EXPECTATIONS & REQUIREMENTS FROM A TIER 1 TO IT'S SUPPLIERS

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Expectations & Requirements of a Tier 1

Agenda

- General Topics
- Practical Topics
- Summary

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General Topics

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Expectations & Requirements of a Tier 1

What does the customer want (regarding safety)?

- Safety expectations to the suppliers: The **product** is **safe**
  - Safe = Absence of **unreasonable safety risk** as well as of **safety risks that can be avoided** through measures, which are possible and reasonable according to the **state of the art**.
    - Compliance with the state of the art is a **legal requirement**
  - **Safety culture** is an important **prerequisite** in order to be able to develop, produce and deliver safe products

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Compliance with the state of the art?

- The compliance with the state of the art requires the **implementation of measures** for avoidance of hazard and damage that are **constructively possible** and seem to be **adequate** and **sufficient** for preventing damage **according** to the sound knowledge of recognized **experts**.

- A **standard** offers a **reference**. However the **state of the art** can have **evolved beyond** the requirements of a standard.
  - I.e. **if you know it better, do it better**
  - Compliance to **ISO 26262** is a **minimum** requirement
  - **ISO 26262** does **not** cover **all** safety aspects of a product

- It is the **responsibility of the supplier** to ensure the **compliance** of his product with the **state of the art** and to provide adequate **evidence**

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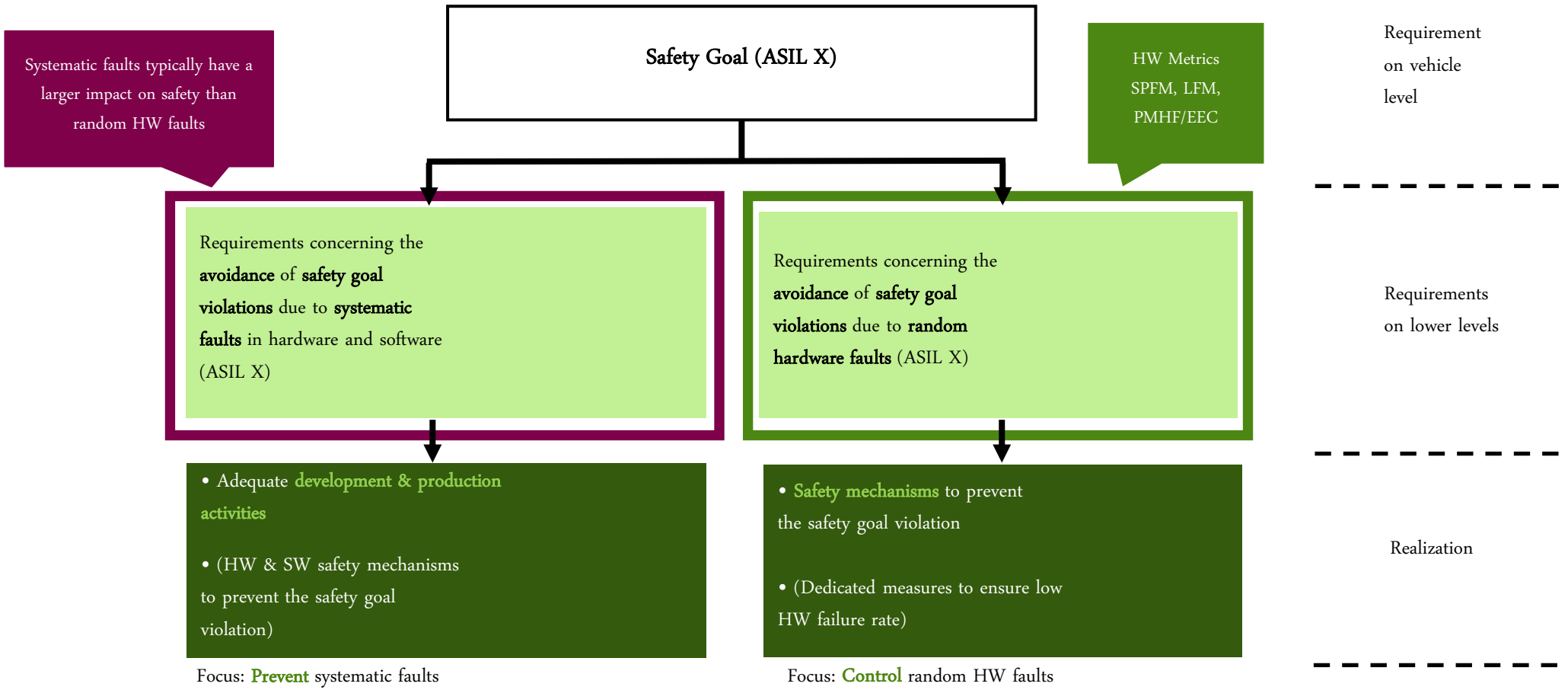
ISO 26262 in a Nutshell



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Expectations & Requirements of a Tier 1

Compliance with ISO 26262

- For a supplier of a HW element compliance is **not limited to** only **part 5**

- **Other parts** need to be **complied with**, too
  - Part 2 Management of functional safety
  - Part 7 Production and operation
  - Part 8 Supporting processes
  - Part 9 Automotive Safety Integrity Level (ASIL)-oriented and safety-oriented analyses
  - Depending on the product
    - Part 4 Product development at the system level
    - Part 6 Product development at the software level

- **Part 10** and **part 11** offer very **useful** guidelines **but** they do **not** address **all** issues

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Compliance with ISO 26262

- The **requirements** of ISO 26262 need to be **tailored** accordingly, e.g.

  - ***7.4.2.1*** *The organization shall appoint persons with the responsibility and the corresponding authority, in accordance with 5.4.2.9, to achieve and maintain the functional safety of the item during production, operation, service and decommissioning.*

    → Supplier is **responsible** for the **aspects** of his **product**, not the whole item

  - **Confirmation reviews**, functional safety **audits** and functional safety **assessments** of the supplier are executed by the supplier **within** the **scope** of his **product**, not the whole item

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Practical Topics

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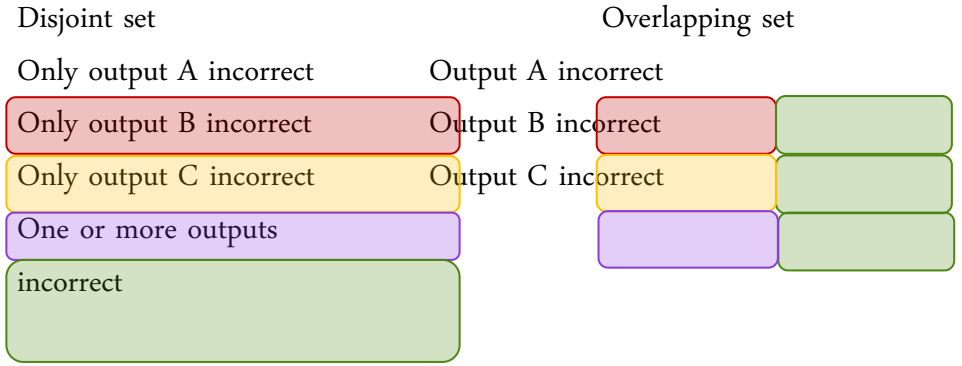
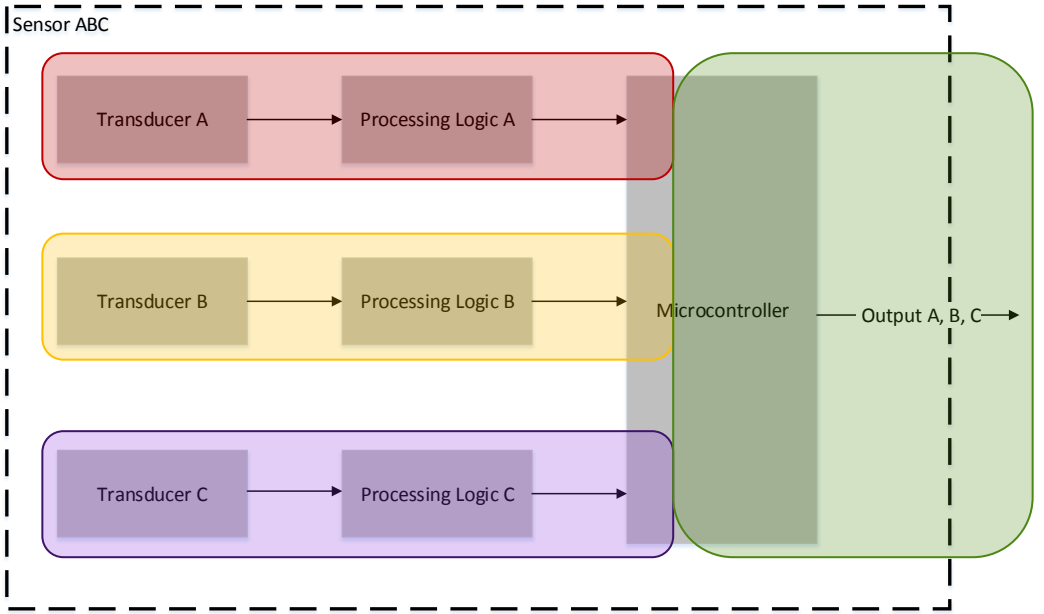
Disjoint safety requirements for random HW faults

- The **failure modes** on product (e.g. sensor) level shall be **disjoint**
  - Failure modes are disjoint if every **fault** of each **HW element of the product** can **contribute** to exactly **one failure mode on product level**
    - Ensure that **failure rates** of an HW element are only **counted once**
  - Example: Sensor ABC failure modes





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Base Failure Rate

- **Part 11** offers **several procedures** to calculate the base failure rates with very different results, e.g. IEC TR 62380 temperature derating

$$\lambda_{die} \sim {}^{1}/_{\tau_{on} + \tau_{off}}$$

where

τ_{off}	time ratio of being in storage or dormant
τ_{on}	total working time ratio
$\tau_{off} + \tau_{on} = 1$	

- Calculation possible with $\tau_{off} \neq 0 \rightarrow \lambda_{calender\ hours}$
- Calculation possible with $\tau_{off} = 0 \rightarrow \lambda_{operating\ hours}$
- $\lambda_{operating\ hours} / \lambda_{calender\ hours} = 1 + {}^{\tau_{off}}/_{\tau_{on}}$

  ➔ factors of **8 to 17** have been seen in applied failure rate calculations

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Base Failure Rate

- Bosch typically prefers the more **conservative calculation**, e.g. IEC TR 62380:

  $\tau_{off} = 0$

- Typical used **sources** for base failure rate calculations
  - **SN 29500**
  - **ISO TR 62380**

- General recommendation: **Define** the to be used base failure rate **calculation procedure** at the **beginning** of the project

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HW safety requirements implemented by SW

Supplier task (SW **provided** by the supplier)

- **Development** compliant with **ISO 26262-6**
- **Determination** of the **DC**
- **Verification** of the **DC**
- **Dependent failure analysis** between **HW** and **SW** elements

Supplier task (SW **specified** by the supplier)

- SW **specification** compliant with **ISO 26262-6**
- **Determination** of the **DC**
- **Verification** of the **DC**
- **Dependent failure analysis** between **HW** and **SW** elements

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Summary

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Expectations & Requirements of a Tier 1

Expectations & requirements to the supplier

- A **safe** product, **compliant** with the **state of the art**
  - The state of the art **might** have **evolved beyond** requirements of **ISO 26262** (if you know it better, do it better)
  - **Functional safety** does **not** necessarily address **all** relevant **safety aspects** (e.g. toxicity, flammability)
- **Compliance** with ISO 26262
  - Compliance with **all relevant normative parts** (2, (4), 5, (6), 7, 8, 9) with adequate tailoring
  - **Part 11** provides very **useful** guidelines **but** does **not** address **everything**
- **Disjoint failure modes** on **product level** in case of quantitative safety analysis
- **Conservative** base **failure rate** estimation, typically according to SN 29500 or IEC TR 62380
- In case of **SW safety mechanisms**
  - Estimation & Verification of the **DC**
  - **Dependent Failure Analysis** between **HW & SW** elements

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Questions?

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