# TOASTY RUGGED FLASHLIGHT

## DESIGN CONCEPT & ASSEMBLY DOCUMENTATION

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| **PROJECT** | **TOASTY FLASHLIGHT - DESIGN CONCEPT** |
| **DRAWING NUMBER** | **TF-001-ASSY-001** |
| **REVISION** | **A** |
| **DATE** | **2026-09-23** |
| **ENGINEER** | **AI MECHANICAL ENGINEER** |
| **APPROVED BY** | **CUSTOMER REVIEW** |
| **SCALE** | **1:1 (MODEL SCALED FOR VISIBILITY)** |
| **UNITS** | **METRIC (mm)** |

## DESIGN REQUIREMENTS SUMMARY

| Requirement | Specification |
|---|---|
| Materials | Lightweight, corrosion-resistant (Aluminum 6061-T6 or equivalent) |
| Water Resistance | IP68 rated, fully sealed against water ingress |
| Batteries | Two 18650 series, field replaceable with gloves, no tools required |
| Operating Temperature | -20°C to +40°C, no overheating |

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|---|---|
| Switch Operation | Glove-operable tactile switch |
| Grip Feature | Integrated knurled grip pattern on body |
| Belt Clip | Interchangeable metal belt clip with secure retention |
| Overall Dimensions | Approx. 150mm length x 30mm diameter |
| Weight Target | < 200g (excluding batteries) |

# BILL OF MATERIALS (BOM)

| Item | Part Number | Description | Material | Qty | Notes |
|---|---|---|---|---|---|
| 1 | TF-BODY-001 | Main Body Tube | Aluminum 6061-T6 | 1 | Anodized black, knurled grip |
| 2 | TF-HEAD-001 | LED Head Assembly | Aluminum 6061-T6 | 1 | Includes thermal management |
| 3 | TF-TAIL-001 | Tail Cap Assembly | Aluminum 6061-T6 | 1 | Glove-operable switch |
| 4 | TF-BATT-001 | Battery Compartment | Stainless Steel 316 | 1 | Spring-loaded contacts |
| 5 | TF-CLIP-001 | Metal Belt Clip | Stainless Steel 316 | 1 | Interchangeable mounting |
| 6 | TF-SEAL-001 | O-Ring Set | Silicone Rubber | 3 | IP68 sealing |
| 7 | TF-LENS-001 | Optical Lens | Tempered Glass | 1 | Anti-reflective coating |
| 8 | TF-SWITCH-001 | Tactile Switch | Engineering Plastic | 1 | Glove-compatible actuator |

# ASSEMBLY INSTRUCTIONS

1. Install O-rings (TF-SEAL-001) on main body tube (TF-BODY-001) at designated grooves
2. Insert battery compartment (TF-BATT-001) into main body tube
3. Attach LED head assembly (TF-HEAD-001) to main body, ensuring proper thread engagement
4. Install optical lens (TF-LENS-001) in LED head assembly with retaining ring
5. Connect electrical contacts between head assembly and battery compartment
6. Install tactile switch (TF-SWITCH-001) in tail cap assembly (TF-TAIL-001)
7. Attach tail cap assembly to main body tube
8. Mount metal belt clip (TF-CLIP-001) to designated slot on main body
9. Perform water resistance test (IP68) and functional verification
10. Final quality inspection and packaging

# EXPLODED VIEW DESCRIPTION

The exploded view shows all components separated along the longitudinal axis to illustrate assembly relationships and component interfaces. Key Features: • Main body tube features external knurling for enhanced grip • Threaded interfaces between head, body, and tail cap for secure assembly • O-ring grooves at all mating surfaces for IP68 water resistance • Battery compartment designed for tool-free access with gloved hands • Interchangeable belt clip with positive retention mechanism • Thermal management integrated into LED head assembly • Glove-compatible switch actuator with tactile feedback All threaded interfaces use standard metric threads with appropriate tolerances for reliable assembly and disassembly in field conditions.

# MANUFACTURING NOTES

CNC MACHINING SPECIFICATIONS: • All aluminum components to be machined from solid bar stock • Surface finish: Ra 1.6 μm maximum on critical sealing surfaces • Thread tolerances: 6g/6H for external/internal threads • Anodizing: Type II, 25μm minimum thickness, black dye • Knurling: Diamond pattern, 0.8mm pitch, 0.3mm depth • Dimensional tolerances: ±0.1mm for critical dimensions • Angular tolerances: ±0.5° for critical angles MATERIAL SPECIFICATIONS: • Aluminum 6061-T6: ASTM B221 compliant • Stainless Steel 316: ASTM A276 compliant • Silicone O-rings: Durometer 70 Shore A, temperature range -50°C to +200°C • Tempered glass lens: 4mm thickness, anti-reflective coating QUALITY CONTROL: • 100% dimensional inspection of critical features • Leak testing at 2m depth for 30 minutes (IP68 verification) • Functional testing of all switches and electrical connections • Drop testing from 1.5m height onto concrete (6 orientations)