Grippers in Human Robot Collaboration
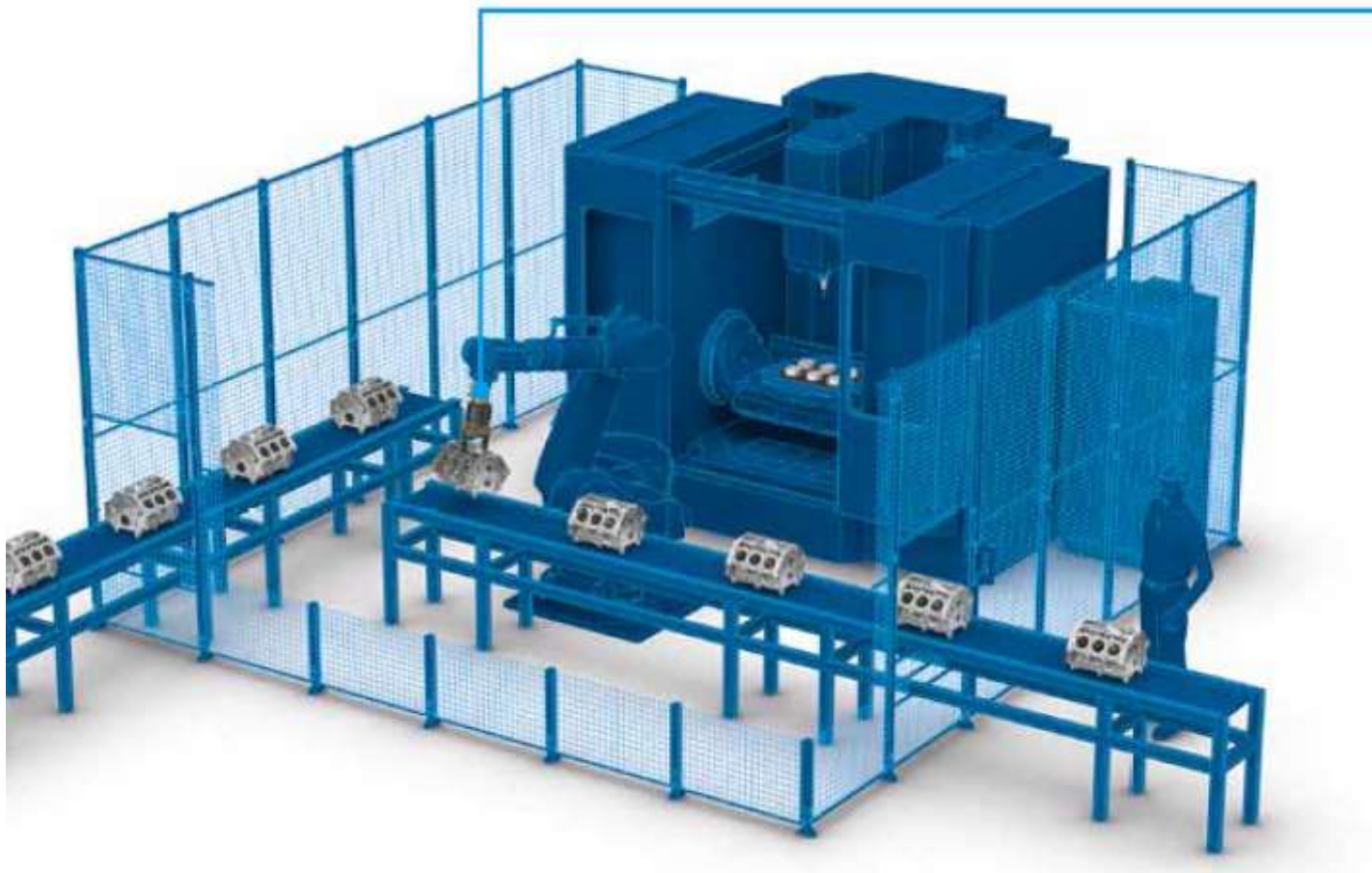
Markus Walderich
Group Manager Automation
SCHUNK

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Agenda

- Human/Robot Collaboration

    - Introduction I   Possibilities of plant design

    - Standardization

    - 4 kinds of collaboration

    - HRC and end effectors I Outlook

HRC - Introduction

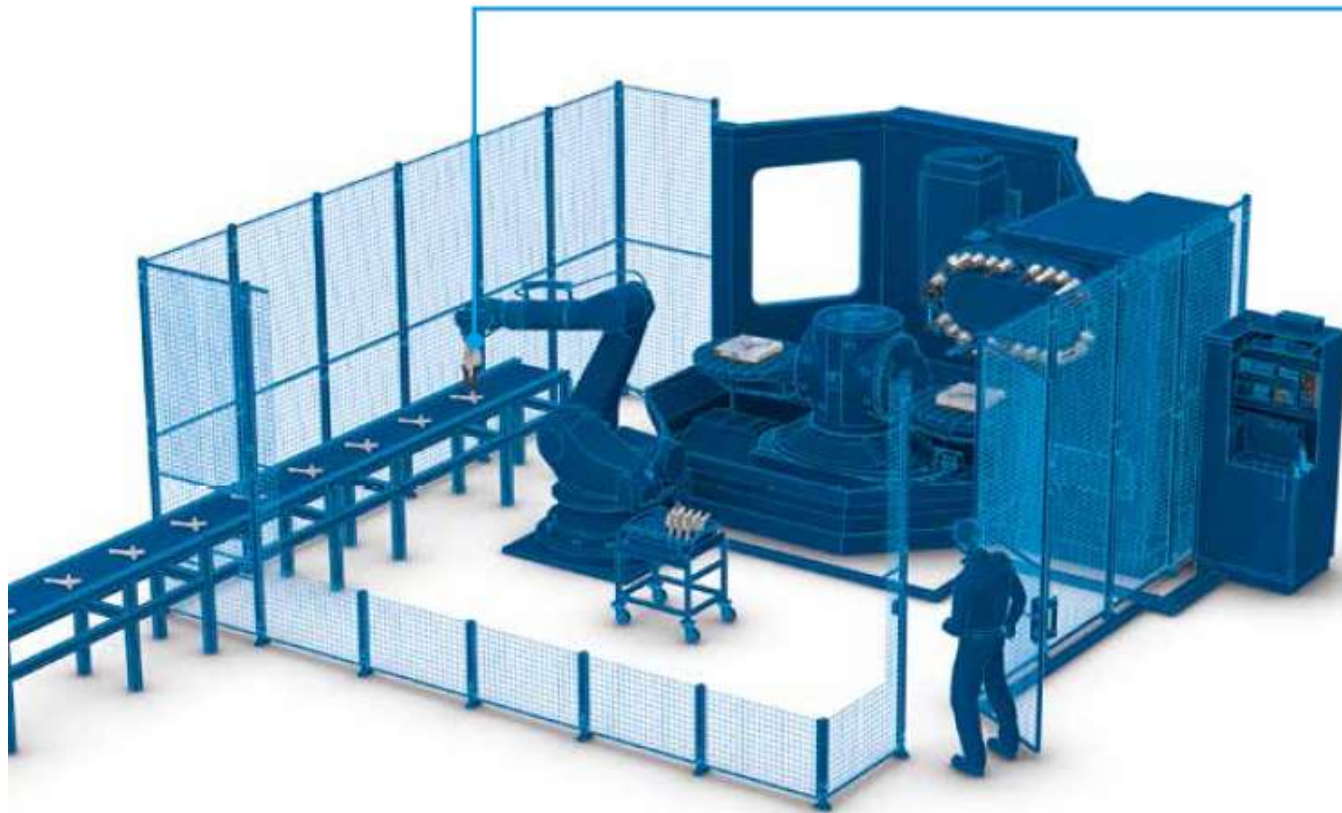AUTOMATE • 2017

Possibilities of Plant Design

Full Automation

Separate machining areas and decoupled work processes. The plant is disconnected from the power supply and production is brought to a standstill when a human enters the production cell.

The NEW PGN-plus and PGN-plus-Electric

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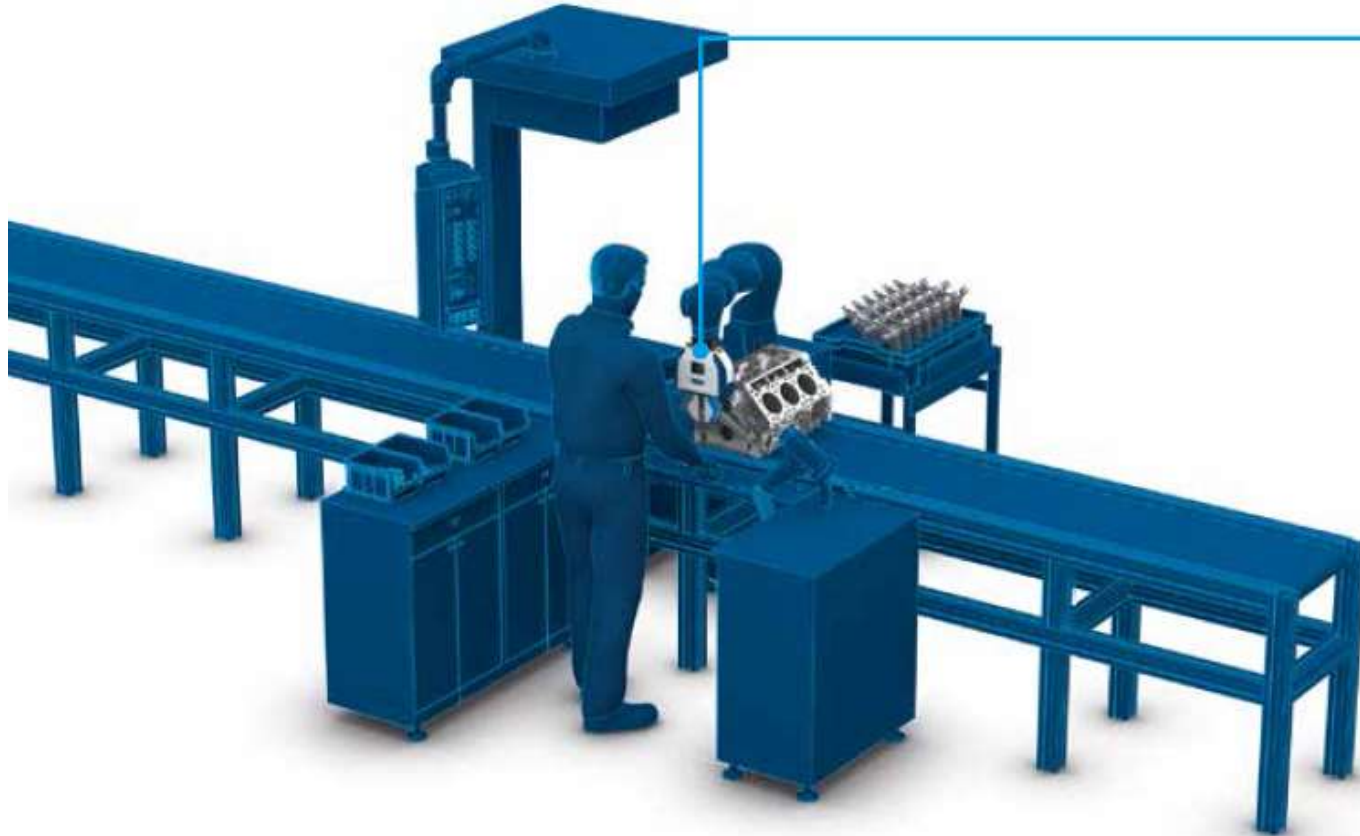
Possibilities of Plant Design

Functional Safety

Shared machining areas with decoupled work processes. The process switches to a slow, safe speed whenever a human enters the area. If the distance becomes too small to ensure safe operation, the system will be stopped and the energy supply will be maintained.

EGN   EZN

Possibilities of Plant Design

Human/Robot Collaboration

Shared machining areas with coupled work processes. The cells continue to work, even in the presence of humans. Any human contact with dangerous areas is detected at all times.

Co-act gripper

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Human/Robot Collaboration

Human/Robot Collaboration

Standardization in Robotics

What is Human/Robot Collaboration?

- **What is HRC?**
- Human/Robot Collaboration

- **Explanation:**
- Describes the interaction between operators [humans] and robots, mainly without the use of protective fences.

- Regardless of the **kind of collaboration**, protecting humans is always the primary focus. In order to ensure safety at all times, collaboration is regulated by **standards and certifications**.

Grippers in HRC - What does that mean?

1. Grippers **never lose** a workpieces

2. Grippers **always detect** human contact

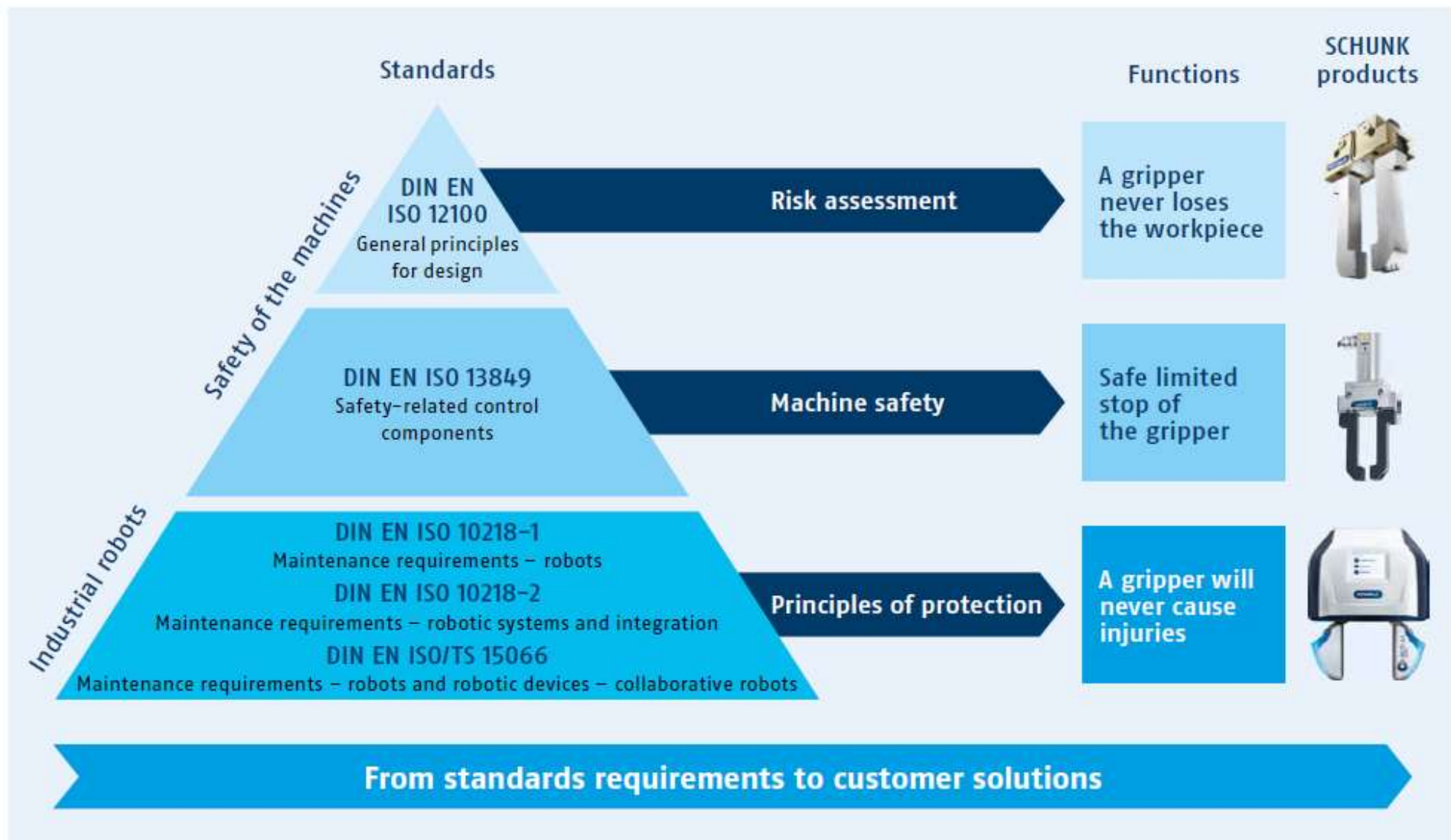3. Grippers **never cause injuries** when gripping
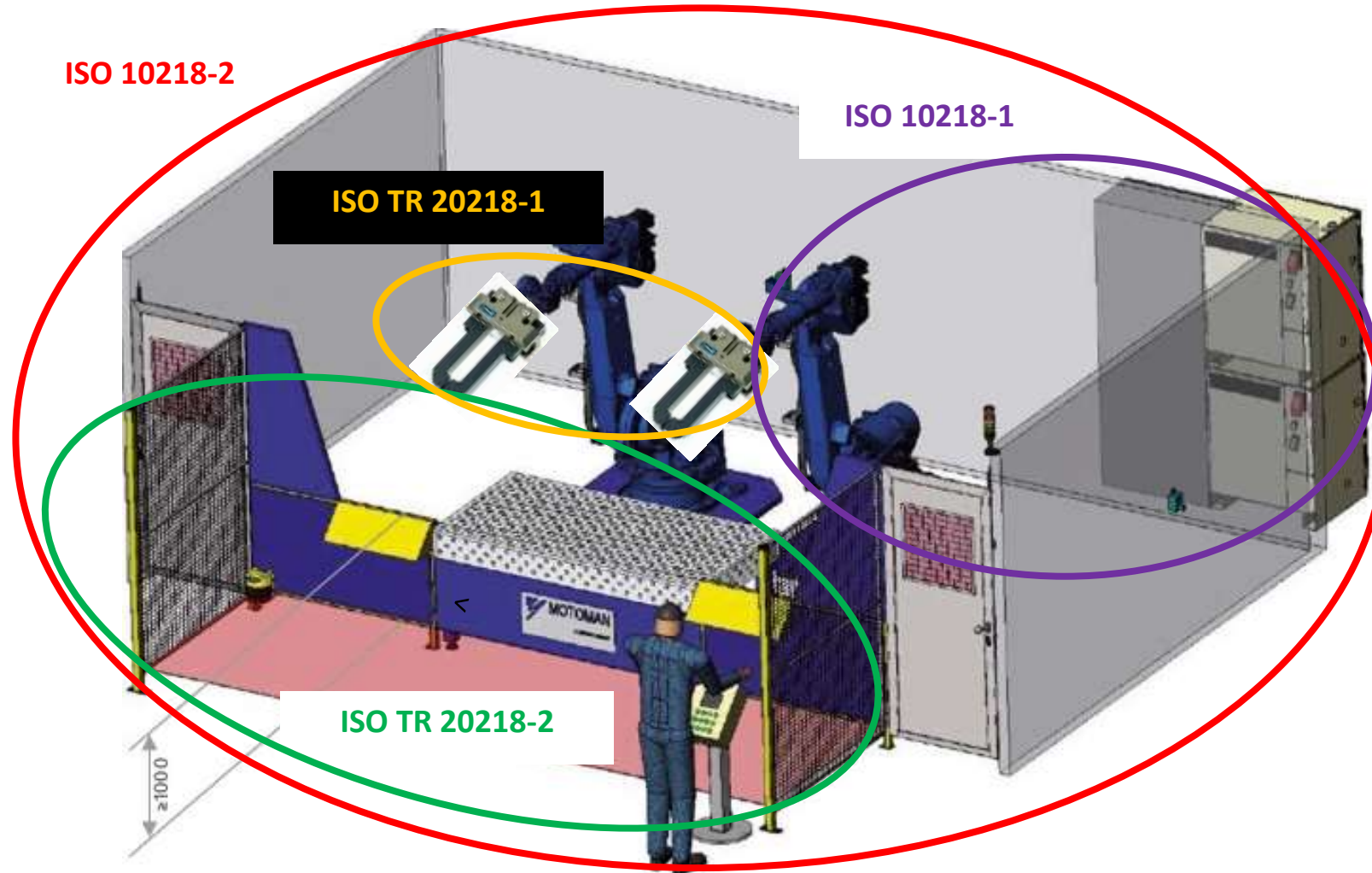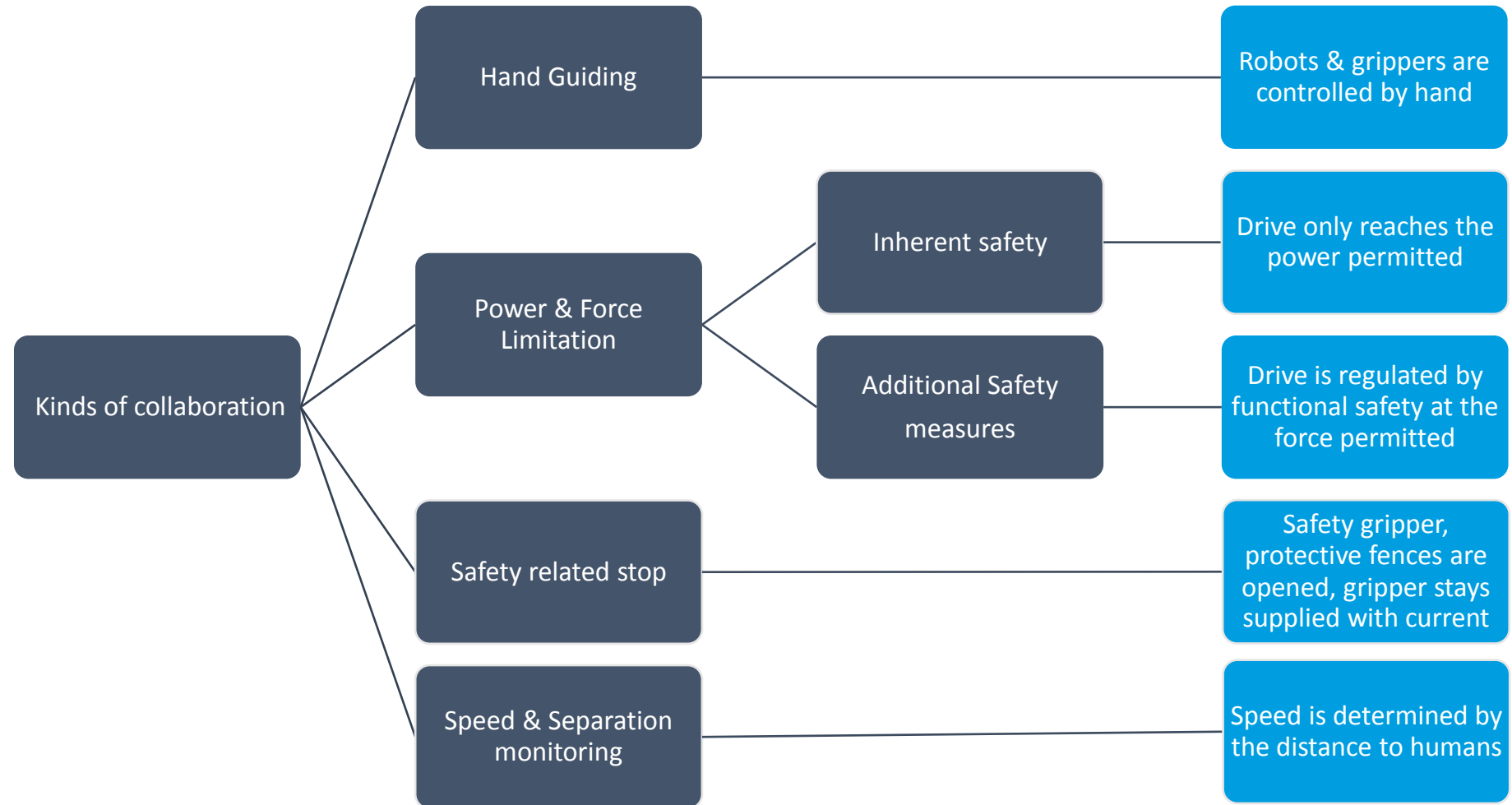
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Standards in Robotics

Big Picture | C-Standards in Robotics

ISO 10218-2

ISO 10218-1

ISO TR 20218-1

ISO TR 20218-2

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4 Kinds of Collaboration

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4 Kinds of HRC

4 Kinds of HRC

Kinds of collaboration

- **Hand Guiding** — Robots & grippers are controlled by hand
- **Power & Force Limitation**
  - **Inherent safety** — Drive only reaches the power permitted
  - **Additional Safety measures** — Drive is regulated by functional safety at the force permitted
- **Safety related stop** — Safety gripper, protective fences are opened, gripper stays supplied with current
- **Speed & Separation monitoring** — Speed is determined by the distance to humans
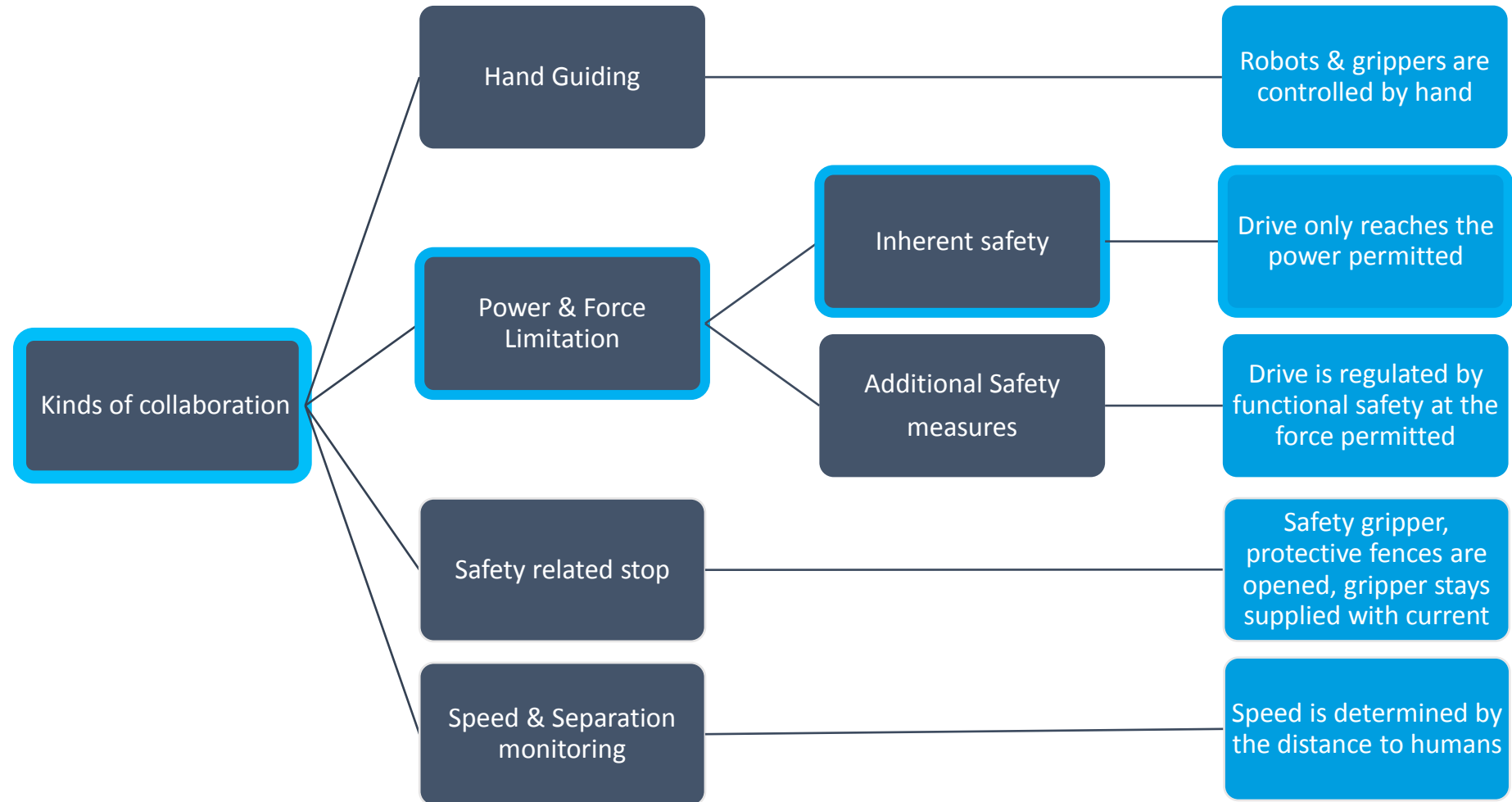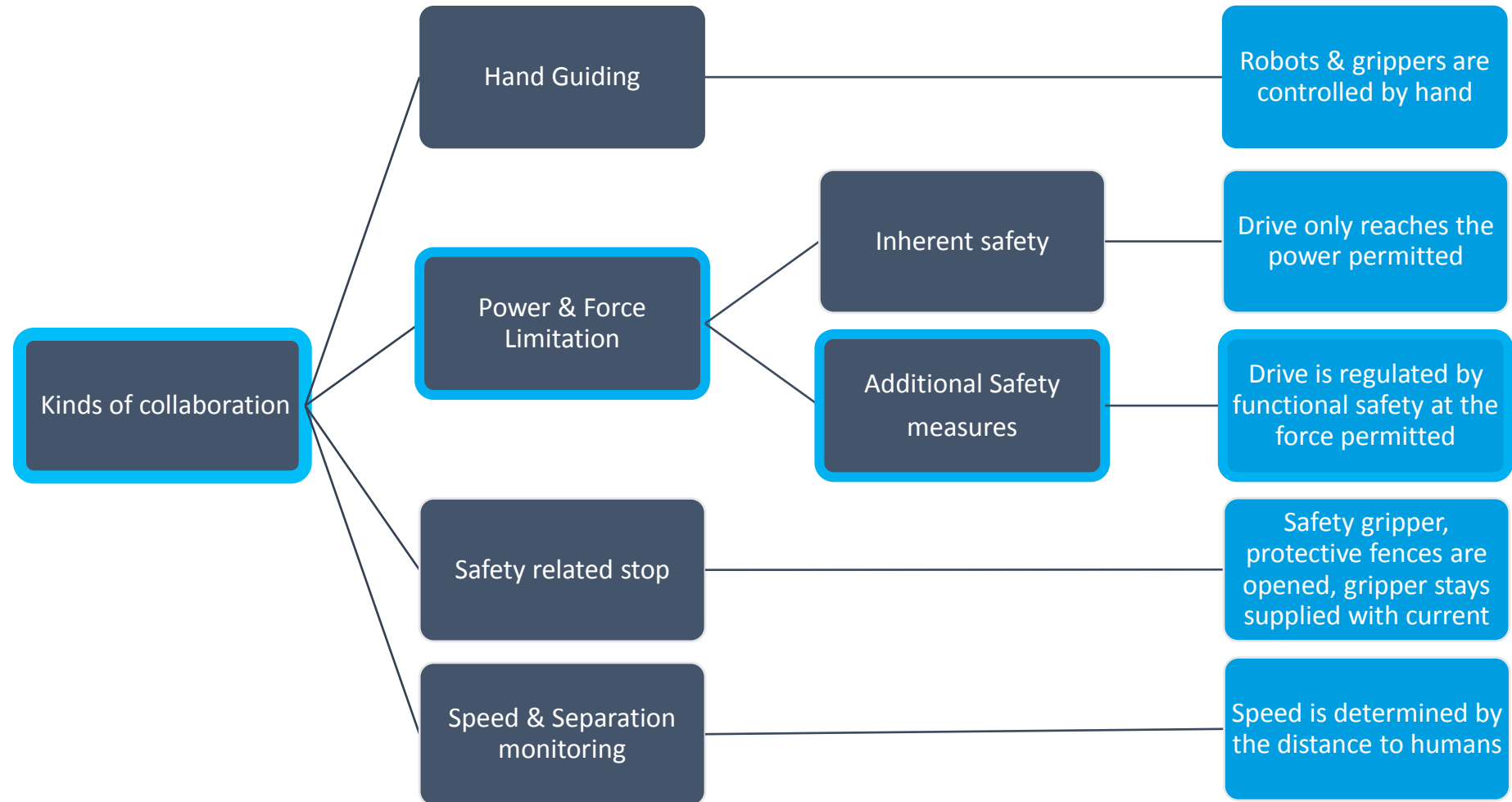
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Hand Guiding

4 Kinds of HRC

Inherently Safe

- Pneumatic or electric grippers can be used

- Limited force and no sharp corners and pinch points

4 Kinds of HRC

Kinds of collaboration

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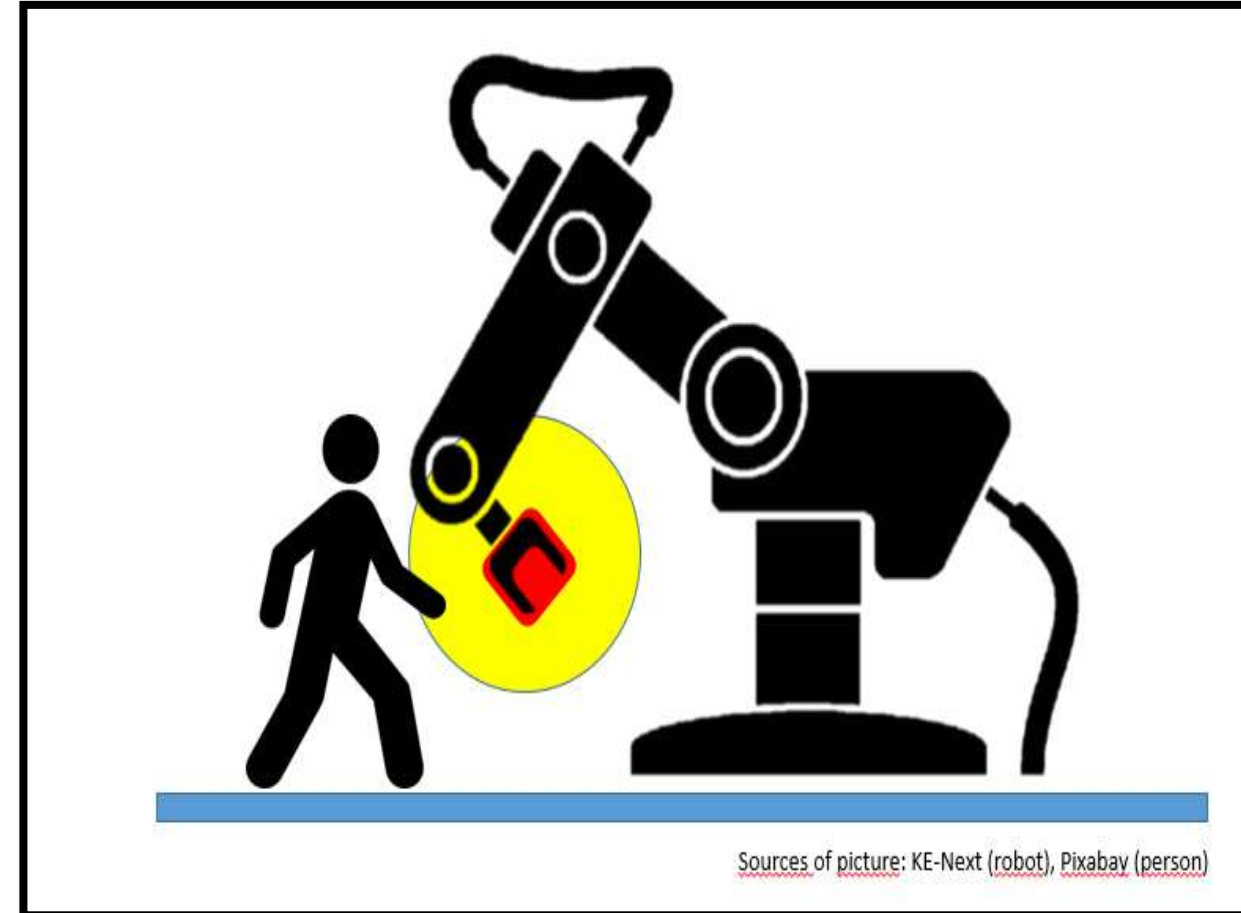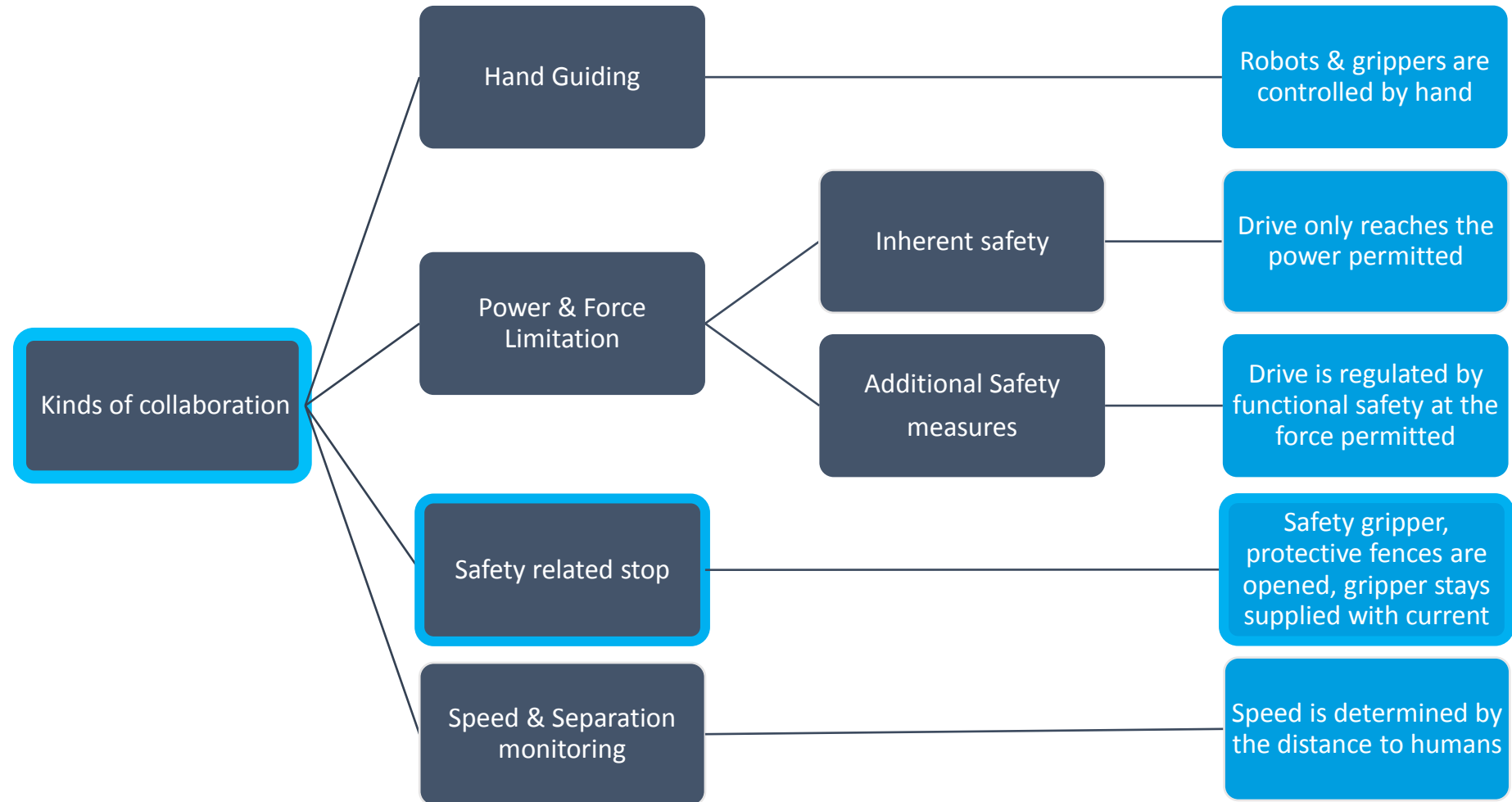
Additional Safety Measures

- Requirement for future HRC grippers

- Gripper has to differentiate between workpiece and other objects e.g. human hand
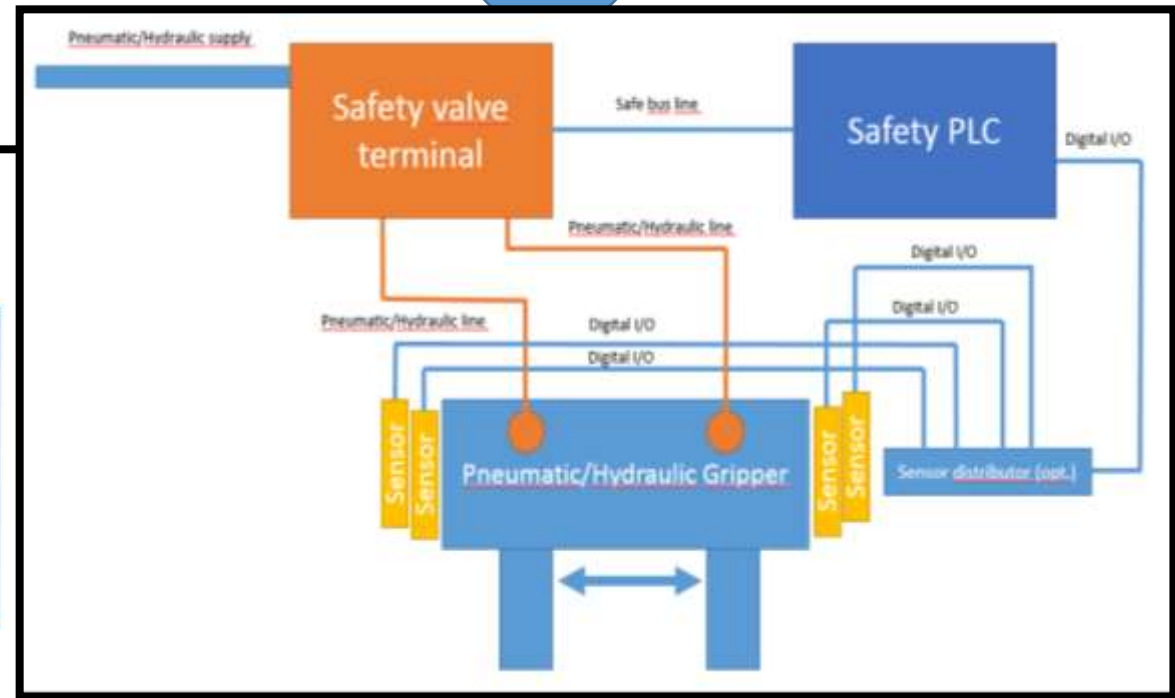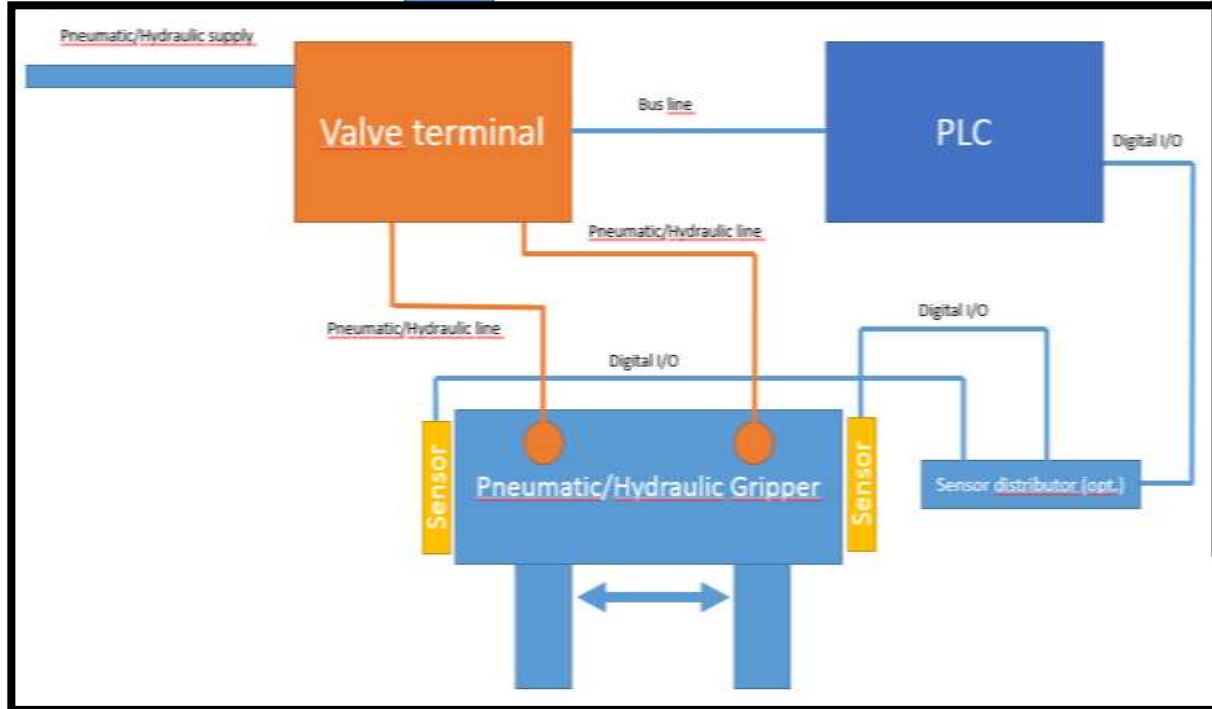
- No product on the market yet

Sources of picture: KE-Next (robot), Pixabay (person)

4 Kinds of HRC

Kinds of collaboration

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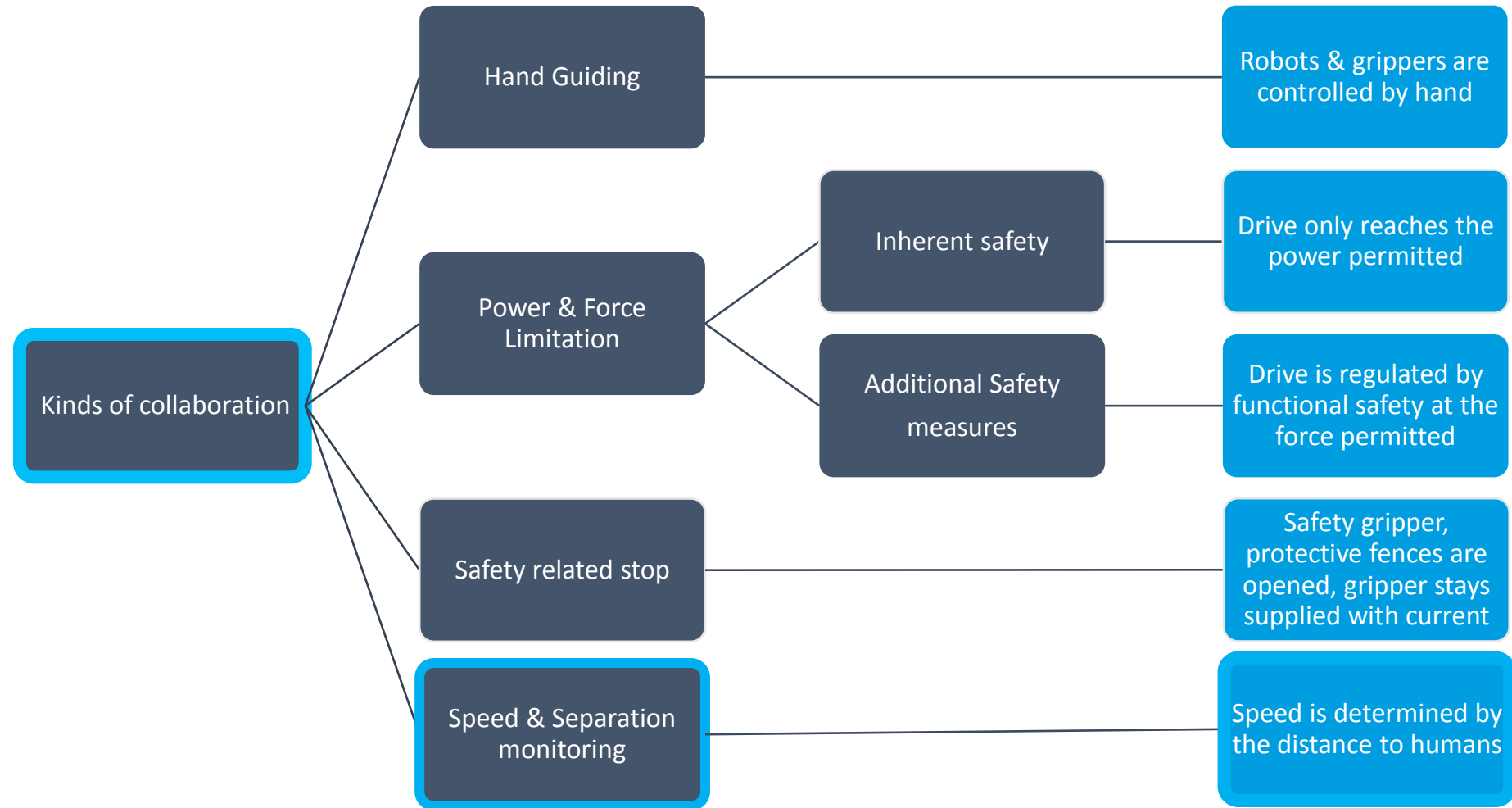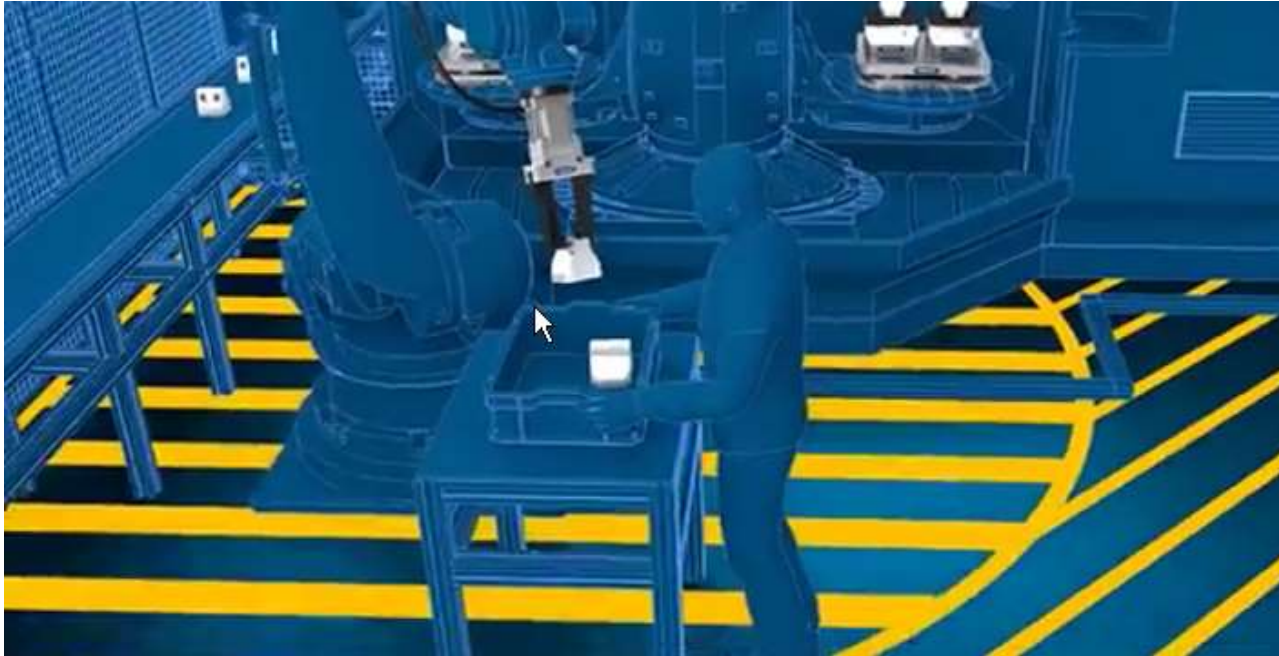# Safety Related Stop

Position monitoring and maintaining of grip force after safety related stop by use of redundant sensors and control

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4 Kinds of HRC

Kinds of collaboration

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Safety Related Stop

https://www.youtube.com/watch?v=vfgyjzp2uJA

Zone 1   Zone 2   Zone 3   Zone 4

Sources of picture: KE-Next (robot), Pixabay (person)

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HRC End Effectors | Outlook

What Defines a Power- & Force Limited Gripper?
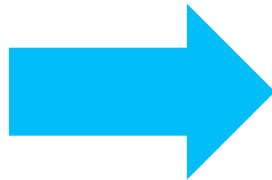
Grippers **never cause injuries** when gripping

Grippers **always detect** human contact

Grippers **never lose** a workpiece

In implementing these principles, SCHUNK focuses on interactive perfection between the various technologies and components

➕ **Force Limitation**
Gripping force limitation is activated in dangerous situations. Otherwise, the gripper can be operated with any force possible.

➕ **Collision Protection**
The HRC-compatible design eliminates all possible risk of injury as a result of human contact.

➕ **Safe Drive**
Grippers must prevent injuries to humans even with high gripping forces. Gripped parts are held reliably if a process is interrupted.

➕ **Environmental Sensor Systems**
The use of different sensors for detecting humans and the environment while simultaneously sensing the workpiece and differentiating it from human hands.

➕ **Software**
Gripper software that evaluates and processes the signals of the environmental sensors. This intelligent software empowers the gripper with artificial intelligence.

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Technology Carrier

Possible technologies for future HRC grippers

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