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Plastic / Nylon Tube Bending – Design Guidelines & Material Reference

For Automotive & Industrial Applications

Role	Name / Position
Document Title	Plastic / Nylon Tube Bending – Design Guidelines & Material Reference
Prepared By	QMS Coordinator
Approved By	QMS Head

Unit 1 :	Unit 2 :
Gat No. 100 Behind Zunka Hotel, Jyotibanagar Talawade, Pune 412114	GatNo.669 and 670, Industrial Estate, Wadacha mala, Jadhavwadi, Chikhali, Pune 411062

RAY PRECICOMP
Lightweight. Leak-Proof. EV-Ready.

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1. Scope

This document provides design guidance and material reference information for plastic and nylon tubes used in automotive and industrial applications.
It is intended to support early-stage design, routing definition, and bend feasibility assessment.

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2. Applicable Tube Sizes & Constructions

Outer Diameter Range: Ø 4 mm to Ø 25 mm
Wall Thickness Range: 0.5 mm to 3.0 mm
(depending on OD, construction, and application)

Tube Constructions

- Monolayer
- Multilayer (application dependent)

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3. Material Options & Application Suitability

Commonly processed materials include:

- PA12 / PA11
- PA6 / PA66
- PA612
- PP
- PE
- TPV

Special material capabilities

- High-temperature monolayer tubes up to 180–200°C (material & application dependent)
- Multilayer (MLT) structures suitable for E10 to E100 fuel compatibility
- 100% bio-based solutions available for fuel and air applications, in both monolayer and multilayer constructions

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4. General Bending Capability Overview

- CNC hot-bending process with controlled heating and cooling
- Typical minimum included bend angle per bend: ≥ 80°
- Continuous and multi-bend geometries supported, subject to design compliance
- Coil and straight-length tubes supported depending on size and geometry

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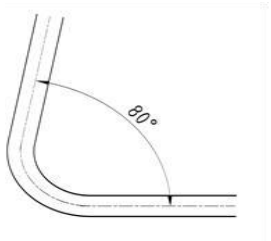
5. Bend Geometry & Straight Length Reference (KEY DESIGN SECTION)

The table below provides reference values for minimum bend radius and minimum straight length between consecutive bends, applicable for monolayer nylon tubes.
Reference basis:

– Approx. 1.0 mm wall thickness
– Minimum included bend angle ≥ 80°
– Tangent-to-tangent measurement between bends



Final feasibility depends on material grade, wall thickness, bend sequence, and application.

Bend Radius & Straight Length Reference Table

Tube OD (mm)	Construction	Min. Bend Radius (mm)	Min. Straight Length Between Bends (mm)	Available Wall Thickness (mm)
6	Monolayer	20	25	0.5 – 2.0
7	Monolayer	25	30	0.5 – 2.0
8	Monolayer	25	30	0.5 – 2.0
9	Monolayer	30	35	0.5 – 2.5
10	Monolayer	35	40	0.5 – 2.5
11	Monolayer	40	40	0.5 – 2.5
12	Monolayer	40	40	1.0 – 3.0
13	Monolayer	50	45	1.0 – 3.0
14	Monolayer	45	45	1.0 – 3.0
15	Monolayer	60	50	1.0 – 3.0
16	Monolayer	60	50	1.0 – 3.0
17	Monolayer	75	55	1.0 – 3.0
18	Monolayer	80	55	1.0 – 3.0
20	Monolayer	100	60	1.0 – 3.0
21	Monolayer	120	65	1.0 – 3.0
24	Monolayer	150	70	1.0 – 3.0
25	Monolayer	175	75	1.0 – 3.0
6–10	Multilayer	Design dependent	Design dependent	1.0 – 2.0
12–18	Multilayer	Design dependent	Design dependent	1.0 – 2.0

Design Notes

- Minimum straight length is measured between tangent points of two consecutive bends
- Tighter radii or reduced straight lengths may be possible depending on:
  - Increased wall thickness
  - Optimized bend sequence
  - Reduced bend angle
  - Material grade
- Multilayer tubes must be reviewed case-by-case
- Closely stacked or reverse bends should be shared early for feasibility confirmation

6. Section Quality & Functional Considerations

- Typical post-bend roundness**: ≥ 85–95%**
- Thin-wall and large-diameter tubes are more sensitive to:
  - Ovality
  - Local wall thinning
  - Surface appearance variation

Design Recommendation

- Avoid locating sealing features, connectors, grooves, or clips within bend zones
- Maintain functional features outside straight sections wherever possible

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7. Design Best Practices

- Maintain uniform wall thickness through bend regions
- Avoid abrupt changes in bend direction
- Share 3D CAD data early for complex or space-constrained routing
- Clearly flag function-critical dimensions during RFQ and design freeze stages

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8. Important Note

This document serves as a design guideline and reference.

Final feasibility depends on part geometry, material selection, and application requirements.

Early technical discussion is strongly recommended for:

- Tight bend radii
- Closely spaced bends
- Multilayer constructions
- Critical functional zones
