensures that every critical step is performed correctly, consistently, and produces defect-free output.

A Control Plan is a Structured Sheet that Tells

- ✓ What to check
- ✓ How to check
- ✓ How often to check
- ✓ Which tool/gauge to use
- ✓ Who will check
- ✓ What actions to take if something goes wrong

Purpose of a Control Plan

A Control Plan ensures:

- ✓ Stable and predictable processes,
- ✓ Consistent product quality,
- ✓ Early detection of problems,
- ✓ Clear instructions for operators,
- ✓ Compliance with customer and regulatory requirements

WHY CONTROL PLAN FAILS

Poor Linkage to PFMEA

- CP controls are not aligned with high-risk failure modes
- AP 'H' or high-severity items are missing or weakly controlled
- CP treated as a standalone document, not as an output of PFMEA

Control Plan Not Reflecting Actual Process

- CP updated only for audits, not after process changes
- Shop floor practice differs from documented CP
- Operator unaware of CP requirements

Reaction Plans Are Weak or Missing

- Reaction plan says "inform supervisor" only. No Clear steps.
- No defined ownership or escalation

Controls Not Capable or Robust

- Measurement system not capable (poor GR&R, unstable gauges)
- Visual checks without clear acceptance criteria
- Manual controls where automation or poka-yoke is needed

Controls Are Detective Only

- Over-reliance on inspection instead of prevention
- No error-proofing or process prevention controls
- Issues detected after defect is created

Changes Not Managed

- Equipment, material, method changes not reflected in CP
- No formal link between change management and CP update
- Old risks continue unaddressed

Training Gaps

- Operators not trained on:
  - What to control
  - Why it is critical
  - What to do when out of control
- CP exists on paper, not in behavior

Treated as a Compliance Document

- Created to "pass audit"
- Not used for daily process control
- No continuous improvement mindset

TYPES OF CONTROL PLAN

The AIAG Control Plan manufacturing is structured into three types, depending on the product phase. Each one has a specific purpose and control level.

PROTOTYPE CONTROL PLAN

Definition: A Prototype Control Plan is used during the early product development stage to control and evaluate prototype parts before the design is finalized.

PURPOSE

- To verify design concepts.
- To check if the part meets initial functional requirements.
- To identify early design or feasibility issues.

CHARACTERISTICS

- Simple and not very detailed.
- Performed mostly by engineering.
- Focus is on design verification, not production stability.

WHEN IT IS USED

- During engineering builds
- During concept validation
- Before production tools and machines are finalized

CONTROLS INCLUDED

- Basic dimensional checks
- Preliminary material/property checks
- Engineering measurements taken manually
- Temporary or flexible inspection methods

PRELAUNCH CONTROL PLAN

Definition: A Pre-Launch Control Plan is used during the late development / early production readiness stage to control and evaluate parts produced with production-intent tooling, processes, and equipment before full-scale production begins.

✅ PURPOSE

- Validate production-intent parts and builds.
- Confirm preliminary process capability levels.
- Identify issues before final plan release.
- Ensure smooth development-to-production transition.

⭐ CHARACTERISTICS

- Uses production-intent tools and processes.
- Verifies process repeatability and capability.
- Applies robust measurement and inspection.
- Used jointly by engineering and manufacturing.

📌 WHEN IT IS USED

- During pilot builds (e.g., PPAP, PV builds)After production tools are available.
- When validating manufacturing processes and operator-based variation.
- Before SOP (Start of Production)

💡 CONTROLS INCLUDED

- Dimensional checks with production-intent gauges.
- Material and property validation to specs.
- Initial Cp/Cpk and PFMEA verification.
- Early audits and standardized work confirmation.

PRODUCTION CONTROL PLAN

Definition: A Production Control Plan is the final, comprehensive control document used during mass production to ensure stable, capable, and repeatable manufacturing processes that consistently produce parts meeting all customer requirements.

✅ PURPOSE

- Ensure processes are stable and repeatable.
- Maintain consistent quality in mass production.
- Detect and prevent defects continuously.
- Link all controls to PFMEA and work instructions.
- Meet all customer-specific requirements.

⭐ CHARACTERISTICS

- Most detailed, fully finalized control plan.
- Uses final production equipment and parameters.
- Focus on SPC, capability, error-proofing.
- Integrates lessons from earlier control plans.
- Strong reaction plans for any issues.

📌 WHEN IT IS USED

- Used during mass production and SOP.
- After full validation and capability approval.
- During audits and continuous-improvement activities.
- When updating controls for changes/issues.

💡 CONTROLS INCLUDED

- Full dimensional checks with production gaging.
- SPC and special-characteristic controls.
- Error-proofing with clear reaction plans.
- Packaging, labeling, and traceability controls.
- Meets all customer-specific requirements.

CONTROL PLAN FORMAT

Part/ Process Number	Process Name or Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Special Char. Class	Methods						Reaction Plan
			No	Product	Process		Product/Process Specification/ Tolerance	Evaluation Measurement Technique	Sample		Control Method	Responsibility	
									Size	Freq.			
1	2	3	4	5	6	7	8	9	10		11	12	13

Supplier Name: XY2 Industrial Plastics	Control Plan # 4563214		Supplier Code: 6096
Part Name: Reinvorcement Seat	Plan Level: Proto Pre-Launch Production x		Plan Prepared By: John Doe

Core Team Members:

Truck Series	HYG Part No. / Revision #	Supplier Part No.
787 T	2	4563214

CODE	REACTION PLAN
1	Mark and separate parts from normal production
2	100% control (parts from production / storage / supplier / customer)
3	Rework if possible and additional control after rework
4	Scrap the parts out of spec.
5	Inform supervisor or quality department

Control Plan Revision Level

REV	DATE	BY	COMMENT

Approvals: *Signature* *Date*

Production Engineering Mgr.:

Production Mgr.:

Quality Mgr.:

Customer Reviewed / Approved: (When Applicable)

DETAILS - PART /PROCESS NUMBER

What it means: A numbering system that shows the sequence of operations in the manufacturing process.

WHY IT IS IMPORTANT

- Shows correct sequence of operations.
- Aligns PFD, PFMEA, and Control Plan.
- Helps auditors trace operations easily.
- Aids quick root-cause identification.
- Ensures consistent execution across shifts.

BEST PRACTICES

- Keep numbering consistent across documents.
- Leave gaps (OP10, OP20…) for additions.
- Match OP numbers to shop-floor sequence.
- Update documents after any process change.
- Link OP numbers with Work Instructions (WI).

Part/ Process Number	Process Name or Operation Description	Machine, Device, Jig, Tools for Mfg
OP 10	CNC Turning – OD Machining	CNC Lathe, Chuck, Cutting Tool, Coolant System
OP 20	CNC Turning – Critical Bore	CNC Lathe + Boring Tool

DETAILS - PROCESS NAME/OPERATION DESCRIPTION

What it means: A clear, brief statement describing the specific activity performed at each process step.

WHY IT IS IMPORTANT

- Gives clear understanding of each operation.
- Ensures correct and consistent process flow.
- Aligns with PFMEA controls and risks.
- Helps auditors verify shop-floor practices.

BEST PRACTICES

- Use simple, clear operation wording.
- Match descriptions with PFMEA and WI.
- Mention tools/stations only when needed.
- Keep wording consistent across documents.

Part/ Process Number	Process Name or Operation Description	Machine, Device, Jig, Tools for Mfg
OP 10	CNC Turning – OD Machining	CNC Lathe, Chuck, Cutting Tool, Coolant System
OP 20	CNC Turning – Critical Bore	CNC Lathe + Boring Tool

Examples: Receiving Inspection, CNC Turning.

DETAILS - MACHINES, DEVICES, JIGS & TOOLS

What it means: Equipment and tooling required to perform a manufacturing operation consistently, safely, and accurately.

WHY IT IS IMPORTANT

- Ensures accurate and repeatable production.
- Reduces operator variability and errors.
- Improves safety and process reliability.
- Enables correct part orientation and clamping.
- Maintains consistent cycle time and output.

BEST PRACTICES

- Use validated & calibrated equipment.
- Follow correct setup/changeover steps.
- Maintain tools/jigs with periodic checks.
- Replace worn tools before quality drops.
- Document settings in WI/Control Plan.

Part/ Process Number	Process Name or Operation Description	Machine, Device, Jig, Tools for Mfg
OP 10	CNC Turning – OD Machining	CNC Lathe, Chuck, Cutting Tool, Coolant System
OP 20	CNC Turning – Critical Bore	CNC Lathe + Boring Tool

Examples: CNC Lathe, Drilling Machine.

DETAILS - PRODUCT CHARACTERISTICS

What it means: Specific drawing-based features of the part that must be measured and controlled to meet customer design requirements.

WHY IT IS IMPORTANT

- Ensures dimensional & geometric accuracy.
- Impacts fit, form, and function.
- Essential for PPAP and capability studies.
- Identifies critical/special characteristics.
- Supports consistent part quality.

BEST PRACTICES

- Copy characteristics exactly from drawing.
- Highlight critical/safety characteristics.
- Use correct gauges and fixtures.
- Align characteristics with PFMEA & CP.

Characteristics			Special Char. Class
No	Product	Process	
1	Outside Diameter-OD		Yes
		Cutting Speed	

Examples: Length, Width, Tensile Strength, Surface Finish.

DETAILS - PROCESS CHARACTERISTICS

What it means: Key process parameters that must be controlled during manufacturing to keep the process stable and capable.

WHY IT IS IMPORTANT

- Maintains stability within limits.
- Prevents variability, improves quality.
- Supports PFMEA detection controls.
- Identifies early signs of drift.

BEST PRACTICES

- Use measurable process parameters.
- Define based on capability.
- Verify settings each shift.
- Update parameters as needed.
- Use SPC to track variation.

Characteristics			Special Char. Class
No	Product	Process	
1	Outside Diameter-OD		Yes
		Cutting Speed	

DETAILS - SPECIAL CHARACTERISTICS

What it means: Features of the product or process that have high impact on safety, function, performance, or regulatory compliance, and therefore require stricter control.

WHY IT IS IMPORTANT

- Ensures tighter control for high-risk features.
- Helps define correct inspection frequency.
- Prevents defects affecting safety or function
- Guides operators to focus on critical points
- Supports customer/OEM special-characteristic requirements

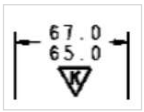
BEST PRACTICES

- Classify based on PFMEA severity & impact.
- Apply stricter controls (SPC, Poka-Yoke, 100% checks)
- Train operators on special-characteristic handling
- Review classification after ECN or design changes
- Ensure symbols match customer drawing requirements

HYMH specify Key characteristics on their drawing.
Marked by symbol: ⧩

Examples:

1.



2.

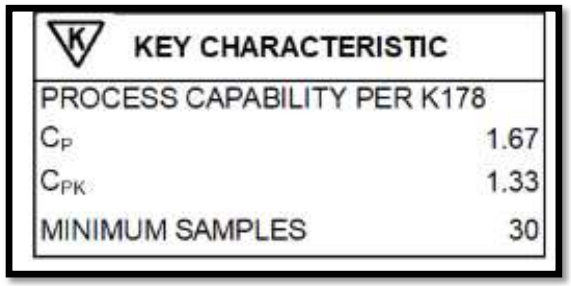
3.

DETAILS - SPECIAL CHARACTERISTICS

SPECIAL CHARACTERISTICS

KEY Characteristics on HYG Drawings

1. HYG specify Key characteristics on their drawing. Marked by symbol. 
   Specification for the process capability of key characteristic might be added on HYMH drawing for the robust control. Example below:



2. CTQ identified by SQE team: Must be reflected in supplier control plan. Same controls are expected for the CTQ parameters also as per the Key Characteristics.

DETAILS – PRODUCT SPECIFICATION

What it means: Technical and performance requirements the product must meet, including material, strength, coating, functional behavior, and customer standards.

WHY IT IS IMPORTANT

- Ensures product meets functional requirements.
- Defines material, grade, hardness, finish.
- Ensures compliance with customer standards
- Identifies features needing testing or validation
- Maintains consistent performance across batches

BEST PRACTICES

- Classify based on PFMEA severity & impact.
- Apply stricter controls (SPC, Poka-Yoke, 100% checks)
- Train operators on special-characteristic handling
- Review classification after ECN or design changes
- Ensure symbols match customer drawing requirements

Characteristics			Special Char. Class	Methods
No	Product	Process		Product/Process Specification/ Tolerance
1	Outside Diameter-OD		Yes	Ø30.00 ± 0.10 mm
		Cutting Speed		1200-1380 RPM

DETAILS – PROCESS SPECIFICATION

What it means: Required operating conditions or technical limits that define how the process must be run to meet product requirements.

WHY IT IS IMPORTANT

- Defines approved operating limits.
- Ensures processes follow validated settings.
- Prevents defects from incorrect conditions.
- Supports validation and PPAP readiness.
- Keeps process performance consistent

BEST PRACTICES

- Document key parameters (speed, temp, torque).
- Match specs with WI, DOE, validation data.
- Include min–max limits, not just targets.
- Verify specs after setup or changeover.
- Update after ECN, tooling, or process changes

Examples: Torque setting: 12–14 Nm, Cutting speed: 1200–1400 rpm.

Characteristics			Special Char. Class	Methods
No	Product	Process		Product/Process Specification/ Tolerance
1	Outside Diameter-OD		Yes	Ø30.00 ± 0.10 mm
		Cutting Speed		**1200-1400 RPM**

DETAILS – EVALUATION MEASUREMENT TECHNIQUE

What it means: The method or tool used to check, measure, or verify a product or process characteristic.

WHY IT IS IMPORTANT

- Ensures consistent and accurate measurement.
- Standardizes how each characteristic is checked.
- Reduces variation between inspectors/techniques.
- Confirms method matches Control Plan & MSA.
- Ensures method is capable and repeatable

BEST PRACTICES

- Use clear, defined methods (Vernier, CMM, Gauges).
- Mention exact gauge/tool name and ID.
- Match technique with WI and MSA results.
- Use visual checks only with defined standards.
- Train operators for uniform, repeatable measurement

Methods					
Product/Process Specification/ Tolerance	**Evaluation Measurement Technique**	**Sample**		**Control Method**	**Responsibility**
		Size	**Freq.**		
Ø30.00 ± 0.10 mm	**Vernier Caliper (ID: G-001)**	1 Pc	Every Hour	SPC Chart + Patrol Inspection	Operator / Inspector
1200-1380 RPM	**Digital Tachometer**	3 Nos	Per shift	1st piece & Patrol Inspection	Inspector

Examples: Vernier Caliper (0.01 mm), CMM, Visual Inspection.

DETAILS – SAMPLE SIZE & FREQUENCY

What it means: Defines how many parts must be checked and how often the inspection must be performed during production.

WHY IT IS IMPORTANT

- Detects process variation early.
- Maintains consistent quality across shifts.
- Reduces risk of defective parts escaping.
- Supports SPC and capability monitoring.
- Ensures inspection is systematic and controlled.

BEST PRACTICES

- Set frequency based on PFMEA severity.
- Use higher sampling for critical features.
- Keep sampling consistent across operators.
- Adjust frequency after changes or feedback.
- Document sampling clearly in Control Plan & WI

Examples: 5 pieces per shift – for non-critical characteristics, 100% inspection – for safety or customer-critical features.

Methods					
Product/Process Specification/ Tolerance	**Evaluation Measurement Technique**	**Sample**		**Control Method**	**Responsibility**
		Size	**Freq.**		
Ø30.00 ± 0.10 mm	**Vernier Caliper (ID: G-001)**	1 Pc	Every Hour	SPC Chart + Patrol Inspection	Operator / Inspector
1200-1380 RPM	**Digital Tachometer**	3 Nos	Per shift	1st piece & Patrol Inspection	Inspector

DETAILS – CONTROL METHOD

What it means: The technique or approach used to monitor, control, or prevent variation in a process or product characteristic.

WHY IT IS IMPORTANT

- Keeps process within defined limits.
- Detects issues before defects occur.
- Maintains repeatability and consistency.
- Ensures PFMEA control strategy is followed.
- Guides operators on correct monitoring steps

BEST PRACTICES

- Use Poka-Yoke, SPC, Gauges, Auto-checks.
- Match method with PFMEA & Control Plan.
- Prefer preventive controls over inspection.
- Train operators on proper control use.
- Review methods after changes or feedback

Examples: SPC charting for critical dimensions, Poka-Yoke/error-proofing.

Methods					
Product/Process Specification/ Tolerance	**Evaluation Measurement Technique**	**Sample**		**Control Method**	**Responsibility**
		Size	**Freq.**		
Ø30.00 ± 0.10 mm	**Vernier Caliper (ID: G-001)**	1 Pc	Every Hour	**SPC Chart + Patrol Inspection**	Operator / Inspector
1200-1380 RPM	**Digital Tachometer**	3 Nos	Per shift	**1st piece & Patrol Inspection**	Inspector

DETAILS – RESPONSIBILITY

What it means: Defines who is accountable for performing the measurement, inspection, or control activity.

WHY IT IS IMPORTANT

- Clarifies who performs each step.
- Avoids role confusion on shop floor.
- Maintains accountability in audits.
- Ensures proper skills and competency.
- Keeps controls consistent across shifts

BEST PRACTICES

- Use roles, not individual names.
- Align responsibilities with WI & training.
- Ensure persons are trained/authorized.
- Update roles after process or org changes.
- Involve Quality team for critical features

Examples: Operator: In-process inspection using gauges, Quality Inspector: Patrol/Final inspection. Supervisor: Verification of control adherence, Maintenance: Control of machine parameters.

Methods					
Product/Process Specification/ Tolerance	**Evaluation Measurement Technique**	**Sample**		**Control Method**	**Responsibility**
		Size	**Freq.**		
Ø30.00 ± 0.10 mm	**Vernier Caliper (ID: G-001)**	1 Pc	Every Hour	**SPC Chart + Patrol Inspection**	**Operator / Inspector**
1200-1380 RPM	**Digital Tachometer**	3 Nos	Per shift	**1st piece & Patrol Inspection**	**Inspector**

DETAILS – REACTION PLAN

What it means: A defined set of immediate actions to be taken when a product or process result is out of specification, out of control, or abnormal. It tells the operator what to do, whom to inform, and how to contain defects.

WHY IT IS IMPORTANT

- Prevents defects from reaching next process.
- Enables quick containment of out-of-spec parts.
- Maintains process stability by reacting early.
- Ensures consistent response across all shifts.
- Required for audits to show control

BEST PRACTICES

- Clearly define actions: stop, segregate, re-inspect.
- Specify required checks or quarantine duration.
- Record abnormal event and corrective action.
- Update plan after gauge, process, or method changes

Examples: Stop the process immediately when reading is out of spec; Inform Supervisor, Re-Inspect.

Methods						Reaction Plan
Product/ Process Specification/ Tolerance	Evaluation Measurement Technique	Sample		Control Method	Responsibility	
		Size	Freq.			
Ø30.00 ± 0.10 mm	Vernier Caliper (ID: G-001)	1 Pc	Every Hour	SPC Chart + Patrol Inspection	Operator / Inspector	1.Stop machine, 2.Segregate last 1 -hour parts, 3.Inform QE
1200-1380 RPM	Digital Tachometer	3 Nos	Per shift	1st piece & Patrol Inspection	Inspector	1. Stop Machine 2. Inform Prod MGR

DETAILS – REACTION PLAN

RULES FOR THE REACTION PLAN

- Purpose of Reaction Plan:
  - Defines immediate and structured response when a control is ineffective
  - Ensures risk is contained, not just reported
- When Reaction Plans Are Required:
  - Mandatory for High Severity, Special Characteristics, and AP ‘H’
  - Required wherever failure leads to customer, safety, or compliance impact
- What a Good Reaction Plan Must Include:
  - Trigger condition: when the reaction plan must be activated
  - Immediate containment: stop process, isolate product, prevent escape
  - Clear responsibility: who takes action (operator / supervisor / quality)
  - Corrective actions: restore control and address root cause.
  - Escalation path: when and how management is informed
- Execution & Effectiveness:
  - Must be clear, practical, and executable on the shop floor
  - Operators must be trained and aware of actions.
  - Reaction effectiveness should be reviewed and improved if recurrence occurs

LINKAGE BETWEEN PFD-PFMEA-CP

These 3 APQP documents must connect and support each other. They are interlinked with each other.

WHY IT IS IMPORTANT

- Ensures the same process steps appear in all 3 documents.
- Helps identify risks (PFMEA) and define controls (Control Plan) for each step.
- Prevents mismatches that lead to audit findings.
- Makes sure that actual process flow = documented process flow.
- Builds a strong foundation for stable and predictable production.

ACTUAL PURPOSE

- PFD → Shows the sequence of operations.
- PFMEA → Shows failure modes, causes, risks at each operation.
- Control Plan → Defines controls and checks to prevent the risks identified in PFMEA.

Conclusion:
PFD tells WHAT happens → PFMEA tells WHAT can go wrong → Control Plan tells HOW to control it.

LINKAGE BETWEEN PFD-PFMEA-CP

Mandatory PFMEA–CP Rules

1. Every high-risk PFMEA item must be controlled
All high Severity and AP ‘H’ failure modes shall have a corresponding control in the Control Plan.

2. Control Plan is derived from PFMEA
Prevention and Detection controls defined in PFMEA must be directly reflected in the Control Plan.

3. No Control = PFMEA is ineffective
If a PFMEA risk is not addressed in the Control Plan, the PFMEA is considered incomplete or weak.

4. Controls must match risk intent-
High-severity risks require robust controls (prevention preferred, detection justified).
Visual or informal checks are not acceptable for AP ‘H’.

5. Reaction Plans are mandatory-
Each PFMEA-linked control must include a clear, actionable reaction plan in the CP.

If it’s critical in PFMEA, it must be controlled in the C

DOCUMENT CONTROL & REVISION HANDLING

Purpose: Managing, updating, and controlling the Control Plan so that only the latest, approved version is used on the shop floor.

WHEN TO UPDATE THE CONTROL PLAN

- Change in process, machine, tooling, layout, or sequence
- Drawing / customer spec change (ECN/ECR)
- Quality issues → complaints, rejections, audit findings
- Addition of special characteristics
- Change in material or supplier

WHY IT IS IMPORTANT

- Prevents use of outdated documents
- Maintains alignment across APQP documents
- Ensures all shifts follow the same approved controls
- Required for audit compliance

HOW REVISIONS MUST BE MANAGED

- Assign new revision number + date + change description
- Review/approve via Quality, Manufacturing, Engineering
- Remove old versions from all workstations
- Update related documents: PFD, PFMEA, WI, Check Sheets
- Ensure operators are trained on the updated version

CONTROL PLAN EXAMPLE

Part/ Process Number	Process Name or Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Special Char. Class	Methods						Reaction Plan
			No	Product	Process		Product/Process Specification/ Tolerance	Evaluation Measurement Technique	Sample		Control Method	Responsibility	
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OP 10	CNC Turning – OD Machining	CNC Lathe, Chuck, Cutting Tool, Coolant System	1	Outside Diameter-OD		Yes	Ø30.00 ± 0.10 mm	Vernier Caliper (ID: G-001)	1 Pc	Every Hour	SPC Chart + Patrol Inspection	Operator / Inspector	1.Stop machine, 2.Segregate last 1 -hour parts, 3.Inform QE
					Cutting Speed		1200-1380 RPM	Digital Tachometer	3 Nos	Per shift	1st piece & Patrol Inspection	Inspector	1. Stop Machine 2. Inform Prod MGR
OP 20	CNC Turning – Critical Bore	CNC Lathe + Boring Tool	2	Bore			Ø10.00 ± 0.05 mm	Bore Gauge (BG-05)	100%	Continue	In-Process Gauge	Operator	1.Stop machine, 2.Inform QE

THANK YOU

HYSTER-YALE
MATERIALS HANDLING