

Deliverable D6.2

Contractual Agreements for Quality Management for the building performance (Technical Monitoring)

Authors: Margot Grim, Manuel Krempf (e7 Energie Markt Analyse GmbH)

Co-Authors: -

Abstract: The contractual agreements scope services of the most relevant stakeholders in the process. The quality manager, the designer for HVAC-systems, the construction company and the construction supervisor on site.

PROJECT & DOCUMENT DATA			
Project	Quantum	Document Type	Deliverable, Contractual Agreements
Project number	680529	Title	Technical Monitoring in existing buildings
Lead beneficiary	e7 Energie Markt Analyse (e7)	Version	V.2.0
Duration	01.01.2016 - 31.12.2019	Due Date	09.11.2017
Funding code	H2020-EeB-2014-2015/H2020-EeB-2015	Date of last correction	13.08.2019
Funding	This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 680529.		

The sole responsibility for the content of this paper lies with the authors. It does not necessarily reflect the opinion of the European Commission (EC). The EC is not responsible for any use that may be made of the information it contains.

QUANTUM Consortium



TECHNISCHE UNIVERSITAET BRAUNSCHWEIG (IGS)
POCKELSSTRASSE 14, BRAUNSCHWEIG 38106
Germany



ENESA a.s. (EA)
U Voborniku 852/10, Praha 919000
Czech Republic



COWI A/S (COWI)
PARALLELVEJ 2, KONGENS LYNGBY 2800
Denmark



NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU (NTNU)
HOGSKOLERINGEN 1, TRONDHEIM 7491
Norway



ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON (UOA)
6 CHRISTOU LADA STR, ATHINA 10561
Greece



EKODOMA (EKO)
Zentenes street 12-49, RIGA 1069
Latvia



ENERGY TEAM SPA (Energy Team)
VIA DELLA REPUBBLICA 9, TREZZANO SUL NAVIGLIO
20090
Italy



FACTOR 4 BVBA (Factor4)
KRUISSTRAAT 127, DUFFEL 2570
Belgium



e7 ENERGIE MARKT ANALYSE GMBH (e7)
WALCHERSTRASSE 11/43, WIEN 1020
Austria



SYNAVISION GMBH (SYNA)
SCHOENAUER FRIEDE 80, AACHEN 52072
Germany



CESKE VYSOKE UCENI TECHNICKE V PRAZE (CVUT)
ZIKOVA 4, PRAHA 16636
Czech Republic



FEDERATIE VAN VERENIGINGEN VOOR VERWARMING EN LUCHTBEHANDELING IN EUROPA VERENIGING (REHVA)
De Mulderij 12, Leusden 3831 NV
Netherlands



BUILDING RESEARCH ESTABLISHMENT LTD (BRE)
BUCKNALLS LANE, WATFORD WD25 9XX
United Kingdom



POLITECNICO DI MILANO (eERG-PoliMI)
PIAZZA LEONARDO DA VINCI 32, MILANO 20133
Italy





1 Inhalt

2	INTRODUCTION.....	5
2.1	WHY SPECIAL CONTRACTUAL AGREEMENTS FOR QUALITY MANAGEMENT?.....	5
3	INTERFACES TO OTHER TASKS	5
4	CONTRACTUAL AGREEMENTS	7
4.1	CONTRACTUAL AGREEMENTS FOR THE QUALITY MANAGER.....	7
4.1.1	DESIGN PHASE	7
4.1.2	PLAN OF EXECUTION / DETAILED PLANNING	8
4.1.3	PREPARATION OF THE TENDER	9
4.1.4	PHASE OF CONSTRUCTION UNTIL HANDOVER.....	9
4.1.5	FIRST USE PHASE / WARRANTY PERIOD	10
4.2	ADAPTION OF SERVICES OF THE DESIGNER/ENGINEERING OF HVAC-SYSTEMS	11
4.2.1	PRELIMINARY DESIGN PHASE	11
4.2.2	DESIGN PHASE	11
4.2.3	TENDERING	12
4.2.4	PHASE OF EXECUTION PLANNING / DETAILED PLANNING.....	12
4.3	CONTRACTUAL AGREEMENTS FOR CONSTRUCTION COMPANIES	12
4.3.1	PHASE OF EXECUTION PLANNING / DETAILED PLANNING.....	12
4.3.1	PHASE OF CONSTRUCTION UNTIL HANDOVER.....	13
4.3.1	FIRST USE PHASE / WARRANTY PERIOD	13
4.4	CONTRACTUAL AGREEMENTS FOR CONSTRUCTION SUPERVISION ON SITE.....	13





- 4.4.1 PHASE OF EXECUTION PLANNING / DETAILED PLANNING..... 13
- 4.4.1 PHASE OF CONSTRUCTION UNTIL HANDOVER..... 13
- 4.4.1 FIRST USE PHASE / WARRANTY PERIOD 13
- 5 APPENDIX 1 14



2 INTRODUCTION

2.1 WHY SPECIAL CONTRACTUAL AGREEMENTS FOR QUALITY MANAGEMENT?

In an ideal world, the building developer orders an energy efficient building and gets it ready adjusted after the construction and commissioning phase for his intended use. In reality, many completed buildings require years of effortful adjusting and optimising. This results in much higher follow-up costs (including energy and maintenance as well as claim management) and the recognition of the builder that he did not get the ordered quality.

Being able to identify a cause is often not possible, as it is unclear where mistakes have occurred: the client suspects deviations of the planning from his requirements, the planner points to incorrect implementation of his planning, but the installer locates exactly in the planning the defects. The facility manager criticizes the insufficient documentation for an efficient operation and in the end, the building user is to blame, who causes due to his inefficient user behavior the higher costs himself.

The increasing complexity of construction projects and the increasing number of project participants - client, planner, construction companies, facility managers, users - brings along many interfaces, which are often defined inadequately. And even if all services according to ordered service descriptions are 100% fulfilled, the detection of ordering, planning, execution, functional, documentation and management faults is often too late to make a change. This is partly because each party primarily fulfills its own service description, and no one has the entire building in view. Additional to that, due to the notorious lack of time that exists in every project, inadequate, cross-functional functional and performance tests are executed in the built-in systems.

For a proper quality management for the building performance, additional tasks have to be done by each stakeholder and all interfaces have to be clearly defined. Imprecise service descriptions of each stakeholder have to be sharpened with clear task descriptions and deliverables.

In this WP the interfaces between the relevant stakeholder will be defined with an "interface-matrix". Thus, each service provider knows exactly his task description and who will be responsible for the step before and after this task. This should help to make the process more transparent and thus easier to find out responsible persons for the delivered quality in the long run.

3 INTERFACES TO OTHER TASKS

In order to embed Deliverable D6.05 properly into the QUANTUM project, there are several interfaces to other tasks.

Interface to Task 1.6 & 3.01

Within work package 3 (Task 3.01), the underlying service descriptions were developed, based on the defined generic quality management process (Task 1.02) and service requirements elaborated which rest on an initial gap analysis and an analysis of existing building development processes (Task 1.06).

Finally, 6 service descriptions have been developed, from which 3 can be grouped as "Technical Monitoring" and thus be allocated to service segment 2.

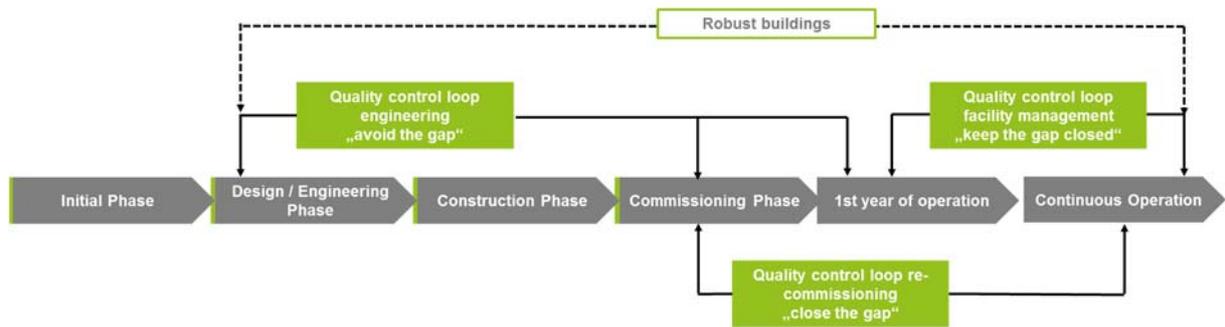


Figure 1: Quality Securing Process in the built environment

A main output of task 1.6 was the definition of gaps, why these quality management tasks are not done in common projects. This outcome was very important for the elaboration of interfaces matrix this task should be integrated into the service descriptions and contracts of the different stakeholders.

Interface to Task 3.5

Task 3.5 collected input from experiences out of pilot projects. These experiences indicated whether the developed services are practicable or have to be adapted in some way. The experiences were important to find further arguments for contractual agreements as building developers often still think, that they will become the ordered quality without a quality management process.

Interface to Task 6.1 and 6.4

In Task 6.1 and 6.4 the business models and business plans were developed. Within this task the pains and needs of the potential clients were investigated and similar, competitive services were studied. This helped to be more convinced, that clear contractual agreements within the service descriptions of the different stakeholder are needed to clear the additional value of the quality management process in comparison to competitive services or to convince building developer of the need of such clarifications.

4 CONTRACTUAL AGREEMENTS

To elaborate contractual agreements respectively text modules for contracts, it is important to know who are the responsible stakeholders, where the relevant interfaces are and who is in charge of which task. Thus, a big stakeholder interfaces matrix was developed with all relevant tasks to deliver a good quality management service for building performance (Technical Monitoring). This interface matrix shall support building developers to precise the service descriptions of the different contractors.

For building developers who would like to bring more transparency into their building development process, the matrix can be handed-over to their contractors. So, every project participant has not only a clear understanding of the own tasks and responsibilities, but also about who is in charge for the step before or the step after each task.

This interface matrix is be seen in Appendix 1.

4.1 CONTRACTUAL AGREEMENTS FOR THE QUALITY MANAGER

Within the QUANTUM project, the project partner synavision elaborated in cooperation with the AMEV (Arbeitskreis Maschinen- und Elektrotechnik staatlicher und kommunaler Verwaltungen/ Research Group for Mechanical and Electrical Technology, National and Communal Administration) a guideline for building developers to order a quality management service for building performance (Technical Monitoring). In Appendix 1 of the AMEV Guideline, a service description for such a quality manager is ready for use to integrate it into a tender. These text modules can be used also in other countries, where the quality manager shall be a new partner during the development process.

The following services can be ordered by building developers or potential cooperation partners, who want to integrate this service into their service (e.g. construction supervision, project manager). The services are sorted chronological along the design phase and their importance for the service (basic services are very important, additional services are very useful, but not necessary for the main part of the quality management).

4.1.1 DESIGN PHASE

Basic services

Preparation of the monitoring arrangement

- Screening of the supporting documents of design planning.
- Derivation of the relevant test parameters for the building and the systems as well as of the appropriate target values from the HVAC planners, respectively coordination and determination with the HVAC planners (e.g. give templates for functional descriptions).
- Integration and where appropriate, completion of measurement and metering systems for individual subsections of the system as a whole, including all interfaces and transfer formats.
- Specification of requirements for the data preparation and transfer.
- Preparation of a procedure regarding TMon service providers for the following project phases. In particular, the procedure should contain the quantity, dates and duration of trial operation as well as necessary preparatory work by other project participants.
- Cooperation in determining the jurisdiction and responsibilities of TMon service providers for the individual steps with the builder and the prospective client.
- Preparation of the monitoring arrangement with all the aforementioned details and transfer to the specialist planners.

Extra services

- Development of a strategy for the preparation of later transfer of information and data to the client.
- At the beginning of the design planning: testing of the planning services of the pre-design planning for completeness, timeliness, consistency and plausibly with respect to the objectives set forth by TMon as well as the preparation of an appropriate protocol. To be tested in particular in the planning services:
 - Exploration of and decision on solution possibilities
 - Pre-dimensioning of systems
 - Explanation of the essential interdisciplinary processes, boundary conditions and interfaces as well as the integration of technical systems

As needed, TMon supports the specialist planner or the commissioning management by consulting for the development of a foundation and, as needed, determines the need for extra services (e.g. extra commissioning management services, GA-integration planning, etc.).

- Before the conclusion of design planning: testing of the planning services from the design planning phase for completeness, timeliness, consistency and plausibility with respect to the objectives set forth by TMon as well as the preparation of an appropriate protocol. To be tested in particular are:
 - Compliance testing for the necessary values determined in design planning with the solutions compiled in the pre-design planning as well as of the general objectives set by the builder.
 - Testing of explanations of the essential interdisciplinary process, boundary conditions and interfaces as well as the integration of technical systems.

As needed, TMon supports the specialist planner or the commissioning management by consulting for the development of a foundation and, as needed, determines the need for extra services (e.g. extra commissioning management services, GA-integration planning, etc.).

- Support for the creation of an launch plan with temporal positioning of the individual measures and integration of the project requirements, while considering the plan for building time.

4.1.2 PLAN OF EXECUTION / DETAILED PLANNING

Basic services

Updating and creating a detailed report for the monitoring arrangement.

- Screening of the supporting documents of the plan of execution with respect to the consideration of the specifications of TMon and, as necessary, requests for important information from the specialist planners.
- Tracking of changes in target values as well as the measuring and evaluation strategies.
- Tracking and, if necessary, itemisation of the specifications for data preparation and transfer.
- Tracking and, if necessary, itemisation of the plan of procedure for the following project phases
- Definition of the requirements of TMon for start-up implementation as well as for functional testing and trial operations.
 - Note: one should be vigilant that eventual trial operations and functional measurements be written out as “Special Services” according to VOB/C, insofar as they already exceed the additional services to be rendered.
- Support for the specialist planners with regard to service descriptions, e.g. functional testing, counter calibration and data matching

- Transfer of the updated monitoring arrangement to the specialist planner for the integration of the specifications of TMon into the service descriptions.

Extra services

- Review of the execution plan for accessibility for launch, and later for maintenance.
- Determination and documentation of the extent of the installations and systems involved in the launch process, in the form of a detailed description of the technical systems and functional building components.
- Creation of a subsection-relationship matrix and development of an interface catalogue in the style of VDI 6039 (in the context of commission management, or
- Testing of the subsection-relationship matrix and the interface catalogue according to VDI 6039
- Compilation or development of checklists and trial protocols for the support of the executing companies in the commissioning phase, acceptance and handover of documentation of rendered functional evidence and performance measurements.
- Definition of requirements for an interdisciplinary commissioning.

4.1.3 PREPARATION OF THE TENDER

Basic services

- Checking to what extent the precise performance description has been included in the call for tenders.

4.1.4 PHASE OF CONSTRUCTION UNTIL HANDOVER

Basic services

Tracking of the monitoring arrangement and evaluation of the trial operations:

- Adjustment of the monitoring arrangement as needed.
- Adjustment and, if needed, detailing of the procedure.
- Coordination of the monitoring arrangement before commissioning with the specialist planners and the construction forms for individual trial operations (prerequisites, dates, participants, etc.).
- Testing and determination of whether the conditions for a trial operation are given, in particular:
 - Target values are confirmed by the specialist planners and builders.
 - Data collection and data transmission are functional (transfer of test data on a predefined path).
 - Systems can run automatically.
 - For trial operation, predefined load scenarios can be manufactured.
- Approval given to the builders or constructors for implementation of the trial operations appropriate to the monitoring arrangement.
- Acceptance of the operational data from the trial operations.
- Analysis and evaluation of the operational data retained from trial operations with respect to achievement of the target values.

- Preparation of a monitoring report, documentation of all test parameters with the appropriate target values and the measured actual values as well as a comparative evaluation. Deviations from the actual value from the target value, along with notes on possible causes or defects (e.g. faulty operational data, faulty parametrisation or poor adjustment) should be communicated to the builders or specialist planners, constructors and/or clients.
- In the case that trial operations are repeated, the appropriate services of TMon service providers should likewise be repeated. Repetitions of the services for additional trial operations are to be paid for separately at cost.
- Preparation of a final report as a summary of the services of technical monitoring and all results, especially the target values for the test parameters and the actual values reached in trial operations.
- Conduction of a final debriefing with with client.

Additional Services

- Verifying the contents of checklists and testing protocols after document return, with respect to completeness and plausibility.
- Support of trial operations on site, in particular for the adjustment of particular load conditions
- Support of interdisciplinary functional and performance testing in cooperation with executing companies and specialist planners. Verification of conformity to the project requirements.
- Support of the formal acceptance after VOB and consultation of the builder for the acceptance after VOB as well as regulatory acceptances.

4.1.5 FIRST USE PHASE / WARRANTY PERIOD

Basic services

- Tracking of the monitoring arrangement, e.g. with consideration for adjustments in use by the building management, in cooperation with the client.
- Recording, analysis and evaluation of the received operations data with respect to the achievement of the goal values relevant to the monitoring arrangement.
- Preparation of monitoring reports. Documentation of all test parameters with the appropriate target values and the measured actual values as well as a comparative evaluation. The reports should be represented in accordance with the trial reports for the trial operations. They each evaluate the preceding time period, up to the last trial report. The long-term test parameters specified in the monitoring concept are represented over the entire time period of monitoring.
- Deviations of the actual values form the test parameters, along with notes about possible causes (e.g. faulty operations data, faulty parametrisation or poor adjustment) must be communicated to the builders or specialist planners, constructors and/or clients.
- Preparation of a final report as a summary of the services of technical monitoring and all results, especially the target values for the test parameters and the actual values reached in trial operations.

Additional services

- Support of the operator for the optimisation of system operation, e.g. by notes for the adjustment of the system parameters for real operations behaviour.
 - Time period:
 - Quantity/Frequency:

- *Note: The planned extent of support should be designated a basis for calculation, e.g. 1x per week, monthly, etc.*
- Transfer of the installed software of the monitoring system to the builder for independent use and an introduction to its use.
- An extra monitoring report before the expiration of deficiency claims.

4.2 ADAPTION OF SERVICES OF THE DESIGNER/ENGINEERING OF HVAC-SYSTEMS

The following contractual texts are in addition to the usual scope of the service description of HVAC designers in order to contribute to the quality management service (Technical Monitoring) effectively. The following elements of the scope of offered service are closely linked to the interface matrix and show the necessary activities of the engineer to allow the Technical Monitoring to succeed.

4.2.1 PRELIMINARY DESIGN PHASE

Additional Services

- Comparison (technical, economic, ecological, operational relevant) of building technology alternatives for selection of HVAC/building control
- Pre-dimensioning of the selected variation
- Setting up a functional diagram or block diagram for each system and in conjunction with other systems.
- Contributing to the scheduling in consideration of performance checks during commissioning and trial operation
- Transfer of the current status of the plan of the preliminary design phase to the Technical Monitoring service provider

4.2.2 DESIGN PHASE

- Gathering the necessary information from the building owner/user for a comprehensive functional and control description of the systems. If he does not receive relevant information (e.g.: time of use, comfort requirements), he has to make an estimation - according to the intended use and define it as precisely as possible for each use zone as well as inform the client about the effects this may have on the operation.
- Coordination and definition of content of the monitoring concept together with the Technical Monitoring service provider (including test values, objective values, data provision and data transfer, scheduling of trial operations).
- Technical description of the system including functional and performance descriptions which are verifiable and without interpretation (target operating states including key performance indicators (KPI)) for the essential systems such as ventilation, heating, cooling, hot water according the enquired information from the Technical Monitoring service provider or to the given template for functional descriptions.
- Create a measurement and counting concept
- Creation of the commissioning concept for the relevant systems including integration of quality management for the performance tests.
- Contributing to the scheduling in consideration of performance checks in the course of commissioning and trial operation
- Transfer of the current status of the plan of the design phase to the Technical Monitoring service provider

4.2.3 TENDERING

- Integration of the precise functional and performance descriptions into the tender including the order to fill in the templates for the performance description equally transparently and with the same level of detail.
- Contributing to the scheduling in consideration of the performance tests in the course of commissioning and trial operation.

4.2.4 PHASE OF EXECUTION PLANNING / DETAILED PLANNING

If the execution planning/detailed planning is done by the design engineer for HVAC-Systems:

- Gathering the necessary information from the building owner/user for an update of the a comprehensive functional and control description of the systems. If he does not receive relevant information (e.g.: time of use, comfort requirements), he has to make an estimation - according to the intended use and define it as precisely as possible for each use zone as well as inform the client about the effects this may have on the operation.
- If necessary, update the monitoring concept together with the Technical Monitoring service provider (including test values, objective values, data provision and data transfer, scheduling of trial operations).
- If necessary, update the technical description of the system including functional descriptions which are verifiable and without interpretation (target operating states including key performance indicators (KPI)) for the essential systems such as ventilation, heating, cooling, hot water according the enquired information from the Technical Monitoring service provider or to the given template for functional descriptions.
- Contributing to the scheduling in consideration of performance tests in the course of commissioning and trial operation
- Transfer of the current status of the plan of the execution planning to the Technical Monitoring service provider

4.3 CONTRACTUAL AGREEMENTS FOR CONSTRUCTION COMPANIES

4.3.1 PHASE OF EXECUTION PLANNING / DETAILED PLANNING

If the execution planning/detailed planning is done by the constructor:

- Gathering the necessary information from the building owner/user for an update of the comprehensive functional and control description of the systems. If he does not receive relevant information (e.g.: time of use, comfort requirements), he has to make an estimation - according to the intended use and define it as precisely as possible for each use zone as well as inform the client about the effects this may have on the operation.
- If necessary, update the monitoring concept together with the Technical Monitoring service provider (including test values, objective values, data provision and data transfer, scheduling of trial operations).
- If necessary, update the technical description of the system including functional descriptions which are verifiable and without interpretation (target operating states including key performance indicators (KPI)) for the essential systems such as ventilation, heating, cooling, hot water according the enquired information from the Technical Monitoring service provider or to the given template for functional descriptions.
- Contributing to the scheduling in consideration of performance tests in the course of commissioning and trial operation

- Transfer of the current status of the plan of the execution planning to the Technical Monitoring service provider

4.3.1 PHASE OF CONSTRUCTION UNTIL HANDOVER

- Executing the commissioning of the individual systems and ensuring the proper interaction between the systems.
- Organise the data transfer from the BMS to the Technical Monitoring Provider
- Remedy of deficiencies after the performance tests

4.3.1 FIRST USE PHASE / WARRANTY PERIOD

- Remedy of deficiencies after recurring performance tests during the period of warranty

4.4 CONTRACTUAL AGREEMENTS FOR CONSTRUCTION SUPERVISION ON SITE

4.4.1 PHASE OF EXECUTION PLANNING / DETAILED PLANNING

- Updating the concept of commissioning management respectively the trial operation phase for the technical systems including integration of quality management for the performance tests.

4.4.1 PHASE OF CONSTRUCTION UNTIL HANDOVER

- Coordination of the construction companies during commissioning in order to execute performance tests in a row.
- Elaboration of detailed schedules for the commissioning and/or trial operation phase including the performance tests.
- Gather the necessary information for the performance tests (plans, schematics, functional descriptions, test reports, data exchange, etc.) from the construction companies.
- Checking whether implementation corresponds to the detailed planning, if necessary with functional checks.
- Coordination of the commissioning process
- Organisation of data transfer of performance data.
- Detection of faults; creation of the list of defects.
- Supervising of the remedy of defects. Contribute to the acceptance of construction work

4.4.1 FIRST USE PHASE / WARRANTY PERIOD

- Supervising of the remedy of deficiencies.



5 APPENDIX 1



Project-phase	Building owner/developer/client		Quality Manager for technical monitoring		Designer/Engineering of HVAC including building control		Constructor of HVAC including building control		Construction supervision on site		
	Task	Responsibility	Task	Responsibility	Task	Responsibility	Task	Responsibility	Task	Responsibility	
	planning	Integral planning	Demanding an integral, cooperative design process with communication rules. Ensuring that all participants have the same understanding of the goals and requirements.	Create an environment for a good collaboration. Secure the understanding of the common goal.							
Selection of technology (HVAC/building control)		Discussion which technologies shall be implemented into the building.	Decision of implemented technology			Comparison (technical, economic, ecological, operational relevant) of building technology alternatives for selection of HVAC/building control	Decision paper for building developer				
Quality management concept				Further development of the quality management concept based on the existing draft and the relevant stakeholders.	Organisation of the quality management process						
Ensuring common knowledge about quality management				Communication of responsibilities and interfaces regarding quality management to all relevant stakeholders (including possible updates and changes).	Ensuring everyone knows their responsibilities and interfaces regarding quality management.						
Design of the technical systems (HVAC/building control)						Planning of the individual technical systems and in conjunction with others.	Planning of technical systems				
Definition of test values for performance tests in the course of the trial operation				Further development of the test parameters for the performance tests and derived from this the templates for the functional description on the basis of the planned technologies (heating, ventilation, air conditioning, etc.).	Ensuring the necessary information for the performance tests during the trial and regular operation.						
Planning and describing the monitoring concept				Check whether all necessary data points for the performance tests are available in the measuring and counting concept or respectively the monitoring concept. If necessary, additional request for additional data points.	Ensuring the necessary information for performance tests during the trial and regular operation.	Elaboration of the measuring and counting concept as well as the energy and operational monitoring concept analogous to the specifications. Creation of a data point list.	Elaboration of the measuring, counting and monitoring concept.				
Gather necessary information		If necessary, further detailing of the usage requirements (occupancy, occupation time, etc.) and comfort requirements (temperature, indoor air humidity, indoor air quality, daylight quality and artificial light quality, acoustical quality (also with regard to technology), hygiene, etc.).	Compilation of necessary information of building usage for further design			Gather necessary information from the building developer/user for the comprehensive functional and control description of the systems. If not all relevant information are delivered by the building developer/user (for example: times of usage, comfort requirements) estimations have to be done, according to the intended use. These should be defined as precisely as possible for each activity zone and the building developer/user should be informed about the effects this may have on the operation.	Gathering respectively defining of missing information for the functional descriptions if necessary. Duty to notify, changes in functions and consumptions may occur if information is missing.				
Functional descriptions				Check the functional descriptions and the monitoring concept to what extent they are sufficient for the performance tests in the course of trial operation and later regular operation. If necessary additional request of additional data points and functional descriptions.	Ensuring the necessary information for performance tests during the trial and regular operation.	Description of the functions and control settings of individual systems and in conjunction with other systems with in the given template.	Precise, without interpretation, measurable description of the system function including performance goals.				
Commissioning concept		Check of the commissioning concept for plausibility also regarding the construction schedule.	Approval of the commissioning concept	Check to what extent the quality management has been integrated into the commissioning management and if necessary integrate this in that part in the commissioning concept.	Ensure that processes of the quality management are integrated into commissioning management.	Elaboration of the commissioning concept for the affected technical systems including integration of the quality management for the performance verification.	Commissioning concept				
Determine the schedule of functionality tests	Realistic construction schedule including sufficient time for performance tests as part of the trial operation	Sufficient time for trial operation including performance tests	Contributing to the construction schedule, in which performance tests are fixed as part of the trial operation. Procedure, scope and interfaces should be defined.	Duty to notify if the schedule is not appropriate to the task.							

Project-phase	Building owner/developer/client		Quality Manager for technical monitoring		Designer/Engineering of HVAC including building control		Constructor of HVAC including building control		Construction supervision on site		
	Task	Responsibility	Task	Responsibility	Task	Responsibility	Task	Responsibility	Task	Responsibility	
tendering	Elaboration of a tender without interpretation for the construction company		Checking to what extent the precise performance description has been included in the call for tenders.	Ensuring the necessary information for the performance tests during the trial and control operation.	Integration of the precise functional and performance descriptions into the tender including the order to fill in the templates for the performance description equally transparently and with the same level of detail.	Clear representation of the desired technology and functions in the tender, which can later be controlled and measured.					
	Allocation of responsibilities concerning performance of technical systems of buildings	Integration of responsibilities into the contracts	Contract design with regard to quality management	Text modules for contracts for the construction companies regarding responsibilities and interfaces in the quality management process.	Allocation of responsibilities and tasks regarding quality management process						
detailed planning	Quality management concept		Further development of the quality management concept based on the existing draft and the assigned stakeholders.	Organisation of the whole quality management process							
	Ensuring common knowledge about quality management		Communication of responsibilities and interfaces regarding quality management to all relevant stakeholders.	Ensuring everyone knows their responsibilities and interfaces regarding quality management.							
	Commissioning management	Check of the commissioning concept on plausibility also regarding the construction schedule.	Approval of the commissioning concept	Check to what extent the quality management has been integrated into the commissioning concept.	Ensure that processes of the quality management are integrated into commissioning management.				Updating the concept of commissioning management for the technical systems including integration of quality management for the performance tests.	Commissioning management	
	Gathering necessary information	If necessary, concretisation of the use and comfort requirements (temperature, indoor air humidity, indoor air quality, daylight quality and artificial light quality, acoustical quality (also with regard to technology), hygiene).	Provide requested information for further planning					The usage descriptions from the planning per activity zone should be updated if it is necessary. The existing usage definitions have to be reconcile with the client.	Gathering and if necessary defining missing information for function descriptions. Duty to notify, changes in functions and consumptions may occur if information is missing.		
	Planning of the executing	Check of the detailed planning	Approval of the detailed planning	Participation in the approval of the detailed planning regarding the necessary information for the performance tests (analog to the specifications of the earlier design process)	Ensuring the necessary information for the performance tests during the trial and regular operation.	If necessary, supervision whether the technical systems including their functional descriptions still agree with the planning and, if necessary, showing changes and their effects.	Supervisor for detailed planing, if systems meet the requirements of the design phase.	Detailed planning including description of the functions and control settings of individual systems and in connection with other systems regarding the given uses and the resulting requirements in the performance template.	Detailed planning: precise, interpretation free and measurable description of the system functions including performance goals and monitoring concept.		

Project-phase	Building owner/developer/client		Quality Manager for technical monitoring		Designer/Engineering of HVAC including building control		Constructor of HVAC including building control		Construction supervision on site		
	Task	Responsibility	Task	Responsibility	Task	Responsibility	Task	Responsibility	Task	Responsibility	
Construction Phase	Coordination of the commissioning, performance tests and hand over process								Coordination of the construction companies during commissioning in order to execute performance tests in a row.	Coordination of the participants on site	
	Detailed planning of the schedule								Creation of detailed schedules including date of completion and execution of functional / performance tests.	Creation of detailed schedules+G33:L34K34F31:E33:L34	
	Gathering the necessary information for the performance tests			Request the necessary information for the execution of performance tests (plans, schematics, functional descriptions, test reports, data exchange, etc.) from the construction supervisor on site.	Ensuring the necessary information for the performance tests during the trial and regular operation.			Elaboration of project documnetation	Documentation of the project execution	Gather the necessary information for the performance tests (plans, schematics, functional descriptions, test reports, data exchange, etc.) from the construction companies.	Compilation of project documentation
	Quality assurance of the construction work									Checking whether implementation corresponds to the detailed planning, if necessary with functional checks.	Quality assurance of construction
	Commissioning							Executing the commissioning of the individual systems and ensuring the proper interaction between the systems.	Commissioning	Coordination of the commissioning process	Commissioning management
	Defining active functional descriptions			Defining active functional descriptions (desired values) in the Performance Test Bench	Programming desired values for the performance tests			Provision of the BMS settings relevant for the execution of pernmance tests	Documentation of the BMS programming		
	Data transfer			Implementation of actual performance data into the Performance Test Bench for target-performance comparison (performane tests)	Implementation of data into software			Organise the transfer of operational data from the BMS to the Technical Monitoring Provider according to the requirements	Hand over performance data for performance tests	Organisation of data transfer of performance data.	Data transfer of performance data.
	Executing of performance tests			After technical completion and commissioning of the technical systems and building control, execution of the performance tests analog to the quality management concept	Quality assurance of performance						
	Creation of the list of defects			Participation in the list of deficiencies based on the results of the performance test.	Integration of the identified deficiencies into the list of deficiencies.					Detection of faults; creation of the list of deficiencies.	Creation of the list of deficiencies.
Acceptance of construction work	Acceptance of construction work	Acceptance of construction work					Remedy of deficiencies	Remedy of deficiencies	Supervising of the remedy of deficiencies. Contribute to the acceptance of construction work	Contribute to the acceptance of construction work	
First use phase (first 12 to 24 months of regular operation)	Training of the operating staff		Support the training of the operating staff with regard to useful functional and performance tests in order to be able to adjust systems more quickly.	Duty to notify that training regarding the operation of facilities also includes optimisation and adjustment.	Support in the training of the operating personnel with regard to functionality of individual systems and the overall system. Support the understanding why this system was chosen and how it should operate in terms of intended use.	Ensuring that the operating staff receive information about the intention of the planned system.	Training of the operating staff with regard to operation, maintenance, operation management and optimisation of the individual systems and the overall system.	Ensuring that the operating staff can operate and optimise the systems.			
	Check of the functionality and performance upon other climate conditions		At least three further test cycles to check the function and performance under different climatic conditions (seasons) to test the systems for all requirements.	Check the operation in the first two years of operation.							
	Corrective action						Remedy of deficiencies	Remedy of deficiencies	Supervising of the remedy of deficiencies.	Supervising of the remedy of deficiencies.	