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SAMPLE QUALITY CONTROL SOP

Automotive Brake Pad Manufacturing

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Plant Location:	Chennai, Tamil Nadu, India

1. OBJECTIVE

This SOP establishes standardized quality control procedures for automotive brake pad manufacturing to ensure consistent product quality, regulatory compliance, and customer satisfaction in accordance with IS 14772:2019 and IATF 16949 standards.

2. SCOPE

This procedure applies to all quality control activities from raw material inspection to final product dispatch for automotive brake pads manufactured at our Chennai facility.

3. RESPONSIBILITY

- [ ] **Quality Control Inspector:** Execute inspection procedures and document results
- [ ] **Quality Supervisor:** Review and approve inspection reports
- [ ] **Production Manager:** Coordinate with QC team for process improvements
- [ ] **Quality Manager:** Overall responsibility for QC system effectiveness

4. MATERIALS AND EQUIPMENT REQUIRED

Testing Equipment:

- [ ] Digital calipers (accuracy: ±0.01mm)
- [ ] Micrometers (accuracy: ±0.001mm)
- [ ] Hardness tester (Rockwell/Brinell)
- [ ] Surface roughness tester
- [ ] Friction coefficient testing machine
- [ ] Compressive strength testing machine
- [ ] Temperature measurement devices
- [ ] Go/No-Go gauges
- [ ] Digital weighing scale (accuracy: ±0.1g)

Documentation:

- [ ] Inspection checklists
- [ ] Test certificates
- [ ] Non-conformance reports
- [ ] Calibration records

5. DETAILED QC PROCEDURES

5.1 INCOMING MATERIAL INSPECTION

Frequency: Every batch (100% inspection for critical suppliers)

Parameters to Check:

- [ ] Visual appearance (color uniformity, surface defects)
- [ ] Dimensions: Length (±0.5mm), Width (±0.3mm), Thickness (±0.2mm)
- [ ] Hardness: 45-65 HRC as per specification
- [ ] Moisture content: <2% maximum
- [ ] Chemical composition verification (random sampling)

Procedure:

- [ ] Collect representative samples (minimum 5 pieces per batch)
- [ ] Conduct visual inspection for cracks, chips, or discoloration
- [ ] Measure dimensions using calibrated instruments
- [ ] Test hardness at 3 random points per sample
- [ ] Document all measurements in Form QC-001
- [ ] Accept/Reject based on specification limits

Acceptance Criteria:

- [ ] All dimensions within specified tolerance
- [ ] No visual defects affecting functionality
- [ ] Hardness values within range
- [ ] Supplier certificate matches test results

5.1.2 Metal Backing Plate Inspection

Frequency: Every batch

Parameters to Check:

- [ ] Material grade: IS 2062 Grade B or equivalent
- [ ] Thickness: 4.5mm ±0.1mm
- [ ] Surface finish: Ra 3.2 µm maximum
- [ ] Dimensional accuracy as per drawing
- [ ] Coating thickness (if applicable): 10-15 microns

Procedure:

- [ ] Verify material certificate from supplier
- [ ] Check dimensions using go/no-go gauges
- [ ] Measure coating thickness using coating thickness gauge
- [ ] Inspect for rust, scratches, or deformation
- [ ] Record findings in Form QC-002

5.2 IN-PROCESS QUALITY CONTROL

5.2.1 Mixing Process Control

Frequency: Every batch
Control Parameters:

- [ ] Mixing time: 15 minutes ±30 seconds
- [ ] Temperature: 80–90°C
- [ ] Moisture content of mix: <1.5%
- [ ] Homogeneity test: Visual and tactile inspection

Procedure:

- [ ] Monitor mixing time using digital timer
- [ ] Check temperature every 5 minutes using calibrated thermometer
- [ ] Take sample for moisture content analysis
- [ ] Conduct visual homogeneity check
- [ ] Document in Process Control Chart QC-003

5.2.2 Molding Process Control

Frequency: Every 50 pieces or hourly (whichever is earlier)
Control Parameters:

- [ ] Molding pressure: 150 ±10 kg/cm^2
- [ ] Temperature: 160 ±5°C
- [ ] Curing time: 8 ±0.5 minutes
- [ ] Demolding temperature: <80°C

Procedure:

- [ ] Verify machine parameters before each batch
- [ ] Check first piece dimensions and approve
- [ ] Monitor process parameters continuously
- [ ] Conduct dimensional check every 25 pieces
- [ ] Record data in Process Control Sheet QC-004

5.3 FINAL PRODUCT INSPECTION

5.3.1 Dimensional Inspection

Frequency: E 100% inspection for first 10 pieces, then 10% random sampling

Critical Dimensions:

- [ ] Overall length: 156.0 ±0.5mm
- [ ] Overall width: 63.2 ±0.3mm
- [ ] Thickness: 17.0 ±0.5mm
- [ ] Friction material thickness: 12.0 ±0.3mm
- [ ] Backing plate thickness: 4.5 ±0.1mm

Procedure:

- [ ] Use calibrated measuring instruments
- [ ] Measure at specified points as per drawing
- [ ] Check parallelism and flatness
- [ ] Verify hole positions and diameters
- [ ] Document in Final Inspection Report QC-005

5.3.2 Performance Testing

Frequency: 5 pieces per batch of 1000 pieces

Tests Required:

- [ ] Friction coefficient test (μ): 0.35–0.45 at 250°C
- [ ] Wear rate test: <2.5 mm^3/MJ
- [ ] Compressive strength: >200 MPa
- [ ] Thermal stability: No delamination up to 350°C

Procedure:

- [ ] Conduct tests as per IS 14772:2019 standard
- [ ] Use certified testing laboratory if in-house facility unavailable
- [ ] Maintain test sample traceability
- [ ] Generate test certificate for each batch
- [ ] File test reports in QC-006 format

5.3.3 Visual and Surface Quality Inspection

Frequency: 100% visual inspection

Inspection Points:

- [ ] Surface finish of friction material
- [ ] Bond strength between friction material and backing plate
- [ ] Edge quality and chamfer uniformity
- [ ] Color consistency
- [ ] Absence of cracks, chips, or foreign materials

Procedure:

- [ ] Inspect under adequate lighting (minimum 500 lux)
- [ ] Check for delamination by gentle hand pressure
- [ ] Verify edge finishing and chamfer dimensions
- [ ] Look for contamination or foreign particles
- [ ] Mark pass/fail status on each piece

5.4 PACKAGING & DISPATCH INSPECTION

5.4.1 Packaging Quality Control

Parameters:

- [ ] Correct part numbers and batch codes
- [ ] Appropriate packaging materials
- [ ] Moisture protection (desiccant packets)
- [ ] Handling instructions and labels

Procedure:

- [ ] Verify part number matching with production order
- [ ] Check packaging integrity and cleanliness
- [ ] Ensure proper cushioning and protection
- [ ] Verify label accuracy and placement
- [ ] Document in Dispatch Inspection Sheet QC-007

6. NON-CONFORMANCE HANDLING

6.1 Identification and Segregation

- [ ] Mark non-conforming products with red tags
- [ ] Segregate in designated quarantine area
- [ ] Fill Non-Conformance Report (NCR) form QC-008
- [ ] Notify production and quality management immediately

6.2 Root Cause Analysis

- [ ] Investigate cause within 24 hours
- [ ] Categorize: Material, Process, Method, or Equipment related
- [ ] Document findings and corrective actions
- [ ] Update process parameters if required

6.3 Disposition

- [ ] **Rework:** If feasible and cost-effective
- [ ] **Use-as-is:** With customer approval and deviation permit
- [ ] **Scrap:** If cannot meet minimum safety requirements
- [ ] **Return to supplier:** For incoming material defects

7. DOCUMENTATION AND RECORD KEEPING

7.1 Required Records

- [ ] Daily inspection reports
- [ ] Test certificates and calibration records
- [ ] Non-conformance reports and corrective actions
- [ ] Customer complaint logs and resolution
- [ ] Supplier quality performance data

7.2 Record Retention

- [ ] Quality records: 7 years minimum
- [ ] Calibration certificates: Until next calibration + 2 years
- [ ] Customer complaints: 10 years
- [ ] Test reports: 5 years

8. CALIBRATION MANAGEMENT

8.1 Calibration Schedule

- [ ] Measuring instruments: Every 6 months
- [ ] Testing equipment: As per manufacturer recommendation
- [ ] Go/No-Go gauges: Annual verification
- [ ] Environmental monitoring devices: Quarterly

8.2 Calibration Procedure

- [ ] Use NABL accredited calibration laboratory
- [ ] Maintain calibration certificates and labels
- [ ] Check calibration status before each use
- [ ] Remove expired instruments from production floor

9. CONTINUOUS IMPROVEMENT

9.1 Quality Metrics

- [ ] First Pass Yield (Target: >98%)
- [ ] Customer complaint rate (Target: <10 PPM)
- [ ] Supplier quality rating (Target: >95%)
- [ ] Cost of Quality (Target: <2% of sales)

9.2 Review and Updates

- [ ] Monthly quality review meetings
- [ ] Quarterly SOP effectiveness review
- [ ] Annual customer satisfaction survey
- [ ] Continuous training and competency development

10. REGULATORY COMPLIANCE

10.1 Indian Standards

- [ ] **IS 14772:2019:** Automotive brake linings and pads
- [ ] **IS/ISO 9001:2015:** Quality management systems
- [ ] **Bureau of Indian Standards (BIS):** Product certification

10.2 International Standards

- [ ] IATF 16949: Automotive quality management
- [ ] FMVSS 571.105: US Federal Motor Vehicle Safety Standards
- [ ] ECE R90: European brake pad regulations

11. TRAINING REQUIREMENTS

11.1 Initial Training

- [ ] 40-hour quality control fundamentals
- [ ] Product-specific knowledge training
- [ ] Measurement and testing procedures
- [ ] Documentation and record keeping

11.2 Ongoing Training

- [ ] Annual refresher training (16 hours)
- [ ] New standard updates and changes
- [ ] Equipment operation and maintenance
- [ ] Root cause analysis techniques

12. EMERGENCY PROCEDURES

12.1 Product Recall

- [ ] Stop production immediately
- [ ] Quarantine suspected batches
- [ ] Notify quality manager and top management
- [ ] Investigate and document root cause
- [ ] Implement corrective and preventive actions

12.2 Critical Non-Conformance

- [ ] Immediate escalation to quality manager
- [ ] Customer notification within 4 hours
- [ ] Containment actions implementation
- [ ] Detailed investigation and reporting

DOCUMENT REVISION HISTORY

Version	Date	Changes Made	Approved By
1.0	Jan 2024	Initial release	Quality Manager
2.0	Jun 2024	Added thermal testing requirements	Quality Manager
2.1	Sep 2025	Updated calibration frequencies	Quality Manager