Technische Universität
Kaiserslautern

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software engineering dependability

Quality Management of Software and Systems:
DIN ISO 9000-Standards

Contents

- Motivation
- Product liability and ISO 900X
- Contents of DIN ISO 9000-3
- Who gives the certificate?
- What can be certified?
- Procedure of certification
- Comparison: DIN ISO 9001 and Software Process Assessments
- Summary

DIN ISO 9000-Standards

- Standards for quality assurance
  - ISO 9000: general goals of a QA-system
  - ISO 9001: criteria for the QA-system of a manufacturing enterprise with development, assembly and marketing service
  - ISO 9002: criteria for the QA-system in production and assembly (no development, no marketing)
  - ISO 9003: criteria for the QA-system in the final assembly
  - ISO 9004: quality management and elements of a QA-system – manual

- None of these standards is designed explicitly for the application to software or software-based systems
  - ISO 9000-3: manual for the application of ISO 9001 to development, delivery and maintenance of software

Motivation

- Proof of an organization's capability to deliver quality results to their customers:
  - This proof is a precondition for companies to participate in public tenders (offers) of the Single European Market.
  - Product liability: in case of damages caused by the product, the question of liability can be clarified easier (Documentation of a suitable QA-System).
- Marketing (no longer: Made in Germany, but: ISO 9000 certified)
- The certificate is not given for unlimited time but can be deprived again. After the certification, checks are made regularly

➔ Permanent obligation to maintain the QA-system

Der erste deutsche Automobil-hersteller, dem der TÜV in allen Bereichen erste Qualität bescheinigt:

Audi.

Erste Qualität im Modellbau: Teamarbeit bei der Prototypenentwicklung anhand des ersten Plastillinmodells.

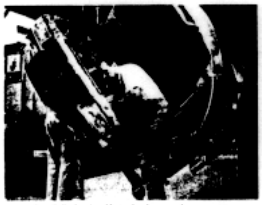
Erste Qualität in der Fahrzeuggeometrie: Entwicklung von CAD-Konstruktionsplänen nach Entwurfskizzen.

Erste Qualität im Design: Finish mit Oberflächenkontrolle am 1:1-Modell.

Erste Qualität in der Motorenfertigung: gruppenorientierte Montage des V6-Motors.

Erste Qualität in der Lackiervorbereitung: Kontrolle der vollverzinkten Karosserie.

Erste Qualität bei der Türmontage: Komplettierung mit Hilfe des Fahrerlosen Transportsystems (FTS).



Erste Qualität in der Unterbodenmontage: ergonomisch günstige Fertigung mittels Schwenkgehänge.

Erste Qualität beim Motoreneinbau: Verbindung der Antriebseinheit mit der Karosserie.

Erste Qualität bei der Dichtigkeitskontrolle: optische 100%-Prüfung der Innenraumisolation.

Erste Qualität bei der Fehleranalyse: Prüfung aus Kundensicht mit direkter Rückmeldung an die Fertigung.

Erste Qualität bei der Fahrzeugvorbereitung: letzte optische Überprüfung vor der Auslieferungsfreigabe.

Erste Qualität bei der Fahrzeugauslieferung: Übergabe des Automobils an den Audi Kundenberater.

Als erster deutscher Automobilhersteller erfüllt Audi die DIN ISO 9001. Und erhält damit die wichtigste Auszeichnung für erstklassige Qualität in Europa.

Das Zertifikat gilt für sämtliche Audi Unternehmensbereiche: Entwicklung und Planung, Logistik und Produktion, Marketing und Kundendienst.

Ausgestellt wird es vom TÜV-CERT, einem unabhängigen Prüf-Institut. Von 1996 an ist jeder Hersteller, der eine europaweite Zulassung beantragt, zur Zertifizierung verpflichtet. Solange wollten wir unsere Kunden allerdings nicht warten lassen. Daß wir die Auszeichnung auf Anhieb und als erster deutscher Automobilhersteller erhalten haben, ist das Ergebnis der Audi Qualitätsstrategie. Basierend auf dem Grundsatz: Vorsprung durch Technik.

Wie ernst unsere Mitarbeiter diesen Grundsatz nehmen, zeigt sich in jedem einzelnen Audi Automobil. Weil darin all die Werte stecken, die weit über den Standard hinausgehen.

Am besten lernen Sie die ausgezeichnete Audi Qualität bei einer Probefahrt kennen. Wozu Sie unsere Partner recht herzlich einladen.

Übrigens behalten wir unser Wissen, wie man mit erster Qualität höchste Anforderungen erfüllt, nicht für uns. Sondern geben es im Rahmen der Audi Akademie auch gern an andere Unternehmen weiter.

Nähere Auskünfte erhalten Sie unter der Telefonnummer 0841/9 66 02-0.

Audi.
Vorsprung durch Technik.

Product Liability and ISO 900X

- Product liability is the obligation to make up for a damage caused by a defective product
- In Germany regulated since 1990 by the product liability law
  - Adds to the contract and tort laws
  - The terms product, fault/defect, producer can be interpreted differently (e.g. dealer or seller can be regarded as producer ➔ liable to the full extent)
- Producer is liable for consequential damages
  - To persons in the private and industrial sector
  - To property in the private sector
- An effective liability exclusion is not possible
- Faults/defects and damages to the product itself do not come under the product liability law

Product Liability and ISO 900X

- Claimant only has to prove a resulting damage
- The fault of the producer concerning the defect does not have to be proven
- The producer has to acquit himself of the fault presumption
  - Proof that the defect did not exist at the time of placing the product on the market
  - Proof that the defect was not avoidable according to the state of the scientific and technical knowledge. Existence of a quality management system (e.g. ISO 900X) can possibly facilitate this

Contents of DIN ISO 9000-3

- It is certified according to DIN ISO 9001: the DIN ISO 9000-3 standard is a reading aid
- QA-System - frame
  - Responsibility of the top management
  - Quality assurance system, internal quality audits, corrective actions
- QA-System – life cycle activities
  - Contract verification, determination of the requirements on the part of the client
  - Planning of the development, planning of the QA
  - Design and implementation, testing and validation
  - Acceptance, duplication, delivery and installation, maintenance
- QA-System – supporting activities
  - Configuration management, management of documents, quality records
  - Measurements, rules, methods and agreements, tools and techniques
  - Acquisition/provision, subcontractor management, training

Who Gives the Certificate?

- Certificates are given by external auditors of accredited certificate authorities, e.g.
  - Technical inspection authorities: RWTÜV systems engineering GmbH - institute for information technology, Essen; TÜV Bavaria-Saxony, Munich; TÜV Cert e.V., Bonn
  - DEKRA AG certification center, Stuttgart; Landesgewerbeanstalt Bavaria, Nuremberg
  - Germanic Lloyd QA certification center, Hamburg; association of the property insurer (Verband der Sachversicherer) (VdS) e. V., Cologne
  - VDE inspection and certificate authority, Offenbach; German association of materials research and testing, NRW, Dortmund; association of the railway vehicle construction for the certification, Berlin
- This list is not complete
- Not each of the listed certificate authorities certifies every branch/sector

What can be certified?

- Business companies
- Parts of business companies (e.g. business areas)
- Process for individual products

Procedure of a Certification

- Preparation
  - Classification of the material affected by DIN ISO 9001
  - Identification of problem areas
  - Implementation of required modifications:
    - Modification of problem areas (e.g. closing of gaps in the guidelines)
    - Training of staff members, training of internal auditors
    - Execution of internal preparation audits
- Execution of the certification
  - Information of the concerned persons
  - Monitoring of the external certifiers
- After the certificate is granted (continuously)
  - Internal Q-audits, management reviews, monitoring and re-audits, training

Comparison: DIN ISO 9001 and Software Process Assessments

	DIN ISO 9001	Software Process Assessment
Subject	Multitude of industrial organizations, products and procedures	At the moment intended for pure software development processes
Goal	Proof of qualification for the generation of quality-compatible results	Detailed objectives and priority specifications for the improvement of the process
Status	Fixed de facto standard	Useful means for problem analysis and process improvement
Basis	Fixed standard text	Flexible Capability Maturity Model
Requirements	Minimal requirements (have to be met without exception)	Hierarchy of demands/requirements depending on the level
Result	Accepted certificate	Actual state, strengths and weaknesses profile
Costs vs. benefit	Benefit is founded by the given certificate	Savings due to process improvements vs. costs for the assessments and the improvement activities

Summary

- The certification according to DIN ISO 9001 has gained importance as verifiable qualification criterion in the quality assurance was achieved.
- The main focus of the ISO 9001-certification is the proof of a QA-system according to the standard. The main focus of the CMM-assessment is on increasing the quality and productivity of the complete SW development process.
- There exists no conversion formula between the ISO-certification and CMM-levels.
- DIN ISO 9001-certification and assessments are no alternatives but approaches which complement each other
  - Economic reasons for certification: the client expects a certificate. Competitors are also certified
  - Technical reasons for assessment: productivity, quality, time saving

Literature

- DIN EN ISO 9000-3, Normen zum Qualitätsmanagement und zur Qualitätssicherung / QM-Darlegung - Teil 3: Leitfaden für die Anwendung von ISO 9001:1994 auf Entwicklung, Lieferung, Installation und Wartung von Computer-Software (ISO 9000-3:1997); Zweisprachige Fassung EN ISO 9000-3:1997, Berlin: Beuth Verlag, August 1998
- DIN EN ISO 9001, Qualitätsmanagementsysteme - Anforderungen, Berlin: Beuth Verlag, 2008.