Henkel

Henkel Adhesive Technologies

SHAPING THE **FORM, FUNCTION,** AND **FUTURE** OF **HUMANOID ROBOTICS**

Henkel Electronics Materials and Application Solutions



AI GENERATED

Humanoid robots bring together advanced electronics, intelligent sensing, actuation, thermal management, and complex material interfaces within a highly integrated platform.

As the industry evolves from prototype development to real-world deployment, material technologies play an increasingly important role in enabling performance, reliability, manufacturability, user experience, and lifecycle serviceability.

Through co-innovation and future-ready collaboration, Henkel helps customers address critical material challenges across key humanoid robotics applications.

Developed around real application challenges observed across humanoid robot OEMs, subsystem suppliers, and emerging robotics ecosystems.

Co-Innovation
Partnering with customers to solve emerging challenges in humanoid robotics, from concept exploration to commercial deployment.

Technology Platforms
Enabling robotic perception, interaction, mobility, reliability, and thermal performance through a broad portfolio of material technologies.

Application Engineering
Helping customers accelerate development through material expertise, process optimization, testing, simulation, and reliability validation.

Emerging Technology Priorities

- Embodied AI and edge computing
- Dexterous manipulation
- Human-centered interaction
- Lightweight and compact architectures
- Reliability and serviceability
- Scalable manufacturing



01 PERCEPTION, INTERACTION & MANIPULATION

- Perception & vision systems assembly
- Electronic skin & tactile sensing
- Dexterous hand assembly

02 HUMAN-CENTERED ROBOTICS

- Skin-friendly materials
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05 BONDING FOR CHALLENGING MATERIALS

- Low surface energy & engineering materials

06 LIFECYCLE SERVICEABILITY

- Serviceable bonding & debonding

From intelligent sensing and assembly to thermal management and lifecycle serviceability, Henkel supports the next generation of autonomous humanoid robotics with materials designed for real-world deployment.

PERCEPTION & VISION SYSTEMS ASSEMBLY

Supporting reliable perception through precision assembly, electronics integration, protection, and thermal management.

Perception systems provide humanoid robots with the ability to understand and respond to their surrounding environment.

By combining vision sensors, depth sensing technologies, AI-enabled processing platforms, and advanced electronics, modern humanoid robots can support navigation, object recognition, spatial awareness, and human-machine interaction.

As perception systems become increasingly distributed throughout the robot, material technologies play an essential role in enabling miniaturization, integration, reliability, and long-term operational performance.



Vision Systems

Supporting precision alignment and reliable fixation of lenses and optical components.

APPLICATIONS

- Active alignment
- Lens bonding/lens attach
- Lens barrel bonding/lens holder bonding
- Bracket fill
- Housing assembly/voice coil motor (VCM) assembly

Semiconductor Packaging

Supporting advanced sensor packaging and miniaturized electronic assemblies.

APPLICATIONS

- Die attach pastes
- Non-conductive die attach films

Electronics Protection & Interconnection

Supporting long-term performance and reliability of distributed perception systems.

APPLICATIONS

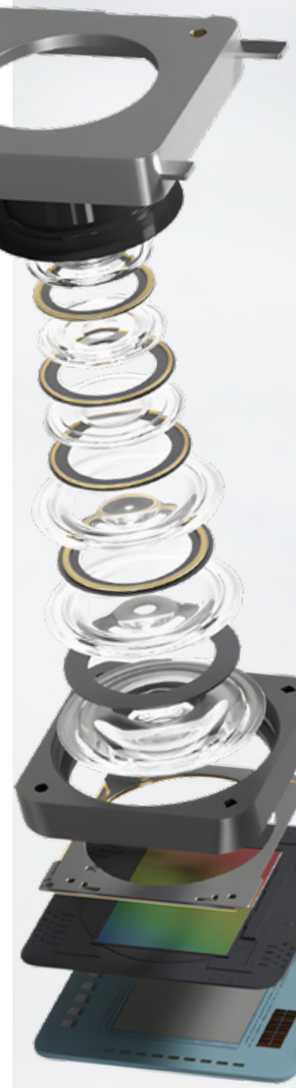
- Flexible printed circuit (FPC) reinforcement
- Underfills
- Electrically conductive adhesives (ECA)
- Grounding & electromagnetic interference (EMI) shielding

Thermal Management

Managing heat generation from high-performance image and sensing systems.

APPLICATIONS

- Thermal interface materials



ELECTRONIC SKIN & TACTILE SENSING

Advancing tactile sensing and intelligent interaction through printed electronics materials and application expertise.

Future humanoid robots will increasingly rely on touch, force feedback, and surface awareness to complement vision-based perception.

Electronic skin technologies enable robots to sense and interpret physical interactions with people, objects, and their surroundings, supporting safer operation, more natural interaction, and higher levels of embodied intelligence.

At the material level, tactile sensing and signal transmission form the foundation of next-generation electronic skin architectures.



TACTILE SENSING

Pressure-Sensitive Carbon Inks 1

Pressure-sensitive sensing layers represent a core technology for electronic skin applications.

By converting physical pressure into measurable electrical signals through controlled resistance changes, pressure-sensitive carbon inks enable robots to detect touch, perceive force, and interpret contact conditions.

These capabilities form the foundation of intelligent tactile sensing and support higher levels of embodied intelligence through real-time physical interaction awareness.

KEY REQUIREMENTS

- Responsive to varying pressure levels
- Accurate pressure distribution measurement
- Stable sensing performance
- Compatibility with scalable printed electronics manufacturing processes

SIGNAL TRANSMISSION

Stretchable Silver Inks 2

Reliable signal transmission is essential for maintaining sensing accuracy across continuously deforming electronic skin systems.

Stretchable silver inks enable conductive pathways on flexible and stretchable substrates, supporting highly conformable sensor architectures while preserving electrical performance under mechanical strain.

KEY REQUIREMENTS

- High electrical conductivity
- Excellent stretchability
- High signal sensitivity
- Broad substrate compatibility
- Support for both 2D and 3D manufacturing approaches



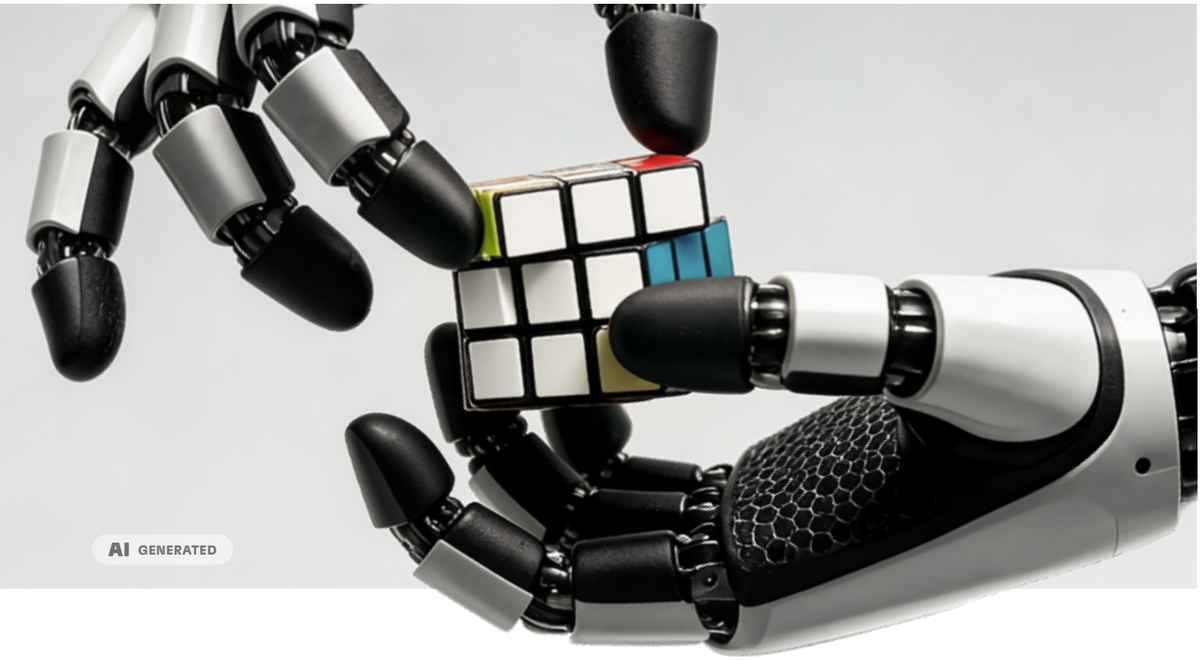
DEXTEROUS HAND ASSEMBLY

Supporting the development of dexterous hand systems through material technologies designed for precision, durability, and reliability.

Dexterous hands are a key enabler of manipulation in humanoid robotics, allowing robots to grasp, handle, and interact with objects in unstructured environments.

As robots evolve from performing predefined tasks to operating in dynamic real-world settings, dexterous hands increasingly require the integration of compact actuation, tactile sensing, advanced materials, and high-cycle mechanical systems.

Material technologies play a critical role in enabling performance, durability, and operational reliability throughout the entire manipulation system.



MECHANICAL ASSEMBLY

Dexterous hands combine diverse materials, compact mechanical architectures, and high-cycle motion systems, creating demanding bonding requirements for strength, durability, and dimensional stability.

Palm Assembly 1

KEY REQUIREMENTS

- Bonding of low-surface-energy materials such as silicone rubber
- High bond strength capable of supporting demanding gripping applications with payloads of up to 20 kg
- Reduced whitening for improved aesthetics
- Reliable performance under repetitive gripping and motion cycles

Motor-to-Bracket Bonding 2

KEY REQUIREMENTS

- Bonding between electric motors and engineering plastics such as PEEK
- Low cure shrinkage and thin bondline control
- Excellent vibration and impact resistance
- Supports operating lifetimes of up to one million motion cycles

Tendon Fixation 3

KEY REQUIREMENTS

- Bonding of polyethylene tendons to aluminum or PEEK anchor structures
- Excellent penetration into fiber bundles
- High toughness for high-cycle motion applications
- Outstanding flex-fatigue resistance

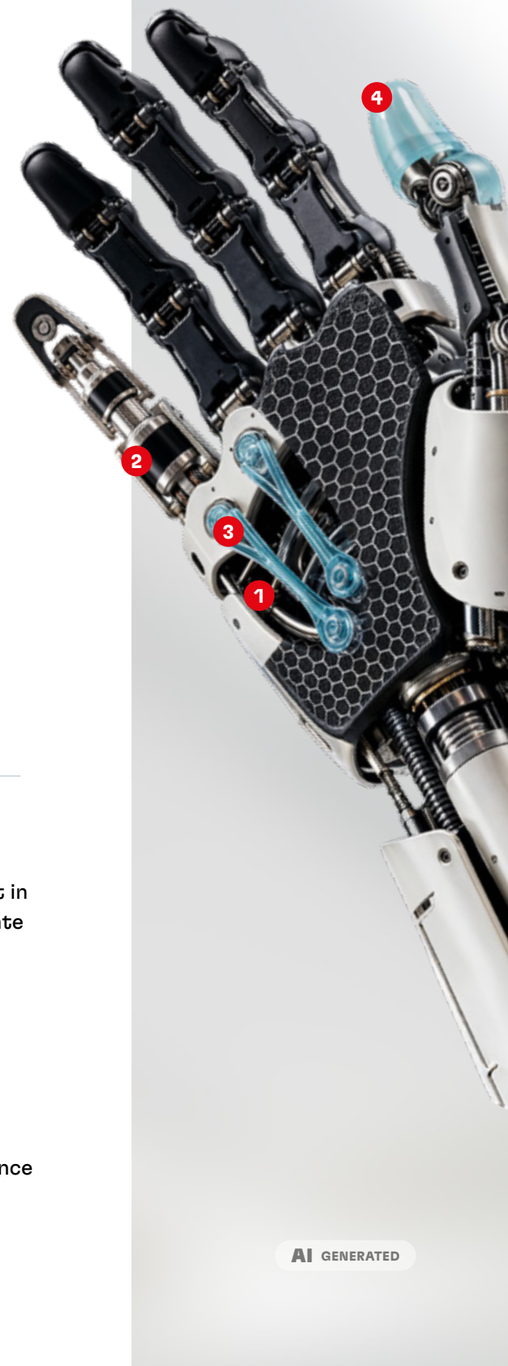
SENSOR INTEGRATION

As tactile sensing and force feedback become increasingly important in humanoid robotics, reliable sensor integration is essential for accurate signal acquisition, long-term performance, and assembly reliability.

Fingertip Capacitive Sensor Fixation 4

KEY REQUIREMENTS

- High bond strength
- Void-free assembly
- Long-term stability
- Excellent environmental resistance and long-term aging performance

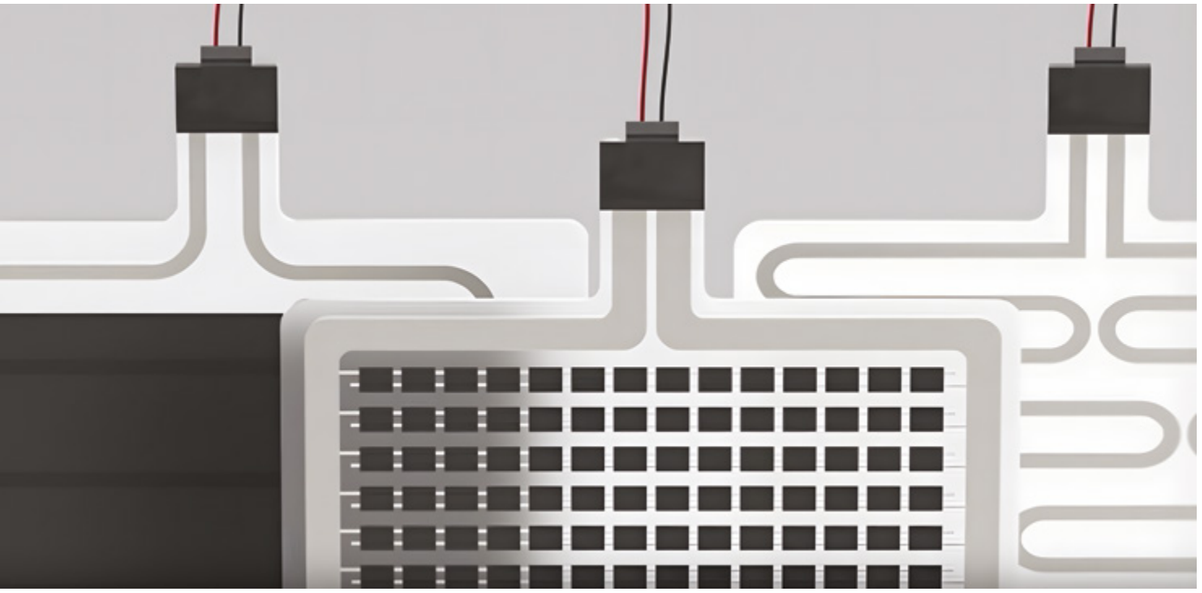


HUMAN-CENTERED DESIGN

Supporting more natural, comfortable, and intuitive human-machine interaction through advanced material technologies.

As humanoid robots expand beyond industrial environments into homes, healthcare, hospitality, retail, and service applications, human interaction becomes an increasingly important consideration.

Future generations of humanoid robots will not only be expected to perform tasks efficiently, but also to interact naturally, safely, and comfortably with people. Material technologies therefore play an important role in shaping user experience, physical interaction, safety, and long-term adoption.



Skin-Friendly Materials

Low-Allergen Polyurethane Reactive (PUR) Hot Melt Adhesives

Humanoid robots designed for close human interaction may involve frequent contact with users during daily operation.

Material solutions used in these applications should support durability and reliable assembly while helping address skin-contact considerations, user comfort, and product safety requirements.

KEY BENEFITS

- Designed for human-interactive applications
- Verified through multiple allergen screening and testing protocols*
- Long-term durability and assembly reliability
- Consistent performance on soft-touch and skin-contact surfaces

Adaptive Thermal Comfort

Printed Heating Inks

Surface temperature can significantly influence user perception and interaction quality.

As humanoid robots move closer to everyday human environments, comfortable and well-controlled surface temperatures can help create more natural, approachable, and human-friendly interactions.

Henkel‘s printed heating technologies and conductive inks enable lightweight, flexible, and highly integrated thermal comfort solutions for humanoid robotic surfaces. These technologies can help create skin-like surface temperatures and improve overall user experience during physical interaction.

KEY BENEFITS

- Rapid thermal response
- Self-regulating temperature profiles
- Lightweight and flexible integration
- Configurable heating zones

Soft-Touch Surface Integration

Water-Based Polyurethane Adhesives

Soft-touch surfaces, textile coverings, and porous materials are increasingly being adopted to create more approachable and consumer-friendly humanoid robots.

Henkel solutions support reliable integration of these materials while enabling flexible manufacturing processes and improved aesthetics.

KEY BENEFITS

- Bonding of textile and porous materials
- Sprayable processing options
- Smooth and uniform appearance
- Support for soft-touch surface designs

* Testing scope and evaluation methods may vary depending on product type and application requirements

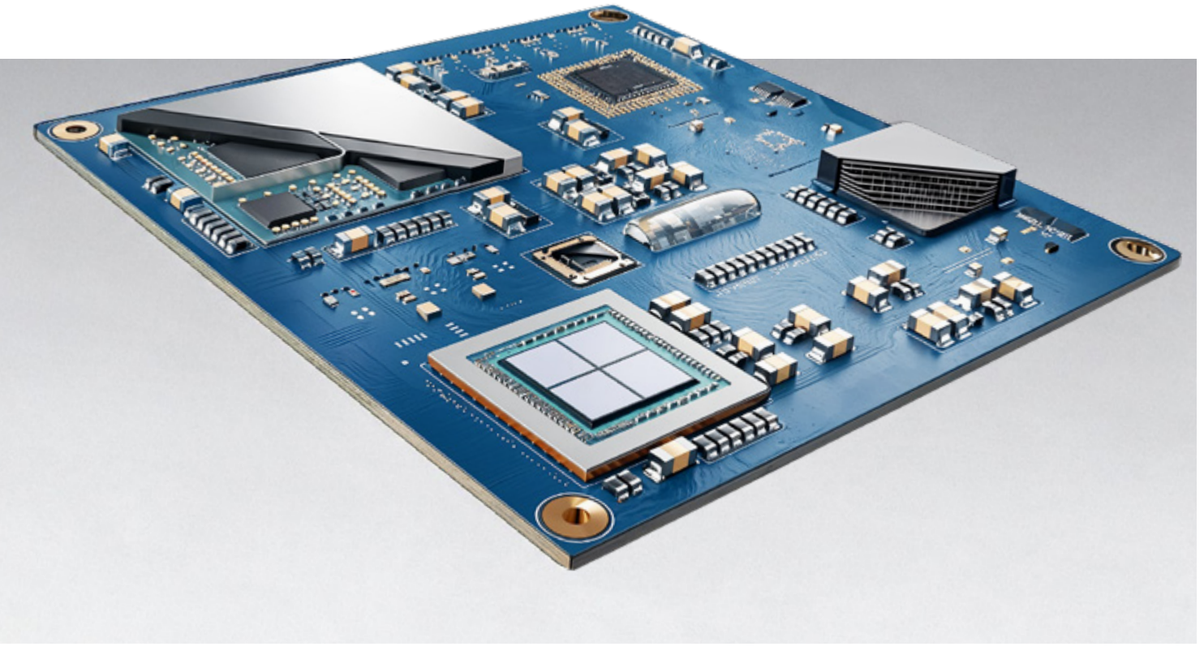


ELECTRONICS PACKAGING, PROTECTION & RELIABILITY

Supporting reliable electronics architectures for next-generation humanoid robots.

Modern humanoid robots rely on increasingly integrated electronics architectures that support perception, AI computing, motion control, power management, and communication throughout the robot.

From package-level protection and board-level reliability to electrical interconnection and environmental protection, material technologies play a critical role in supporting system performance, operational reliability, and long-term durability.



Package-Level Protection & Reliability

Supporting advanced electronics packaging and component-level protection.

APPLICATIONS

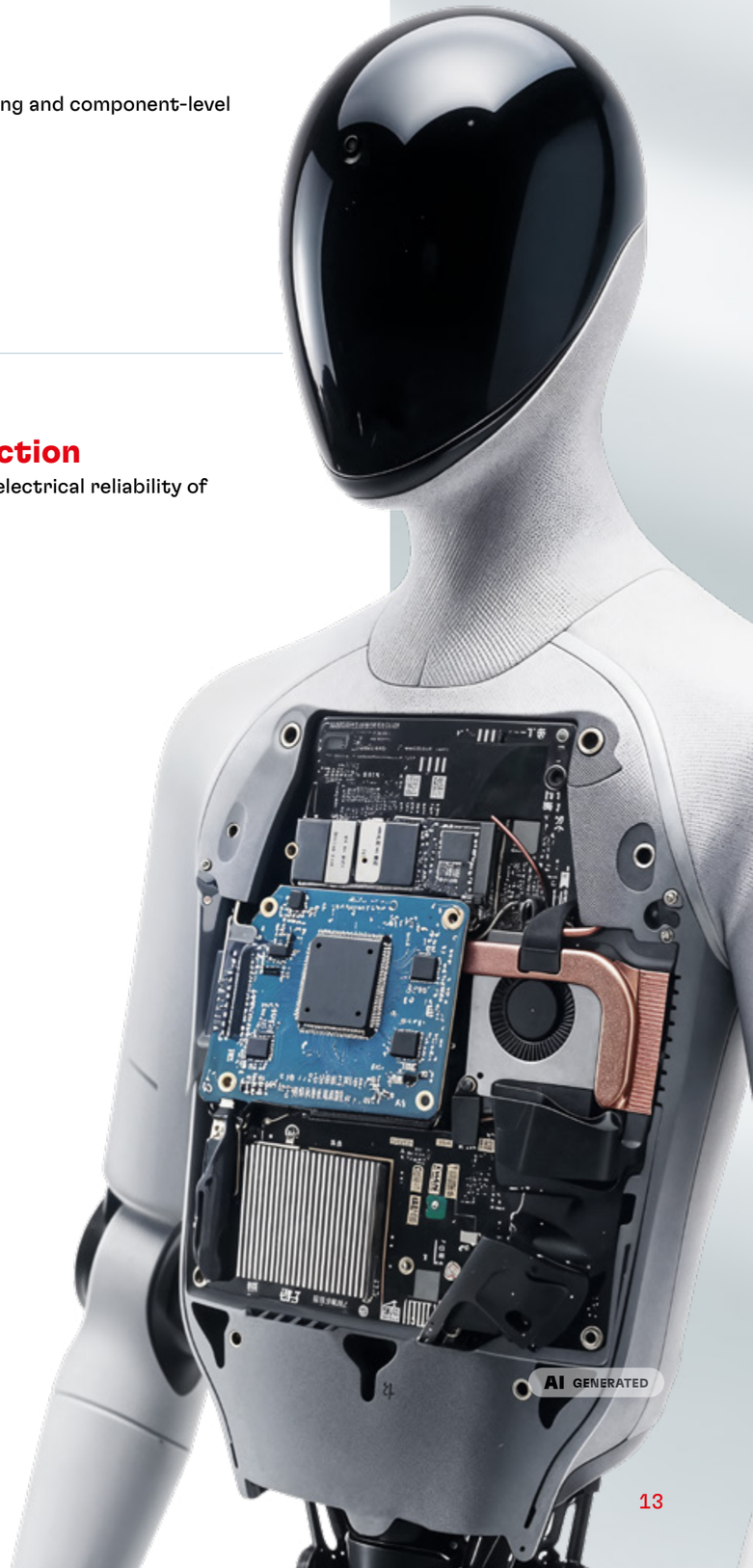
- Semiconductor encapsulants
- Semiconductor underfills
- Semiconductor pastes
- Semiconductor films

Board-Level Protection & Interconnection

Improving environmental resistance and electrical reliability of electronic assemblies.

APPLICATIONS

- Board-level encapsulants
- Board-level underfills
- Conformal coatings
- Conductive adhesives
- Conductive inks
- EMI shielding materials
- Thermal interface materials

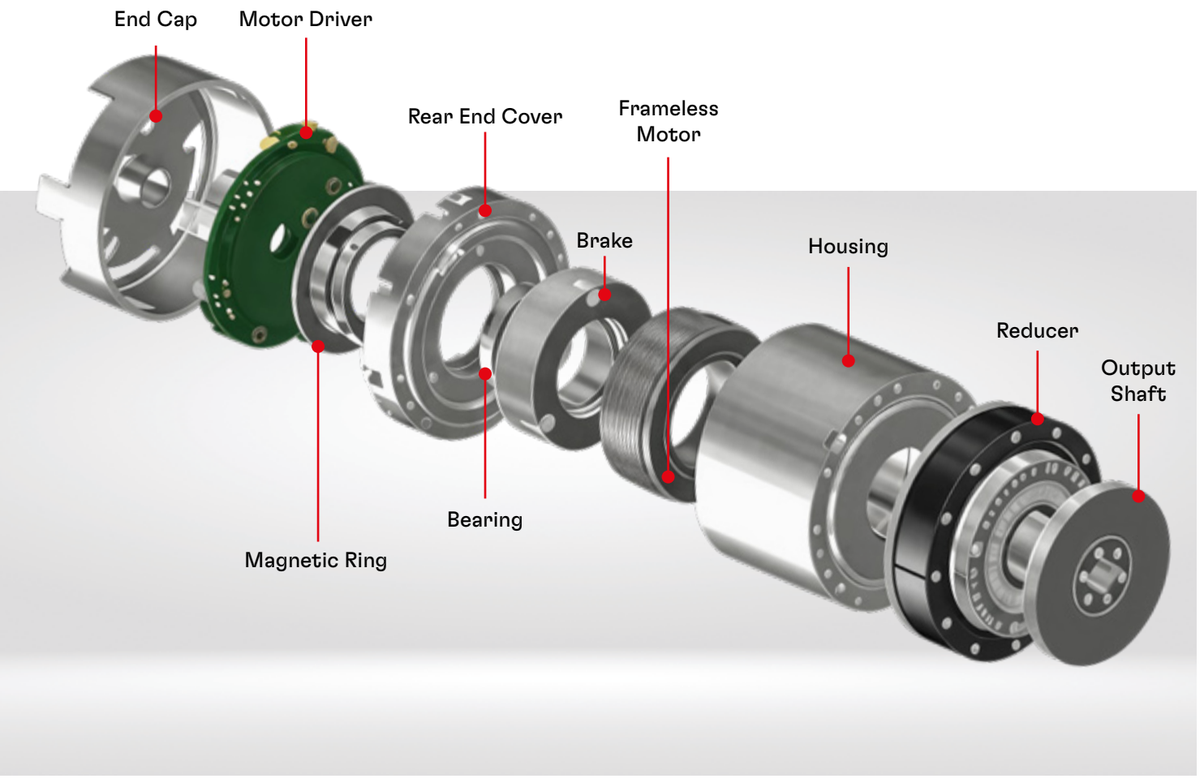


JOINT MODULE ASSEMBLY & RETENTION

Supporting durable, precise, and reliable motion systems through advanced assembly technologies.

Joint modules represent one of the most critical subsystems in humanoid robots, directly influencing mobility, precision, reliability, and system longevity.

The increasing adoption of lightweight materials, highly integrated architectures, and high power-density designs creates demanding requirements for structural bonding, component retention, and long-term assembly reliability.



Encoder Disc / Magnetic Ring Bonding

Encoder assemblies require precise positioning and dimensional stability to maintain signal accuracy throughout the lifecycle of the joint module.

KEY REQUIREMENTS

- Fast positioning and rapid fixture
- Low-stress bonding
- Low shrinkage and dimensional stability
- Vibration resistance
- Thermal cycling reliability

Rotor Magnet Bonding

Permanent magnets are bonded to rotor cores and must withstand high rotational speeds, centrifugal forces, and long-term thermal and mechanical stresses throughout robot operation.

KEY REQUIREMENTS

- High bond strength
- Excellent peel and shear resistance
- Elevated temperature resistance
- Impact resistance and toughness
- Long-term vibration durability

Threadlocking

Threaded fasteners throughout humanoid robots are continuously exposed to vibration and dynamic loading conditions.

KEY REQUIREMENTS

- Resistance to self-loosening
- Long-term reliability
- Corrosion protection
- Serviceability options

Bearing & Gear Retention

Reliable bearing and gear retention is essential for maintaining drivetrain performance and compensating for manufacturing tolerances.

KEY REQUIREMENTS

- Gap filling capability
- High mechanical strength
- Resistance to lubricants and process fluids
- High-temperature performance

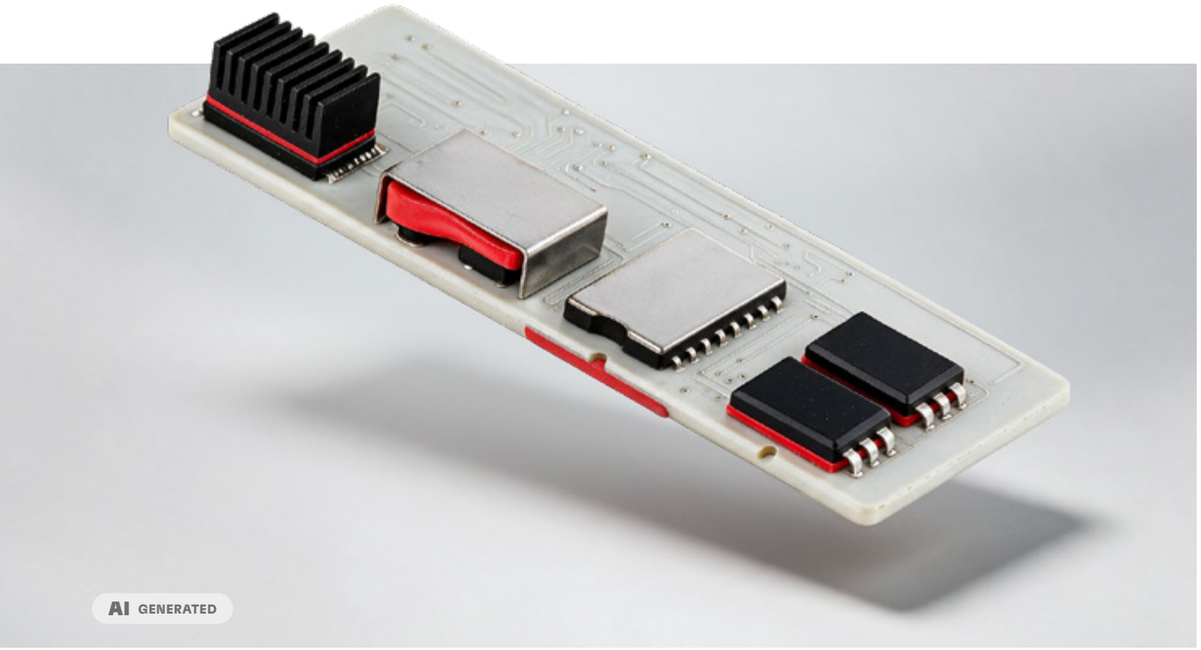


AI COMPUTE THERMAL MANAGEMENT

Supporting next-generation robotic intelligence through reliable AI computing and advanced thermal management.

AI compute platforms serve as the central intelligence hub of humanoid robots, enabling perception, planning, decision-making, and motion control through increasingly powerful computing architectures.

As AI workloads continue to increase, processors, memory, power electronics, and communication modules generate significant thermal loads within highly compact systems. Effective thermal management is essential to maintaining computing performance, system reliability, and autonomous operation.



THE INTELLIGENCE LAYER OF HUMANOID ROBOTICS

AI Compute Platform Thermal Management

AI compute platforms integrate processors, memory, power electronics, and communication modules within highly compact architectures.

As AI workloads continue to grow, increasing heat flux and tighter thermal interfaces create greater demands on thermal management materials.

TYPICAL THERMAL SOLUTIONS

- GAP PAD®
- Thermal gels
- Liquid gap fillers

Main Control Unit Thermal Management

Modern humanoid robots increasingly integrate AI processors, memory, power electronics, and communication modules within highly compact control units.

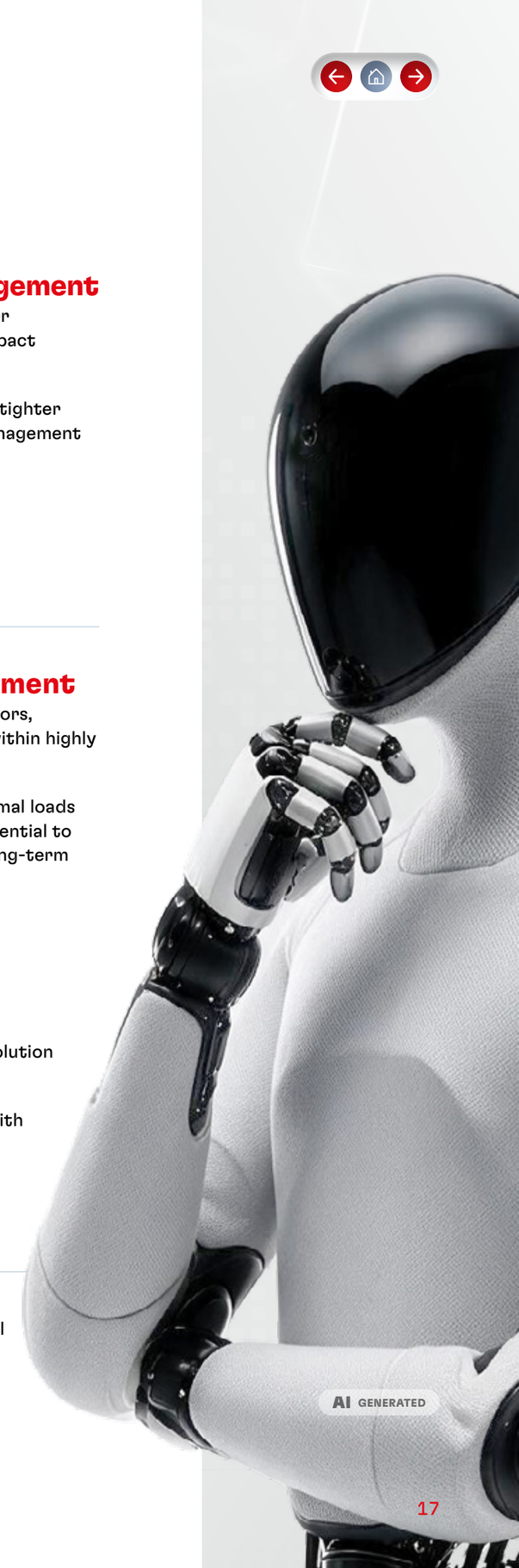
As AI workloads continue to grow, power density and thermal loads increase significantly. Effective thermal management is essential to maintain computing performance, system reliability, and long-term operational stability.

TYPICAL THERMAL SOLUTIONS

- **SIL PAD® (Thermally Conductive Insulating Pads)**
  Recommended for relatively flat thermal interfaces.
  - Thickness range: 0.125 – 0.5 mm
  - Thermal conductivity up to 3.5 W/m·K
  - Electrical insulation and thermal conductivity in one solution

- **Thermal Gels**
  Recommended for complex geometries and interfaces with larger tolerances.
  - Low interfacial thermal resistance
  - Excellent wetting and gap-filling capability
  - Suitable for automated dispensing processes

Supporting embodied intelligence through efficient thermal management of AI compute and control systems.



MOTION SYSTEM THERMAL MANAGEMENT

Supporting reliable and efficient actuation through advanced thermal management technologies.

Motion systems are among the most thermally demanding subsystems in humanoid robots, integrating actuators, joint modules, sensors, drive electronics, and mechanical structures within highly compact architectures.

The combination of multiple heat sources, distributed system layouts, and increasing heat flux densities creates significant thermal management challenges. Continuous motion, high torque output, and increasing actuator power density generate thermal loads that directly affect precision, efficiency, reliability, and system longevity.



THE MOTION LAYER OF HUMANOID ROBOTICS

Dexterous Hands Thermal Management

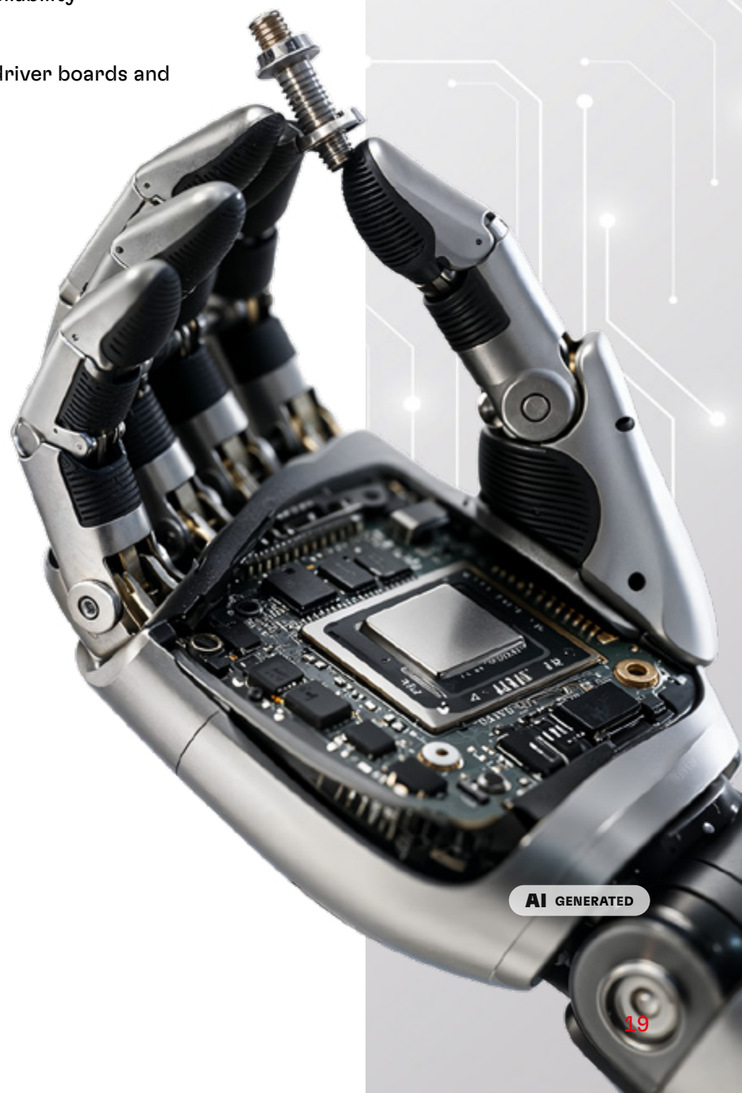
Dexterous hands integrate miniature motors, driver electronics, sensors, and control units within extremely compact spaces.

Heat generation is primarily concentrated in miniature joint motors, driver boards, and sensing electronics, making effective thermal management critical for precision, responsiveness, and reliability.

TYPICAL THERMAL SOLUTIONS

- **Thermally Conductive Encapsulation Materials**
  Recommended for encoders, driver boards, and compact electronic assemblies
  - Thermal conductivity: 1.0 – 1.5 W/m·K
  - Thermal management and component protection in one solution
  - Improved vibration and environmental reliability

- **Thermal Gels**
  Recommended for heat transfer between driver boards and palm structures
  - Thermal conductivity: 1.5 – 2.0 W/m·K
  - Excellent gap-filling capability
  - Low interfacial thermal resistance



Joint Modules Thermal Management

Joint modules are among the most thermally demanding subsystems in humanoid robots.

High-torque operation, rapid acceleration, and continuous motion can generate significant transient thermal loads that must be effectively managed to maintain performance and reliability.

TYPICAL THERMAL SOLUTIONS

- **GAP PAD®**
  Recommended for relatively regular and large-area thermal interfaces
  - Thermal conductivity up to 10.0 W/m·K
  - Excellent tolerance compensation capability
  - Long-term thermal reliability

- **Thermal Gels**
  Recommended for complex geometries and highly integrated thermal interfaces
  - Ultra-low interfacial thermal resistance
  - Excellent wetting characteristics
  - Automated dispensing compatibility

- **Phase Change Materials (PCM)**
  Recommended for applications with significant transient heat generation
  - Absorbs thermal peaks during operation
  - Reduces hot-spot temperatures
  - Improves thermal stability

Supporting reliable motion, precision control, and long-term durability through advanced thermal management technologies.



LOW SURFACE ENERGY & ENGINEERING MATERIALS

Addressing challenging bonding applications through specialized material technologies and application expertise.

Low surface energy and engineering materials are increasingly being adopted across humanoid robots to support lightweight design, durability, advanced functionality, and improved user interaction.

These substrates often present significant bonding challenges due to their inherent surface characteristics. Applications such as protective covers, soft-touch surfaces, structural components, and joint-related assemblies require material solutions capable of delivering robust adhesion, durability, and long-term reliability.



AI GENERATED

Rubber-to-Metal Bonding 1

Two-Part Acrylic Adhesives

Rubber materials are widely used in humanoid robots for foot pads, protective covers, and impact-absorbing components, where reliable bonding is essential for durability and long-term performance.

TYPICAL ROBOT APPLICATIONS

- Robot feet and sole pads
- Protective covers
- Impact-absorbing components

KEY REQUIREMENTS

- Fast fixture and curing
- High bond strength
- Excellent vibration and impact resistance
- Compatibility with low surface energy substrates

TPU-to-Metal Bonding 2

Two-Part Polyurethane Adhesives

TPU materials are increasingly adopted in humanoid robots for flexible outer skins, joint protection covers, and soft-touch surfaces, combining durability with user-friendly interaction.

TYPICAL ROBOT APPLICATIONS

- Joint covers
- Flexible exterior panels
- Wear-resistant components

KEY REQUIREMENTS

- High flexibility
- Extended assembly window
- Long-term durability under repeated deformation
- Reliable adhesion to dissimilar materials



AI GENERATED

PEEK-to-Metal Bonding
Two-Part Epoxy Adhesives

PEEK and other engineering plastics are increasingly used in lightweight structural assemblies, actuator systems, and motor mounting structures where strength, stability, and weight reduction are critical.

TYPICAL ROBOT APPLICATIONS

- Motor brackets
- Structural components
- Lightweight actuator assemblies

KEY REQUIREMENTS

- High mechanical strength
- Thermal aging resistance
- Chemical resistance
- Long-term structural stability

PTFE-Coated Surface Bonding
Modified Silane (MS) Sealants

PTFE-coated and other low-friction surfaces are used in cable routing, connector retention, and specialized mechanical interfaces where adhesion is traditionally difficult to achieve.

TYPICAL ROBOT APPLICATIONS

- Cable routing and fixation
- Connector retention
- Low-friction functional surfaces

KEY REQUIREMENTS

- Excellent adhesion on difficult-to-bond substrates
- Thermal and chemical resistance
- High toughness
- Serviceability and repairability





Supporting lightweight design, material innovation, and robust assembly across next-generation humanoid robots.

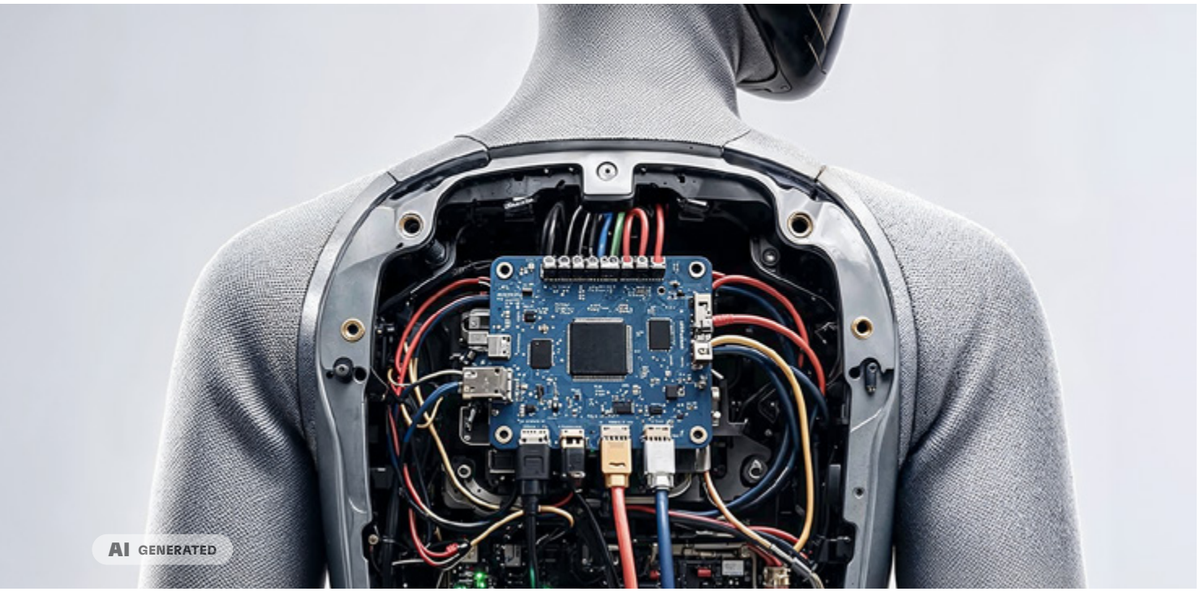


SERVICEABLE BONDING & DEBONDING

Supporting maintainability, repairability, and lifecycle performance through serviceable bonding technologies.

As humanoid robots transition from prototype development to large-scale deployment, serviceability becomes an increasingly important design consideration.

Adhesive solutions must not only deliver long-term reliability during operation, but also support efficient maintenance, component replacement, and non-destructive repair throughout the product lifecycle.



Debondable Assemblies

Unlike permanent structural assemblies, selected humanoid robot subsystems may require inspection, upgrading, replacement, or repair throughout the product lifecycle.

Serviceable bonding technologies provide reliable retention during operation while enabling controlled disassembly when maintenance is required.

TYPICAL ROBOT APPLICATIONS

- Exterior panels and cosmetic covers
- Functional access doors and service covers
- Battery compartment assemblies
- Sensor modules
- Maintenance-intensive robotic subsystems

KEY REQUIREMENTS

- Reliable retention during operation
- Controlled disassembly capability
- Support for non-destructive maintenance
- Simplified repair and component replacement

Wire Harness Connector Fixation

Wire harnesses and connectors throughout humanoid robots are exposed to continuous vibration, movement, and thermal cycling during operation.

Reliable fixation helps prevent connector loosening and unintended disconnection while maintaining accessibility for inspection, maintenance, and repair.

TYPICAL ROBOT APPLICATIONS

- Joint module connectors
- Dexterous hand internal wiring
- Sensor connectors
- Battery and power system connectors
- Main control unit cable routing and fixation

KEY REQUIREMENTS

- High vibration resistance
- High-temperature durability
- High-viscosity, non-sag performance for reliable component retention
- High toughness under dynamic loading conditions
- Reworkability and serviceability
- Compatibility with challenging substrates

Supporting maintainability, reliability, and lifecycle performance across next-generation humanoid robot platforms.



RECOMMENDED PRODUCT PORTFOLIO

Representative Material Solutions for Humanoid Robotics Applications

Henkel offers a broad portfolio of adhesives, sealants, functional coatings, thermal management materials, and printed electronics technologies that support key humanoid robotics applications.

The products shown represent selected examples mapped to common application scenarios in humanoid robotics.

Representative examples only. Additional products may be recommended depending on specific application requirements.

Final product selection should be determined based on system architecture, operating conditions, assembly processes, reliability targets, and validation results.

Please contact **Henkel Application Engineering** for evaluation, validation, and solution recommendations.

PERCEPTION, INTERACTION & MANIPULATION

Electronic Skin

Application Area	Recommended Products
Pressure-Sensitive Carbon Inks	› LOCTITE® ECI 7004HR E&C + LOCTITE® NCI 7002 E&C › LOCTITE® ECI 7004LR E&C + LOCTITE® NCI 7002 E&C
Stretchable Silver Inks	› LOCTITE® ECI 1014 E&C
Printed Heating Inks	› LOCTITE® ECI 8001 E&C

Dexterous Hand Assembly

Application Area	Recommended Products
Palm Assembly	› LOCTITE® 460 + LOCTITE® SF 770
Tendon Fixation	› LOCTITE® 403 + LOCTITE® SF 770
Motor-to-Bracket Bonding	› LOCTITE® EA E-120HP
Fingertip Capacitive Sensor Fixation	› LOCTITE® ABLESTIK ATB 100 › LOCTITE® ABLESTIK ATB 100U
Joint Encoder Module Assembly	› LOCTITE® PE 8083 AB › LOCTITE® PE 8086-AB
Palm Thermal Gap Filling	› BERGQUIST® GAP FILLER TGF 1500 › BERGQUIST® GAP FILLER TGF 2000

HUMAN-CENTERED ROBOTICS

Human-Centered Design

Application Area	Recommended Products
Adaptive Thermal Comfort	› LOCTITE® ECI 8001 E&C

RELIABILITY & LONGEVITY

Electronics Packaging, Protection & Reliability

Application Area	Recommended Products
High-Flow Underfills	› LOCTITE® ECCOBOND UF 3808 › LOCTITE® ECCOBOND UF 3811 › LOCTITE® ECCOBOND UF 4002
High-Reliability Underfills	› LOCTITE® ECCOBOND UF 3833
High Thermal Underfills	› LOCTITE® ECCOBOND UF 4550HTC
Large-Die Corner Bonding	› LOCTITE® ECCOBOND EN 3915T
Encapsulation (Thermal Cure)	› LOCTITE® ECCOBOND EN 3838T › LOCTITE® ECCOBOND EN 3946 › LOCTITE® ECCOBOND EN 3847
Encapsulation (UV Cure)	› LOCTITE® 3705 › LOCTITE® ECCOBOND EN UV9721
Encapsulation (UV + Thermal Cure)	› LOCTITE® ECCOBOND EN 3839 › LOCTITE® ECCOBOND EN 3770
Encapsulation (UV + Moisture Cure)	› LOCTITE® ECCOBOND UV 90 Series › LOCTITE® ECCOBOND UV 97 Series
PCB Protection (Conformal Coating)	› LOCTITE® STYCAST CC 8555 › LOCTITE® STYCAST UV 7996 › LOCTITE® STYCAST PC 40-UMF
FPC Reinforcement	› LOCTITE® 190024LV
BTB Connector Protection	› LOCTITE® ECCOBOND EN UV4202
Thermally Conductive Adhesive	› LOCTITE® SI 5821 › LOCTITE® ABLESTIK SI 5823 › LOCTITE® ABLESTIK SI 5825

RELIABILITY & LONGEVITY

Joint Module Assembly

Application Area	Recommended Products
Encoder Disc / Magnetic Ring Bonding	› LOCTITE® AA 352
Rotor Magnet Bonding	› LOCTITE® AA 330 › LOCTITE® AA 3273 › LOCTITE® AA 326 + LOCTITE® SF 7649 › LOCTITE® AA 332 + LOCTITE® SF 7387 › LOCTITE® AA 392 + LOCTITE® SF 7387 › LOCTITE® EA E-20HP › LOCTITE® EA E-60HP › LOCTITE® EA E-214HP
Threadlocking	› LOCTITE® 222 › LOCTITE® 242 › LOCTITE® 262 › LOCTITE® 290
Bearing & Gear Retention	› LOCTITE® 638 › LOCTITE® 648 › LOCTITE® 680
Stator Potting	› LOCTITE® PE 8082 AB › LOCTITE® PE 8083 AB
Drive Control Board Thermal Management	› BERGQUIST® GAP PAD® TGP 10000ULM › BERGQUIST® GAP PAD® TGP 12000ULM › BERGQUIST® GAP FILLER TGF 10000 › BERGQUIST® LIQUI FORM TLF 10000

Representative examples only.
Product recommendations may vary based on specific application requirements, operating conditions, and validation results.

Please contact
Henkel Application Engineering
for evaluation, validation, and solution recommendations.

THERMAL MANAGEMENT

AI Compute Thermal Management

Application Area	Recommended Products
AI Compute Thermal Management	› BERGQUIST® GAP PAD® TGP 6000ULM › BERGQUIST® GAP PAD® TGP 3004SF › BERGQUIST® GAP FILLER TGF 1500LVO › BERGQUIST® LIQUI FORM TLF 6000HG

LIFECYCLE SERVICEABILITY

Serviceable Bonding & Debonding

Application Area	Recommended Products
Wire Harness Connector Fixation	› LOCTITE® HHD 9397BK

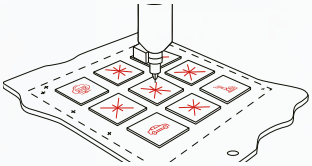


SHAPING THE **FORM, FUNCTION**, AND **FUTURE** OF **HUMANOID ROBOTICS**

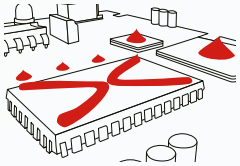
Through Co-Innovation, Technology Platforms and Application Engineering



Semiconductor Packaging Materials

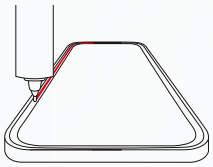


Component Assembly Materials

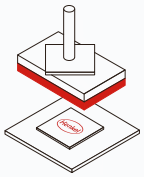


Thermal Management Materials

Board-Level Encapsulants & Underfills



Device Assembly Materials



Printed Electronics Materials

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