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Bottle Defect Diagnostic Manual

Every blow-moulding output defect — symptom, likely cause, first action, diagnosis, remediation and prevention — for converters running Delta El Nile preforms on the stretch-blow line.

Generated **2026-06-27** from Delta's live defect database · 33 defects · Delta El Nile for Industry

Use this manual to diagnose defects in bottles blown from Delta El Nile preforms. Each defect lists the symptom, the most likely causes (most probable first), the first action to take, how to diagnose which cause applies, how to remediate it on the line, and how to prevent recurrence. Generated from the same defect database as the on-site defect advisor.

Quick reference — all defects

WALL — CLARITY, THICKNESS, INTEGRITY

- Pearlescence / white haze in body
- Uneven wall thickness — body has thin and thick zones
- Pinholes / micro-perforations in wall
- Stress cracking — visible white lines / star cracks
- Thin spots in specific zones (often shoulder or label panel)

BASE — CRYSTALLINITY, PUSHBACK, CRACKING

- Crystallization at heel / base (whitish opaque)
- Base pushback / inverted base under fill
- Base haze / chevron whitening
- Base diamond / petaloid distortion
- Base cracking under fill or transport

BODY — SHRINKAGE, OVALITY, PANEL COLLAPSE

- Body shrinks / deforms after demold
- Body panel / shoulder collapse (vacuum panel)
- Body out-of-round (ovality)
- Visible gate / parting line marks on body
- Bottle warping / distorted shape after blowing

NECK — THREAD, SUPPORT-RING, SEALING SURFACE

- Neck deformation / out-of-round neck
- Neck burn marks / browning
- Incomplete or damaged threads
- Support ring damage / chipping

COSMETIC

- Color drift / off-tint across production
- Black specks / gels in wall
- Sink marks / surface depressions in thick sections
- Uneven gloss / matte patches on body

PROCESS & OPERATIONAL ISSUES

- Cycle time creeping above target
- Inconsistent bottle weight or wall thickness across cavities
- Mold contamination / surface deposits
- Preform jam / handling failure in oven
- Resin dryer dewpoint above -40°C

PRESSURE

- Burst under 1-bar pressure test (CSD)
- Burst during blow molding (catastrophic)
- Bottle creep deformation in warm storage
- Top-load / pancake failure in pallet stack
- Leak under neck / weep at finish

Wall — clarity, thickness, integrity 5

MAJOR

Pearlescence / white haze in body

Body wall shows pearly white shimmer or milky haze, particularly visible against dark backgrounds. The bottle is structurally intact but loses optical clarity. Typically appears uniformly across body or in stretched zones.

LIKELY CAUSES

- Preform body undercooled — insufficient orientation during stretch
- Stretch rod velocity too high — material did not orient before main blow
- Pre-blow pressure too low — bottle did not pre-stretch enough
- Lamp output decayed (typical at >2000 hours)

FIRST ACTION

Increase preform body temperature by 2-3°C and rerun a 30-bottle sample.

DIAGNOSE

- Inspect last 30 bottles: is pearlescence uniform, or localized to specific zones?
- Check lamp hours log — lamps >2000 hr typically lose 15-25% output
- Measure preform surface temperature at oven exit with IR pyrometer
- If localized to one cavity, the issue is cavity-specific (lamp or valve)

FIX

- Step 1: Increase lamp power in middle zones by 5-10%, hold one cycle to stabilize
- Step 2: If still pearlescent, reduce stretch rod velocity by 0.1 m/s
- Step 3: Check oven exit temperature with IR pyrometer; should be in target range for application
- Step 4: Verify neck cooling water flow — overcooling neck can radiate down into body

PREVENT

- Track lamp hours in plant log; replace at 2000 hr threshold
- Verify oven exit temp daily via IR pyrometer
- Calibrate pre-blow valves quarterly

Sources: AMI Plastics PET Blow Molding Reference §4.2 · Petcore Technical Brief 2020

MAJOR Uneven wall thickness — body has thin and thick zones

Wall thickness varies by more than ±15% across the body when measured around the circumference or top-to-bottom. Cross-section shows clearly asymmetric distribution. Causes top-load and burst failures.

LIKELY CAUSES

- Asymmetric heating across preform — one side hotter than other
- Lamp output uneven (some lamps decayed)
- Preform off-center in oven — closer to lamps on one side
- Pre-blow valve flow rate uneven

FIRST ACTION

Measure 4-point wall thickness on 10 sample bottles, identify pattern (front-back, top-bottom, around circumference).

DIAGNOSE

- Cut bottle horizontally at body midpoint; measure wall at 0°, 90°, 180°, 270°
- Tabulate by cavity number to see if pattern is cavity-specific or systemic
- Inspect preform feeding orientation in oven
- Check pre-blow valve flow rates with manometer per cavity

FIX

- Step 1: Replace all lamps showing >15% output deviation
- Step 2: Re-center preform feeding rails so preforms stay axisymmetric in oven
- Step 3: Balance pre-blow flow per cavity using flow valves
- Step 4: Inspect mold for parallel alignment; correct if off

PREVENT

- Weekly 4-point wall thickness audit on each cavity
- Monthly lamp output measurement and replacement schedule
- Calibrate pre-blow valves quarterly

Sources: AMI Plastics §3.5 · Petcore CSD Wall Distribution Study 2022

CRITICAL Pinholes / micro-perforations in wall

Visible or invisible micro-holes in the bottle wall that cause slow leaks. Often only detected after fill or in leak tester. Concentrated in thin wall zones, particularly the base radius or shoulder.

LIKELY CAUSES

- Localized over-stretching at thin wall point (wall < critical thickness)
- Preform contamination (dust, foreign particle blown through)
- Resin pellet quality issue — gels or unmelted fragments
- Mold surface damage causing weakness initiation

FIRST ACTION

Run 100% leak-test on current production lot; segregate suspect lot.

DIAGNOSE

- Backlight a sample bottle and rotate slowly to spot pinholes
- Inspect resin pellets under magnification for contamination
- Check preform inlet feeding for stray particles
- Run mold surface inspection — look for pits, scratches, deposits

FIX

- Step 1: Stop production; do not ship lot until cause identified
- Step 2: Switch to a fresh resin lot if contamination suspected
- Step 3: Increase wall thickness target by raising preform weight 1-2 g
- Step 4: Inspect and polish mold surface if surface damage found

PREVENT

- Daily resin dewpoint check before production start
- Weekly preform inlet cleanout
- Quarterly mold surface inspection and polish

Sources: Petcore Pinhole Defect Study 2021 · AMI §6.3

CRITICAL Stress cracking — visible white lines / star cracks

White lines, stars, or fissures appearing in the bottle wall — typically in the base radius, shoulder, or stress concentration points. May appear immediately or develop over days/weeks. Bottle weakens progressively until burst.

LIKELY CAUSES

- Residual stress in molded bottle (cooled too fast, insufficient relaxation)
- Bottle exposed to chemical environment (cleaning agent, ozone)
- Excessive top-load in stacking
- Geometric stress concentration in mold (sharp radius)

FIRST ACTION

Identify if cracks appear on the line or develop later; segregate suspect lot.

DIAGNOSE

- Map crack location on 20 bottles — pattern should reveal cause
- Check if cracks appear immediately after demold or hours/days later
- Test bottle in target storage environment (heat, chemicals)
- Inspect mold for sharp radii or stress-concentration features

FIX

- Step 1: Reduce mold cooling rate by raising mold temp 2-3°C
- Step 2: Reduce demolding pressure differential
- Step 3: Check storage/transport for chemical exposure
- Step 4: If geometric, request mold review from Delta engineering

PREVENT

- Verify mold temperature stable at target each shift
- Test bottle in target storage environment before approving new programs

Sources: Petcore Environmental Stress Cracking Brief 2022

MAJOR

Thin spots in specific zones (often shoulder or label panel)

Wall thinner than target in a specific zone, typically the shoulder transition or where the label panel begins. Other zones may be normal thickness. Top-load failure risk increases.

LIKELY CAUSES

- Preform under-heated in that zone — material did not flow enough during stretch
- Pre-blow pressure too low — bottle did not pre-stretch all zones evenly
- Mold cooling overcooled that zone during blow (PET locked in early)

FIRST ACTION

Identify which zone is thin via cross-section, then adjust the corresponding lamp zone power.

DIAGNOSE

- Cut bottle vertically; measure wall thickness at 1-cm intervals from neck to base
- Identify the lamp zone heating the preform corresponding to the thin region
- Verify pre-blow timing — should activate before thin region fully stretches

FIX

- Step 1: Increase lamp zone power 5-10% in the affected zone
- Step 2: Increase pre-blow pressure 1-2 bar
- Step 3: Verify mold cooling channels in affected zone — over-cooled mold locks PET early

PREVENT

- Periodic full-bottle wall scan during PVT (production validation test)

Sources: AMI Plastics §3.5

Base — crystallinity, pushback, cracking 5

CRITICAL

Crystallization at heel / base (whitish opaque)

White, opaque, brittle region at the heel or base. Material has converted from amorphous to semi-crystalline PET, losing transparency and impact strength. Affected zones are typically brittle and may crack under shock.

LIKELY CAUSES

- Preform too hot at bottom — extended dwell above 100°C crystallized PET
- Oven exposure too long for preform mass
- Bottom lamp zones over-powered
- Preform jammed in oven during cycle (localized overheating)

FIRST ACTION

Reduce bottom-zone lamp power by 5-10%, check next cycle.

DIAGNOSE

- Tap the crystallized region — if it cracks easily, confirmed crystallization
- Cross-section the bottle and inspect for milky-white versus clear PET
- Check oven jam alarms log for the previous shift
- Compare base temperature reading on preform IR pyrometer with target

FIX

- Step 1: Reduce bottom lamp zone power by 5%; if still crystallized, by another 5%
- Step 2: Increase line speed to reduce oven dwell time (if cavity output allows)
- Step 3: Verify oven cooling fans operating — hot oven environment lingers heat
- Step 4: Check preform handling — preforms that stop in oven (jams) overheat locally

PREVENT

- Install or verify oven-jam detection sensor
- Set oven max-dwell alarm (kicks preform when exceeded)
- Plant SOP: any oven jam triggers stop + cool + restart, not just resume

Sources: AMI Plastics §5.1 · Sidel SBO Operations Manual

CRITICAL Base pushback / inverted base under fill

Base of the bottle inverts (pops upward) when filled, typically after capping. Bottle no longer stands stably. Common with insufficient base material distribution.

LIKELY CAUSES

- Pre-blow pressure too low — bottom did not push out fully against mold base
- Stretch rod velocity too low — material reached base too late
- Preform body too hot — material distributed too easily, leaving base thin
- Mold base cooling insufficient

FIRST ACTION

Increase pre-blow pressure by 1-2 bar.

DIAGNOSE

- Measure base wall thickness — should be ≥0.25 mm for water, ≥0.35 mm for CSD
- Check stretch rod position at end of stroke (should fully contact preform bottom)
- Inspect mold base for damage / deposits / coolant flow
- Test in target fill conditions (temperature affects PET creep)

FIX

- Step 1: Increase pre-blow pressure by 1 bar; verify pre-blow timing not delayed
- Step 2: Increase stretch rod velocity by 0.1 m/s
- Step 3: If issue persists, reduce middle-zone body temperature by 1-2°C (more material reaches base)
- Step 4: Inspect mold base for damage / deposits

PREVENT

- Daily base thickness check on first 10 bottles after start
- Weekly inspection of mold base surface and coolant flow

Sources: Sidel SBO §7.4 · AMI §4.6

MINOR Base haze / chevron whitening

White chevron or radial pattern visible at the bottle base. Material is structurally fine but visually cosmetic-defective. Customer brands often reject for shelf appearance.

LIKELY CAUSES

- Cold base — material did not orient enough during stretch
- Resin grade not optimized for base whitening (some PET grades whiten more)
- Stretch rod tip too cold (cools center first)

FIRST ACTION

Increase bottom-zone lamp power by 3-5%.

DIAGNOSE

- Photograph base under standard lighting; document chevron pattern
- Compare to baseline acceptable samples
- Verify resin lot is the qualified grade for this program

FIX

- Step 1: Increase bottom lamp zone 3-5%
- Step 2: Reduce stretch rod velocity by 0.05-0.1 m/s
- Step 3: If resin-grade related, request grade swap from Delta supply

PREVENT

- Document acceptable base appearance baseline at program start
- Include base photo in QA daily checklist

Sources: Petcore Base Aesthetics 2021

MAJOR Base diamond / petaloid distortion

Petaloid base does not form symmetric diamonds — some petals are deeper, some shallower, or twisted. Bottle stability and pressure rating compromised.

LIKELY CAUSES

- Preform centered incorrectly in mold (off-axis stretching)
- Stretch rod alignment off
- Base mold halves not parallel
- Pre-blow asymmetric across cavity

FIRST ACTION

Inspect preform centering and stretch rod alignment.

DIAGNOSE

- Photograph base from underneath on 10 bottles per cavity
- Measure diamond depth at each petal
- Verify stretch rod runout < 0.1 mm
- Check mold parallel alignment with dial indicator

FIX

- Step 1: Re-align stretch rod centerline with mold centerline
- Step 2: Balance pre-blow flow per cavity
- Step 3: Adjust mold base alignment

PREVENT

- Stretch rod alignment check at every shift change

Sources: AMI §4.7

CRITICAL Base cracking under fill or transport

Cracks appear in the base radius after filling or during transport. Bottle leaks immediately or develops slow leak. Catastrophic failure mode.

LIKELY CAUSES

- Base wall too thin — insufficient material at heel
- Base crystallization (brittle PET cracks under shock)
- Stress concentration at base radius (mold geometry)
- Excessive top-load

FIRST ACTION

STOP production; segregate lot. Measure base wall thickness.

DIAGNOSE

- Cross-section 10 bottles at base; measure heel wall thickness
- Inspect for crystallization (white opaque region)
- Check mold base for sharp radii or surface damage

FIX

- Step 1: Stop production
- Step 2: Increase pre-blow pressure to redistribute material toward base
- Step 3: If crystallization, reduce bottom-zone heating
- Step 4: Engineering review if recurrent — mold geometry may need radius increase

PREVENT

- PVT (production validation test): drop test 1m on hard surface
- Daily base wall measurement during first hour of production

Sources: Petcore Base Crack Study 2022

Body — shrinkage, ovality, panel collapse 5

MAJOR Body shrinks / deforms after demold

Bottle leaves the mold visually OK, but shrinks or distorts within seconds to minutes — typically losing 1-3% of OD as PET contracts. Final bottle is undersized vs target.

LIKELY CAUSES

- Mold cooling insufficient — bottle demolded while still partially plastic
- Demold time too short for cycle
- Mold temperature set too high

FIRST ACTION

Increase mold cooling water flow; lengthen blow cycle by 0.2 s.

DIAGNOSE

- Measure bottle OD immediately after demold, then again 5 minutes later
- Verify mold inlet/outlet coolant temperature delta < 3°C
- Check mold coolant flow with manometer

FIX

- Step 1: Reduce mold inlet coolant temp by 2-3°C
- Step 2: Increase coolant flow rate
- Step 3: Lengthen blow cycle 0.2 s to allow more cooling

PREVENT

- Monitor mold inlet/outlet temp delta continuously; alarm if > 3°C

Sources: AMI §6.1

CRITICAL Body panel / shoulder collapse (vacuum panel)

Side of the bottle or shoulder collapses inward, often when the contents cool (creating vacuum) or under thermal stress. Visible concave region; bottle no longer cylindrical.

LIKELY CAUSES

- Wall too thin to resist internal vacuum (hot-fill scenario)
- Geometry has insufficient vacuum panels for hot-fill
- Hot-fill temperature too high for resin grade
- Bottle stored above design temperature

FIRST ACTION

Verify product is using hot-fill-rated preform; if water/CSD preform used for hot-fill, swap immediately.

DIAGNOSE

- Confirm bottle application matches preform design (water preforms cannot hot-fill)
- Measure fill temperature at capping
- Inspect bottle geometry for vacuum panels (chamfered sections)

FIX

- Step 1: Switch to hot-fill-rated preform (heavier, thicker wall)
- Step 2: Reduce fill temperature to <85°C if using ambient PET
- Step 3: Engineering review for vacuum-panel geometry redesign

PREVENT

- Match preform application to fill protocol; never substitute water for hot-fill
- Verify hot-fill temperature at fill line continuously

Sources: Petcore Hot-Fill Brief 2021

MAJOR

Body out-of-round (ovality)

Bottle cross-section is oval rather than circular. Roll test fails. Labeling problems on automatic labeler.

LIKELY CAUSES

- Mold halves not aligned
- Preform off-axis in mold
- Asymmetric heating
- Mold ejection forces uneven

FIRST ACTION

Roll bottle on flat surface; ovality is visible if it does not roll smoothly.

DIAGNOSE

- Measure OD at 0° and 90° on 10 bottles per cavity
- Calculate ovality = (max OD - min OD) / max OD
- Should be <1% for acceptable

FIX

- Step 1: Re-align mold halves
- Step 2: Verify preform feeding centering
- Step 3: Balance lamps to equalize heating

PREVENT

- Roll test on QA hourly samples
- Mold alignment check at startup

Sources: AMI §3.6

MINOR

Visible gate / parting line marks on body

Mold parting line visible as a raised seam on the body, sometimes with flash (excess material). Cosmetic defect; doesn't affect function.

LIKELY CAUSES

- Mold halves not fully closed during blow
- Mold worn at parting line
- Pre-blow pressure too high (forces seam visibility)

FIRST ACTION

Inspect mold clamping force; should hold mold fully closed under blow pressure.

DIAGNOSE

- Look for raised seam line; check if it has flash (extra material) or just visible
- Measure mold clamping force at each cavity

FIX

- Step 1: Increase mold clamping force
- Step 2: Inspect mold parting surfaces for wear; refurbish if pitted
- Step 3: Reduce pre-blow pressure slightly

PREVENT

- Monthly mold parting surface inspection

Sources: AMI §5.4

MAJOR

Bottle warping / distorted shape after blowing

Bottle does not hold its intended shape — body bows, leans, or twists, or the bottle fails to stand straight. Distortion appears after the bottle leaves the mold, often worsening as it cools.

LIKELY CAUSES

- Bottle ejected too hot — insufficient cooling time in mold
- Mold cooling water temperature too high or uneven
- Uneven wall thickness causing asymmetric shrinkage
- Preform body temperature profile uneven across the oven

FIRST ACTION

Increase mold cooling time by 0.3-0.5s and rerun a 30-bottle sample.

DIAGNOSE

- Place 10 bottles on a flat surface — check for lean or rock
- Measure mold cooling water inlet and outlet temperature
- Check cooling time in the recipe against the SKU baseline
- Inspect wall thickness distribution — uneven walls shrink unevenly

FIX

- Step 1: Increase mold cooling time until bottles hold shape
- Step 2: Verify chilled-water temperature is within 7-12 C and flow is balanced
- Step 3: If wall distribution is uneven, address that defect first (it is the root cause)
- Step 4: Check oven lamp zones for uneven preform heating

PREVENT

- Maintain consistent chilled-water temperature and flow
- Verify cooling time whenever cycle time is reduced

Sources: AMI Plastics PET Blow Molding Reference 5.6 · Sidel SBO Operations Manual

Neck — thread, support-ring, sealing surface 4

CRITICAL Neck deformation / out-of-round neck

Neck no longer round, threads damaged, or neck dimensions out of tolerance. Cap fitting fails; bottle is unsealable.

LIKELY CAUSES

- Neck cooling insufficient — neck still soft when transferred
- Transfer gripping damaged
- Preform neck quality issue (Delta should be notified)
- Mold neck insert wear

FIRST ACTION

Measure neck ID and roundness with gauge; check transfer grip wear.

DIAGNOSE

- Use neck gauge ring to test 20 bottles
- Measure thread depth and pitch
- Inspect transfer chuck grippers for wear / contamination
- Confirm preform neck cooling water flow

FIX

- Step 1: Verify and improve neck cooling water flow
- Step 2: Inspect/replace transfer chuck grippers
- Step 3: If preform-quality issue, contact Delta engineering with photo + lot number

PREVENT

- Hourly neck gauge check on production line
- Weekly transfer chuck inspection

Sources: AMI §2.3 · Krones Neck Quality Guide

MINOR Neck burn marks / browning

Dark brown discoloration on the neck, often at the support ring or thread. PET has localized over-heating during preform IM or oven exposure.

LIKELY CAUSES

- Preform support ring exposed to oven heat (shielding failure)
- Lamp leak to neck area
- Preform from supplier already had marks (notify Delta if so)

FIRST ACTION

Inspect oven neck-shielding mechanism; should fully cover neck during heating.

DIAGNOSE

- Examine 10 bottles; pattern reveals oven vs preform origin
- Check oven neck-shield wear / contamination

FIX

- Step 1: Adjust or replace oven neck shielding
- Step 2: Verify lamp aim — should not project onto neck
- Step 3: If preform-origin, contact Delta with photo + lot

PREVENT

- Daily oven neck-shield inspection

Sources: AMI §2.4

CRITICAL Incomplete or damaged threads

Threads on the neck are partial, rough, or have flash. Cap does not seat properly, threading is rough, or torque is irregular.

LIKELY CAUSES

- Preform neck damaged in handling
- Mold neck insert worn or chipped
- Transfer chuck damaged threads

FIRST ACTION

STOP production. Inspect preform inlet for thread damage.

DIAGNOSE

- Inspect 30 preforms before they enter oven — look for thread defects
- Inspect mold neck insert with magnifier
- Check transfer chuck thread-engagement surface for wear

FIX

- Step 1: If preform-origin, contact Delta with photo + lot
- Step 2: Inspect/replace mold neck insert
- Step 3: Inspect/replace transfer chuck

PREVENT

- Inspection station before oven to catch damaged preforms
- Monthly mold neck insert inspection

Sources: AMI §2.3

MAJOR

Support ring damage / chipping

Support ring on the neck has visible chips, cracks, or rough surface. Risk of failure during transfer or capping.

LIKELY CAUSES

- Transfer chuck grippers damaged or worn
- Preform handling impact (jams, drops)
- Mold neck insert damage at support ring location

FIRST ACTION

Inspect transfer chuck for chip damage.

DIAGNOSE

- Examine 20 bottles at support ring with magnifier
- Check transfer chuck for wear / chip damage on gripper face

FIX

- Step 1: Replace damaged transfer chuck grippers
- Step 2: Inspect mold neck insert

PREVENT

- Weekly transfer chuck inspection

Sources: AMI §2.3

Cosmetic 4

MAJOR

Color drift / off-tint across production

Bottle color shifts between batches or shows different tint than approved sample. Critical for brand-customer programs.

LIKELY CAUSES

- Masterbatch ratio drift
- Different resin lot in current production
- Masterbatch contamination

FIRST ACTION

Compare current production to retained color sample; verify masterbatch ratio.

DIAGNOSE

- Visual comparison to approved color reference
- Verify masterbatch feed rate per cycle
- Check resin lot number and supplier certificate

FIX

- Step 1: Calibrate masterbatch dosing pump
- Step 2: Verify masterbatch lot quality
- Step 3: If resin lot specific, switch lots

PREVENT

- Color reference retained for each program
- Masterbatch dosing calibration weekly

Sources: Petcore Color Quality Brief

MAJOR

Black specks / gels in wall

Visible black or dark specks, or transparent gel-like inclusions in the bottle wall. Customer brand rejection.

LIKELY CAUSES

- Burnt PET from extruder hot spot
- Foreign material in resin (regrind contamination)
- Filter / screen damage
- Wet PET pellets (insufficient drying)

FIRST ACTION

Inspect dryer dewpoint; should be < -40°C.

DIAGNOSE

- Inspect resin pellets with magnifier
- Check dryer dewpoint reading
- Verify extruder screen / filter condition

FIX

- Step 1: Verify dryer dewpoint < -40°C; replace desiccant if needed
- Step 2: Switch to fresh resin lot
- Step 3: Inspect/replace extruder screens

PREVENT

- Daily dryer dewpoint check
- Quarterly extruder screen replacement

Sources: Petcore Gels Defect Brief 2020

MINOR Sink marks / surface depressions in thick sections

Localized shallow depressions or dimples on the bottle surface, typically near thicker sections such as the base or shoulder. The surface looks pulled inward. Cosmetic defect; visible under shelf lighting.

LIKELY CAUSES

- Thick wall section cools and contracts inward (material shrinkage)
- Insufficient blow pressure to hold the wall against the mold
- Preform section over-thick for the bottle geometry

FIRST ACTION

Increase main blow pressure by 1-2 bar and rerun a sample.

DIAGNOSE

- Identify where sink marks appear — usually at the thickest wall sections
- Measure wall thickness at the sink location vs surrounding area
- Check main blow pressure against the SKU baseline

FIX

- Step 1: Increase main blow pressure so the wall is held firmly against the mold
- Step 2: If marks persist, review preform selection — a thinner preform section may be needed
- Step 3: Increase mold cooling at the affected zone if available

PREVENT

- Match preform section thickness to the bottle geometry during SKU setup
- Verify main blow pressure at every recipe change

Sources: AMI Plastics PET Blow Molding Reference 5.7

MINOR Uneven gloss / matte patches on body

Body surface shows alternating glossy and matte patches. Cosmetic defect; visible under shelf lighting.

LIKELY CAUSES

- Mold surface contamination (oil, dust)
- Mold surface damage (scratches)
- Cooling water leak inside mold

FIRST ACTION

Inspect mold surface visually and tactilely.

DIAGNOSE

- Clean mold surface with appropriate solvent
- Inspect for scratches / pitting
- Check for coolant leaks

FIX

- Step 1: Clean mold surface thoroughly
- Step 2: Polish mold if surface damaged
- Step 3: Replace mold seals if leak detected

PREVENT

- Weekly mold surface inspection and cleaning

Sources: AMI §5.5

Process & operational issues 5

MAJOR Cycle time creeping above target

Average cycle time exceeds the recipe target, reducing output. May be gradual drift over days or sudden jump.

LIKELY CAUSES

- Lamp output decay requires longer dwell
- Cooling time stretched (mold or material)
- Preform handling delays
- Air pressure / volume insufficient

FIRST ACTION

Identify which phase is longer: heating, blowing, or cooling.

DIAGNOSE

- Review cycle-phase timing report
- Check lamp output (replace at end-of-life)
- Verify air compressor pressure

FIX

- Step 1: If heating phase, replace lamps and check oven exit temp
- Step 2: If cooling phase, verify mold cooling water flow
- Step 3: If air phase, verify compressor pressure and dryer

PREVENT

- Track cycle time trends; alarm when it drifts

Sources: Sidel SBO Operations

MAJOR

Inconsistent bottle weight or wall thickness across cavities

Bottles from different cavities have different weight, thickness, or quality. Production output variable.

LIKELY CAUSES

- Lamp output drift in some cavities (lamps end-of-life)
- Heating asymmetric across cavities
- Pre-blow valve timing inconsistent per cavity

FIRST ACTION

Map wall thickness or weight by cavity number to identify which cavity is drifting.

DIAGNOSE

- Sample 10 bottles per cavity; record weights and wall thicknesses
- Identify which cavities are out of range
- Inspect lamps for deviant cavities
- Verify pre-blow timing per cavity

FIX

- Step 1: Sample 10 bottles per cavity; record weights
- Step 2: Identify which cavities are out of range
- Step 3: For deviant cavities, check lamps (replace if >2000 hr) and pre-blow valve timing
- Step 4: Verify mold cooling water is balanced across cavities

PREVENT

- Weekly per-cavity weight check

Sources: Petcore Cavity Balance Brief 2022

MAJOR

Mold contamination / surface deposits

White or brown deposits on the mold surface, visible imprints on bottles, cycle quality degrading over time.

LIKELY CAUSES

- PET vapor outgassing (additive volatilization)
- Mold release contamination
- Cooling water hardness deposits

FIRST ACTION

Stop and clean mold surface with appropriate solvent.

DIAGNOSE

- Inspect mold surface with magnifier
- Sample deposit and identify chemistry

FIX

- Step 1: Clean mold thoroughly
- Step 2: Verify mold venting
- Step 3: Check cooling water hardness

PREVENT

- Weekly mold cleaning schedule
- Quarterly cooling water hardness test

Sources: AMI §5.6

CRITICAL

Preform jam / handling failure in oven

Preforms stop moving through the oven, jam at transfer, or arrive misoriented at the mold. Production stops.

LIKELY CAUSES

- Preform feeding rail damage / wear
- Preform-quality defect (deformation in feed)
- Sorter / orienter calibration drift

FIRST ACTION

STOP. Clear jam, inspect feeding system, restart.

DIAGNOSE

- Identify jam point — feeder, sorter, oven entry, transfer
- Inspect preforms in feed for damage
- Check sorter / orienter alignment

FIX

- Step 1: Clear jam and resume only after inspection
- Step 2: If preform-quality, contact Delta with sample + lot number
- Step 3: Calibrate sorter / orienter

PREVENT

- Pre-oven inspection station
- Operator SOP: any jam triggers cool-down before resume (prevents crystallization)

Sources: Sidel SBO Manual

CRITICAL Resin dryer dewpoint above -40°C

Dryer dewpoint reading above -40°C. PET pellets too wet. Results in hydrolysis during processing → gels, pinholes, weak bottles.

LIKELY CAUSES

- Desiccant saturated
- Dryer regeneration cycle failure
- Air leak in dryer
- Ambient humidity higher than dryer rated for

FIRST ACTION

STOP production. Wet PET causes downstream defects.

DIAGNOSE

- Check dryer dewpoint reading and trend
- Inspect desiccant beds for saturation
- Verify regeneration cycle running

FIX

- Step 1: STOP production until dryer recovered
- Step 2: Run dryer regeneration cycle
- Step 3: Replace desiccant if recurrent

PREVENT

- Continuous dewpoint alarm < -40°C
- Monthly desiccant inspection

Sources: Petcore Resin Drying Brief

pressure 5

CRITICAL Burst under 1-bar pressure test (CSD)

Bottle ruptures during pressure test or after filling with carbonated product. Most common rupture point is the base radius or wall thin spot.

LIKELY CAUSES

- Wall thickness insufficient for carbonation pressure
- Stress concentration at base radius
- Material defect (gel, contamination weakening wall)
- Wrong preform application (water preform used for CSD)

FIRST ACTION

Confirm preform application is CSD-rated; if any doubt, stop and verify SKU.

DIAGNOSE

- Verify preform SKU matches application; CSD requires CSD preform
- Measure wall thickness at rupture location
- Inspect bottle for gel inclusions
- Check pressure-test procedure parameters

FIX

- Step 1: Switch to higher-weight CSD preform if recurrent
- Step 2: Engineering review of base geometry if rupture is at base
- Step 3: Verify resin lot QA

PREVENT

- PVT must include burst-pressure test at 2× design pressure
- Hourly QA samples to burst-tester

Sources: Petcore CSD Pressure Test Standards

CRITICAL Burst during blow molding (catastrophic)

EMERGENCY: bottle bursts inside the mold during the blow cycle. Loud bang, potential operator hazard, mold contamination, downtime.

LIKELY CAUSES

- Preform body overheated — material lost strength before stretch
- Main blow pressure too high for preform thickness
- Stretch rod started before pre-blow built pressure
- Wrong preform SKU loaded

FIRST ACTION

EMERGENCY — stop production. Reduce body temp by 5°C and reduce main blow pressure by 5 bar.

DIAGNOSE

- Verify preform SKU loaded matches recipe
- Check temperature settings versus recipe
- Verify blow timing (pre-blow before main blow)

FIX

- Step 1: STOP production immediately for inspection
- Step 2: Reduce body temperature by 5°C; reduce main blow by 5 bar
- Step 3: Verify pre-blow timing — should always be active before main blow valve opens
- Step 4: Confirm preform is the correct SKU for this bottle (wrong preform = guaranteed burst)

PREVENT

- Operator SOP: SKU confirmation at recipe load
- Burst-detection sensor on every cavity

Sources: Sidel SBO Safety Manual

CRITICAL Bottle creep deformation in warm storage

Bottle deforms over hours or days in warehouse storage above 30°C. Most common in Gulf/MENA/Sub-Saharan climates. Bottle no longer cylindrical, pallets become unstable.

LIKELY CAUSES

- Wall too thin for climate creep resistance
- PET grade not optimized for hot-climate creep
- Warehouse temperature exceeds design assumption
- Stacking height exceeds design top-load

FIRST ACTION

Measure warehouse temperature; verify bottle is climate-rated for actual conditions.

DIAGNOSE

- Record warehouse temperature over 24 hours
- Top-load test at warehouse temperature
- Compare bottle wall vs climate-rated specification

FIX

- Step 1: Switch to climate-rated preform (heavier wall)
- Step 2: Engineering review of wall thickness for climate × distribution × stacking
- Step 3: Reduce pallet stack height
- Step 4: Climate-control warehouse if economically viable

PREVENT

- Use Delta's preform engineering advisor at /preform-engineering.html to size walls for climate
- Top-load test at expected storage temperature, not just ambient

Sources: Petcore Hot-Climate Brief 2021 · INDPACK Plastic Packaging Hot-Climate Study

CRITICAL Top-load / pancake failure in pallet stack

Bottom-layer bottles collapse vertically under stack weight. Pallet becomes unstable. Most common with multi-layer pallets and tall bottles.

LIKELY CAUSES

- Wall too thin for top-load
- Bottle geometry has weak point (panel design)
- Pallet stacked too high
- Bottle slightly empty / not full

FIRST ACTION

Verify pallet stacking spec; reduce stack height as immediate mitigation.

DIAGNOSE

- Measure top-load capacity in test press: should be ≥ stack force × safety factor
- Inspect bottle for vertical reinforcement features

FIX

- Step 1: Reduce pallet stacking layers (immediate)
- Step 2: Engineer heavier preform for higher top-load
- Step 3: Geometric redesign if recurrent (mold change)

PREVENT

- Top-load test at every QA sample
- Match preform weight to pallet stack design

Sources: ASTM D2659 Top-Load Test

CRITICAL Leak under neck / weep at finish

Liquid escapes from beneath the cap or at the threading region. Often slow leak rather than immediate burst.

LIKELY CAUSES

- Cap sealing surface not aligned
- Thread profile damaged
- Neck out-of-round (ovality)
- Cap-to-bottle torque insufficient

FIRST ACTION

Inspect cap torque calibration; verify cap is correct for bottle.

DIAGNOSE

- Verify cap torque per spec
- Check thread profile with magnifier
- Test neck for ovality with gauge ring

FIX

- Step 1: Calibrate cap torque
- Step 2: If thread damage, see neck_thread_incomplete
- Step 3: If ovality, see body_ovality

PREVENT

- Cap torque calibration daily
- Neck gauge ring check hourly

Sources: ASTM D5208 Cap Sealing

Appendix — Incoming QC Checklist

Minimum sampling at goods-in, against the Delta spec sheet for the ordered SKU. Reject and quarantine any lot outside tolerance and contact Delta with data + lot number under the quality guarantee.

CHECK	SAMPLE	ACCEPT
DIMENSIONAL		
Overall height & body diameter	10 / cavity / shift	Within drawing tolerance
Net weight	10 / cavity / shift	Within ±target g
Perpendicularity / lean	10 / shift	Stands upright; within spec
WALL		
4-point wall thickness (body)	5 / cavity	Even; ≥ minimum spec
Base clearance / standing	5 / cavity	Stable; no rocker / pushback
PERFORMANCE		
Top-load (axial)	5 / shift	Above target for stack height
Burst / pressure (CSD)	5 / shift	Above rated pressure
Leak / weep at finish	10 / shift	No leak under test
Thermal stability (hot-fill / warm store)	Per program	No creep / deform
VISUAL		
Clarity / pearlescence / haze	5 / cavity	Clear; no white haze
Colour vs reference; specks / gels	5 / shift	No visible difference / defect