QUALICHeCK
Towards better quality and compliance

Towards improved Quality of Works

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Workshop “Voluntary and Regulatory Frameworks to Improve Quality and Compliance”

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Quality of Works within QUALICHeCK

Tasks:

- Examples of existing situations regarding the quality of works
- Analysis of the reasons for good and poor quality of works
- Set of possible approaches (‘best practices‘) for improved quality of works

Approach:

- 3 reports based on the tasks
- Factsheets on interesting approaches
- Working together with other focus areas within QUALICHeCK: data collection from participating countries, better compliance and effective penalties
- Market feedback: stakeholders, QUALICheCK platform, events, webinars, road shows, BUILD UP Skills

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Critical Situations on the Construction Site

Critical situation	QUALICHeCK focus area	Transmission characteristics: Whole component	Transmission characteristics: Thermal bridges	Ventilation: Airtightness of envelope	Ventilation: Airtightness of ducts	Ventilation: Systems	Sustainable summer comfort technologies	Renewables in multi-energy systems
Very general	No or poor specifications of product performances	D1	D1				D1	
	No or poor specifications of execution performances					A2		
	No framework for control of performances							
	Time pressure	S1, S4	S1, S4	S1, S4	S4	S4	S4	S4
	Language barriers at construction sites							
	Insufficient knowledge of new techno-logies/construction workers not adequately trained	C1 / E1 / R1 / S1 / S4 / AIII / CI	C1 / E1 / R1 / S1 / S4 / AIII / CI	C1 / E1 / R1 / S1 / S4 / S5 / AII / AIII / CI	E1 / S4	E1 / R1 / S4 / AI / AII	C1 / E1 / S4 / CI	C1 / E1 / R1 / S4 / AI / AII/ CI
	Necessary specialists not part of the construction team	C1 / R1 / S4 / AIII / CI	C1 / R1 / S4 / AIII / CI	C1 / R1/ S4 / S5 / AIII / CI	S4	R1 / S4 / AI / AII	C1 / S4 / CI	C1 / R1 / S4 / AI / AII / CI
	Poor communication between planners and contractors	S4 / SIII	S4 / SIII	S4 / S5 / SIII	S4 / SIII	S4 / SIII	S4 / SIII	S4 / SIII
	Lack of technical details (improvisation on construction site)	S4 / EI	S4 / EI	S4 / S5 / EI	S4 / EI	S4 / EI	S4 / EI	EU2 / S4 / EI
	Constructed building components/ technologies not documented as a basis for subsequent maintenance						AI	EU2 / AI

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Building envelope / Opaque / General	Wrong (insulation) material: λ-value, thickness, etc.	D1 / E2 / S2 / CI / RI					D1 / CI	
	Incomplete or incorrectly installed insulation layer: gaps, uneven surfaces	S1 / C1 / EI / RI / UKI / UKII	S1 / CI / EI / RI / UKI / UKII				EI	
	Incompatible (insulation) material to specific situations: e.g. vacuum insulation	RI						
	Damages of insulation material during construction	E2 / S1 / RI	RI					
	Wet (insulation) material: storage on site, protection during construction	E2 / S1 / RI						
	Incorrect waterproof layers in wet areas (bathrooms, etc.)	E2 / S1 / RI / SI	RI					
	Not enough drying time for built-in moisture (concrete, wood)	E2 / RI						
	Wrong airtightness material			EI / RI				
	Incomplete air or moisture barrier	E2 / RI	RI	RI	RI			
	Damages of air or moisture barrier during the implementation	E2 / RI	RI	RI				
	Joints not realised with insulation according to requirements/design		D1 / RI					
	Joints not watertight/airtight	E2 / S3 / RI	RI	E2 / RI				
	Incorrectly realised joints due to installations (pipes, ducts)							

Critical Situations on the Construction Site

Critical situation / QUALICHeCK focus area				Transmission characteristics		Ventilation			Sustainable summer comfort technologies	Renewables in multi-energy systems
				Whole component	Thermal bridges	Airtightness of envelope	Airtightness of ducts	Systems		
Building envelope	Opaque	Compo-nents to ground	Wrong (insulation) material: water resistance	E2 / S1 / RI						
		Base slab/ foun-dations	Wrong (insulation) material: pressure resistance	E2 / RI						
		Ventila-ted roof	Not enough air space for ventilated roof							
			Not enough openings for ventilated roof							
		Cool roof	Wrong coating for cool roof						US-GI	
	Transparent	General	Wrong windows or façade elements: U-value	D1 / RI					D1	
			Wrong windows or façade elements: g-value, τ-value	D1 / RI					D1	
			Joints between windows and walls not insulated		D1 / E2 / DI / DII / EI / RI					
			Joints between windows and walls not watertight/airtight	D1 / E2 / S1 / RI	D1 / S1 / DI / DII / EI / RI	D1 / S1 / EI / RI				
		Shading systems	Top mounted roller shutters uninsulated at contact surface to wall		D1					
			Blinds without sufficient rear-ventilation							

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Critical situation / QUALICHeCK focus area			Transmission characteristics		Ventilation			Sustainable summer comfort technologies	Renewables in multi-energy systems
			Whole component	Thermal bridges	Airtightness of envelope	Airtightness of ducts	Systems		
Building service systems	General	Wrong system components installed: collector peak load, inverter efficiency, fan efficiency, pump efficiency, etc.							
		Incorrect setting of hydraulic flows							A1, S1, EU2
		No hydraulic calibration							
	Fixation	Incompatible mounting material: anchors, etc.							
	Pipes/ ducts	Wrong diameters of pipes/ducts							
		No/poor insulation of pipes/ducts							
		No accessibility for cleaning							
		Duct connections not airtight				EU1 / SII			
		Joints with other system components not airtight: fan, AHU				EU1 / SII			
	Control	Wrong settings: night setback, CO_2/humidity/temperature controls							A1, EU2
	PV system	Damaged PV cells							
		Not enough rear ventilation							
		Cables: Mistakes regarding parallel vs. series connection							
		No connection to inverter							
		Insulation behind the arrays not high temp.resistant							
		Incorrect installation on the roof, causing water leakage							
		Incorrect instllation on the roof, causing damages on							D1

Critical Situations on the Construction Site

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Building service systems	Solar thermal	Not enough distance/insulation behind collectors at walls/roofs							
		Insulation behind the panels not high temperature resistant (e.g. integrated in facades)							
		Storage feed-in at middle/top							EU2
	Heat pump	Setting: no priority for DHW							
		Storage feed-in at top (DHW) and middle (heating)							
		Too low refrigerant quantity							F1
		Incorrect positioning of the outdoor unit (too close to walls, in an attic) -> poor performance							F1
		Time for defrosting of the outdoor heat exchanger set at a too low value -> poor performance							F1
	Ventilation system	Setting of airflow rate on default instead of specific necessary setting/wrong air flow rates							
		Required filters not included					A2		
		No electrical connection of the auxiliary heating					F1		
		Installation without accessibility for maintenance					A2		

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Documented Examples of existing Situations regarding Quality of the Works

Reasons for poor quality:

1. Poor specifications at level of projects, standards, regulations:
   a. Materials to be used (e.g. material characteristics of insulation, correct construction details (joints), …)
   b. Performances to be achieved (e.g. air- and watertightness, wind resistance for PV panels, acoustical performances of ventilation systems, …)
   c. With respect to the execution principle (e.g. under which conditions may roofing be installed
2. Lack of competence
   a. Designer level (see also QUALICHeCK work package "Reliable and easily accessible input data")
   b. Execution level
   c. Language barriers
3. Critical economic conditions
   a. Critical financial conditions
   b. Critical timing conditions
4. Lack of control
   a. By parties involved in the project
   b. By third parties (government, independent control organisations, …)

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Documented Examples of existing Situations regarding Quality of the Works

Study	Country	Reported by	Covered areas	Date of study	Transferability	Results/consequences
Field test on combined heat pump and solar thermal systems	Austria	OEGNB	Heat pumps, solar thermal systems	2010-2013	National, international	Revised training material for installers
Study on ventilation systems in classrooms	Austria	OEGNB	Mechanical ventilation systems in classrooms	2008	National, international	Revised training material for ventilation installers
Impact of storm on PV systems	Belgium	BBRI	Installation of PV systems	2010-2013	National, international	Development of design and installation specifications
Cypriot analysis of the National Status Quo within BUILD UP Skills	Cyprus	The Cyprus Institute	Insufficient knowledge/ training, necessary specialists not part of construction team	2012	National, international	Roadmap for policies and actions for construction sector employees
Burgholzhof study	Germany	Fraunhofer IBP	Insulation material, quality of windows, thermal bridges, window seams, roller shutters	2002	National, international	General: U-value definitions of glazings have been revised; practical recommendations
Estonian analysis of the National Status Quo within Build Up Skills	Estonia	Tallinn University of Technology	Insufficient knowledge of new technologies/construction workers not adequately trained	2012	National	The number of skilled workforce needs to be increased
Estonian housing stock technical condition – apartment buildings (1990-2010)	Estonia	Tallinn University of Technology	Insulation material, damages on construction site, wet insulation, waterproof layers, built-in moisture, moisture and air barriers, joints	2010-2012	National, countries with similar constructions & climate, partly international	Guidelines for designers and builders
Quality of ventilation systems in residential buildings: status and perspectives in Estonia	Estonia	Tallinn University of Technology	Ventilation systems: Joints not airtight, no accessibility for cleaning/ maintenance, wrong settings, filters not included	2013	National, partly international	Guidelines for HVAC designers and builders
EU project SAVE DUCT	EU (focus on BE, F, S)	BBRI	Ductwork, airtightness	1997-1998	International	Recommendations to use circular ducts and factory-fitted sealing gaskets

17 documented Examples of existing Situations regarding Quality of the Works

Study	Country	Reported by	Covered areas	Date of study	Transferability	Results/consequences
EU project CombiSol	EU (focus on A, F, D, S)	OEGNB	Installation of solar thermal systems	2007-2010	International. Test included systems from 4 countries	Guidelines for manufacturers and installers
Study on common problems with heat pumps	France	Cetiat	Heat pumps	2009	National only	Advice to join the quality label QualiPac
Romanian analysis of the National Status Quo within Build Up Skills	Romania	URBAN-INCERC	Time pressure, insufficient knowledge/training, necessary specialists not part of the construction team	2012	National	Starting point for the definition of a national qualification strategy and a roadmap
Småhuss-kadenämnden (The board for moisture and mould damages in single-family house)	Sweden	Chalmers University of Technology	Time pressure, insufficient knowledge/training, insulation material, construction damages, wet material, waterproof layer, water resistance, hydraulic flows	2001	National, countries with similar constructions & climate, partly international	Education and information reg. less risky construction types. Foundations with insulation above concrete slabs are no longer used.
Wrong insulation material in loose fill insulations in attics	Sweden	Chalmers University of Technology	Wrong insulation material; λ-value, thickness, etc.	1998	International	Practical recommendations for improvement
Problems with external thermal insulation composite systems (ETICS)	Sweden	Chalmers University of Technology	Joints not watertight/airtight	2009	National, countries with similar constructions & climate	Recommendations for safe ETICS constructions in the Swedish situation
The causes and costs of defects in construction	Sweden	Chalmers University of Technology	General, especially lack of motivation/ control	1999	Probably international	45 % of the detected defects originated from the construction site, mostly by lack of motivation
Factors that affect the building's air tightness	Sweden	Chalmers University of Technology	Building airtightness	2010	National, countries with similar constructions	Recommendations for improved building airtightness (0.3 l/sm²)

Example: Burgholzhof: Surveillance of Design and Construction Work

- 500 residential units in low energy level
- Fraunhofer IBP contracted by city of Stuttgart to check EP calculations, design of joints, realisation on site
- Quality check for all three parts was important:
  - Proofs of thermal protection had to be corrected, up to 4 times
  - Many of the details had to be improved/clarified by adding material descriptions, etc.
  - Windows U-values and g-values did not meet specifications (at that time two types of U-values: measured acc. DIN and officially published with „safety“ allowances, g-values deemed less important)
  - Thermal separation of balcony plates not accurate, filled partly with mortar or concrete (thermal bridges)
  - Window seams filled with polyurethane foam (not durable elastic)
  - Insulation material with inferior thermal conductivity
  - Top mounted roller shutters create thermal bridges at the location where the shutters are on top of the wall
  - Additional insulation on the inner side of cellar walls problematic (pipes, fixtures)

15 Best Practice Examples to solve the critical Situations

Solution	Country	Reported by	Covered areas	Date of solution	Type of solution	Legal/ other	Transfera-bility
Training and certification schemes for installers at AIT	Austria	OEGNB	Installation of heat pumps, PV, solar thermal and ventilation systems	Since 2001	Training and certifica-tion of installers	Voluntary, recommended by klimaaktiv	Yes
Guidelines, check-lists and commissio-ning protocols by professional associations	Austria	OEGNB	Installation of heat pumps, PV, solar thermal and ventilation systems	Since ca. 2005	Guideline, checklist, Comm. protocol	Voluntary	Yes
Voluntary building certification including measure-ments	Austria	OEGNB	Building envelope quality	Pilot phase in 2001, in place since 2003	Quality assessment by third party	Voluntary	Yes
IEE project WE-Qualify	Cyprus	The Cyprus Institute	Knowledge/training, specialisation, material, installation, damages during construction, wet material, roller shutters	2013 + 36 months	Education of workers (training material + training)	Recommen-dative/ volun-tary	In general yes
Scheme of Vocatio-nal Qualifications: I have the qualifi-cations. I certify!	Cyprus	The Cyprus Institute	Knowledge/training, specialisation	2013, ongoing	Education and certi-fication of workers	Recommen-dative/ volun-tary	In general yes
RAL Window and Front Door Installa-tion Guideline	Germany	Fraunhofer IBP	Window installation, airtightness, water tight-ness, thermal bridges at window/wall connection	Since 1998, regular updates	Guideline and education of workers	Accepted rules of technology	Yes
RAL Certification of Window Installation	Germany	Fraunhofer IBP	Window installation, air-tightness, water tight-ness, thermal bridges at window/wall connection	Since 1998	Certification of manufacturer including installation	Voluntary	Yes

15 Best Practice Examples to solve the critical Situations

Solution	Country	Reported by	Covered areas	Date of solution	Type of solution	Legal/ other	Transfera-bility
Guidelines for dwelling designers, builders, owners	Estonia	Tallinn University of Technology	Technical details, insulation layers, airtightness material, joints	2010-2012	Guideline	Voluntary	Yes
BUILD UP Skills QualiShell project	Romania	URBAN-INCERC	Knowledge/training, qualification of wor-kers, building envelope: transmission charact. + envelope airtightness	2013-2015	Qualification schemes, mechanism for long lasting large scale implementation	Integrated in the national qualification system	Partially
Swedish guidelines on waterproof layers in wet areas (GVK, BBV)	Sweden	Chalmers University of Technology	Waterproof layers in wet areas	Since 1988	Education of workers, guidelines and authorisation of companies	Voluntary, several insurance comp. require work acc. GVK/BBV	Yes. Negotia-tions with insurance companies
Quality framework for ducts	Sweden	Chalmers University of Technology	Air duct tightness	Since 1966	Airtightness test and certification	Voluntary, but applied in 90-95% of buildings	Yes
Guideline BuildE – Energy efficient	Sweden	Chalmers University of Technology	Communication between planners and contractors	Initiated in 2013	Checklist, guidelines, standardisation of calculation tools	Voluntary	Probably yes
Quality framework CIGA for insulation of cavity walls	UK	Fraunhofer IBP	Cavity wall insulation	Since 1995	Certificate for installers, guarantee for home owners	Voluntary	In general yes. Connection to UK ministries
Quality framework SWIGA for insu-lation of solid walls	UK	Fraunhofer IBP	Solid wall insulation	2010	Certificate for installers, guarantee for home owners	Voluntary	In general yes. Connection to UK ministries
Guideline for selecting cool roofs	US/ Greece	University of Athens	Cool roofs	2010	Guideline	Voluntary	Countries/regi ons with hot climate and limited roof insulation

Example: UK Quality Framework CIGA for Insulation of Cavity Walls

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- Cavity Insulation Guarantee Agency (CIGA)
- Established in 1995
- Provision of 25 years guarantee for cavity wall insulation fitted by registered installers in the UK
- Residential and non-residential buildings
- List of system designers and installers
- Guarantee covers defects in material + workmanship
- Since 2013 „hard to treat“ cavity insulation guarantee for homes with > 3 storeys or walls with narrow cavities
- CIGA HTT Guarantee was issued for nearly 130000 home owners within 2013

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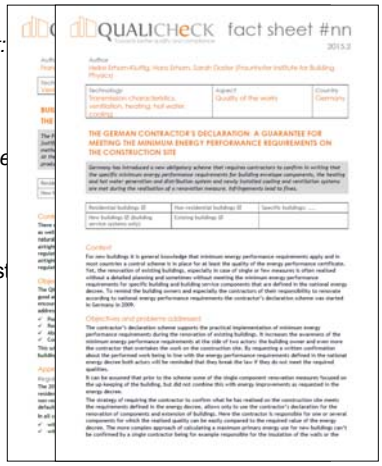
What‘s in the pipeline?

- Fact Sheet:
  „Building regulations can foster quality management: The French example on building airtightness“
- Draft Fact Sheet:
  „The German Contractor‘s Declaration – A guarantee for meeting the minimum energy performance requirements on the construction site“
- Contact with organisations being responsible for best practice solutions included in the report
  > feedback needed
- Search for additional best practice solutions


QUALICHeCK fact sheet #nn

THE GERMAN CONTRACTOR'S DECLARATION: A GUARANTEE FOR MEETING THE MINIMUM ENERGY PERFORMANCE REQUIREMENTS ON THE CONSTRUCTION SITE

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