

REGEOCITIES

D3.4

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June 2015

Recommendation guidelines for a common European regulatory framework



Co-funded by the Intelligent Energy Europe
Programme of the European Union

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DATE OF PUBLICATION: June 2015



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List of main abbreviations and acronyms used in the project

Technical:

ATES Aquifer Thermal Energy Storage BHE Borehole Heat Exchangers
BTES Borehole Thermal Energy Storage COP Coefficient of Performance

GIS Geographical Information System GSHP Ground Source Heat Pump
GW Groundwater
H&C Heating and Cooling

HVAC Heating, Ventilating, and Air Conditioning RES Renewable Energy Sources
SGE Shallow Geothermal Energy
SPF Seasonal Performance Factor

TRT Thermal Response Test
UTES Underground Thermal Energy Storage

Administrative (general or on European level):

EED: Energy Efficiency Directive
EPBD: Energy Performance of Buildings Directive
NREAPs: National Renewable Energy Action Plans
RES Directive: Directive on the promotion of the use of energy from renewable sources
SEAPs: Sustainable Energy Action Plans (for cities)
WFD: Water Framework Directive

EXECUTIVE SUMMARY:

The Regeocities Project has undertaken an analysis of the shallow geothermal energy market conditions in different regional, municipal and local jurisdictions across EU Member States with varying degrees of market maturity.

The legislative and regulatory frameworks of 10 EU countries were considered as part of the project in the context of market maturity, highlighting best practices that have supported development in mature regions including Sweden, Germany, France and Denmark.

A common set of barriers preventing the sustainable growth and development of shallow geothermal energy in Europe were identified in the early part of the project. In addition a set of common tools were developed to simplify regulatory requirements and implement a transferrable methodology for registering data from shallow geothermal installations. These tools will allow local authorities to better quantify the potential for shallow geothermal energy deployment and provide a basis for improving energy planning at local level.

The Regeocities project has developed regulatory guidelines in conjunction with support tools, aimed at facilitating local authorities in the implementation of the requirements under several EU Directives, that includes promoting the sustainable development of shallow geothermal resources, environmental protection, as well as a common permitting and data collection structure for newly planned and operating systems.

The recommendations propose a centralised and streamlined administrative process, that differentiates the requirements for permitting of small domestic or residential systems through a simplified online registration or notification process. A more complex permitting system comprising risk assessment, environmental impact assessment, permitting and subsequent monitoring is recommended for larger scale systems.

The implementation of these guidelines at local level will facilitate the compilation of detailed information on shallow geothermal energy potential and utilisation. The guidelines will also provide a uniform methodology of calculating energy produced from shallow geothermal energy systems as well as promoting sustainable growth in the sector across EU Member States.

1 INTRODUCTION:

The identification of common barriers to the development of the shallow geothermal energy sector in Europe in several jurisdictions, and the regulatory and administrative best practices in mature markets, has guided the development of common tools for administering, permitting and data gathering from shallow geothermal energy systems at local level.

This document presents a set of common regulatory framework guidelines, aimed at facilitating local authorities in Europe in implementing regulatory and permitting procedures for shallow geothermal energy systems.

The compilation of these recommendations is based on the extensive work undertaken as part of work package 2 of the Regeocities project where a detailed overview of the best practice regulatory and permitting procedures in Member States with a mature market was undertaken and presented in deliverable 3.1.

The guidelines make reference to other Regeocities project deliverables where common tools for supporting the regulatory and permitting process including a database and handbook for registering shallow geothermal energy systems (deliverable 3.2), as well as the recommendation for the integration of ground source heat pump systems in different city areas and buildings (deliverable 3.3).

This document is compiled as a generic guideline document, addressing specific topics highlighted in the regulatory recommendation flow chart presented. The implementation of these recommendations at local level, should be undertaken in the context of the legislative and regulatory systems applicable in the different local settings and result in the creation of new regulations or the modification of existing ones.

2 LEGISLATION

The legislation section provides the basis for understanding the principal legislative instruments that are utilised to identify geothermal and shallow geothermal energy resources in legislation. This legislation can be applied at national, regional, municipal or local level depending on the jurisdiction under consideration.

2.1 The term “geothermal energy”, as well as “geothermal heat”, “geothermal heating and cooling” and “geothermal water” shall be introduced in national and regional specific legislation acts (e.g. mining, water and environmental legislation or other relevant legislation) in cases of states/regions/municipalities where such provisions have not already been made.

2.2 The definition of geothermal energy should be included in the state and regional/municipal/local legislation. This should reflect the common definition given in the RES Directive 2009/28/EC:

‘Geothermal energy is the energy stored in the form of heat beneath the surface of the solid Earth’.

2.3 The legislation will define the ownership of geothermal energy resources and should identify the relevant authority responsible for licensing and regulating geothermal energy at regional/municipal/local level

3 REGULATIONS

Regulatory definitions are required in the implementation of successful legislation for shallow geothermal energy resources. The following definitions are considered important in establishing a clear regulatory framework for shallow geothermal resources. Whilst these can vary between member states/regions/municipalities/local authorities, broad definitions are required to provide the background and inform the local regulatory process.

3.1 Regulatory definitions are required when setting the operational framework for shallow geothermal energy systems. These definitions are not all applicable or mandatory when considering GSHP system regulations, but can be applied at local level to define the scope of shallow geothermal energy resources.

- System Type:
 - Ground Source Heat Pump (GSHP): open and closed loop systems
 - Borehole Thermal Energy Storage (BTES)
 - Aquifer Thermal Energy Storage (ATES)
- Size or installed capacity of a proposed system – distinguishing small or large scale installations
- Temperature – where this may represent a cut off point above which geothermal resources are no longer considered as shallow
- Depth – where a lowermost depth limit of ground source systems is considered and distinguished from deep geothermal energy resources where these may be governed by other legislation and regulations. This limited can also be coupled with installed capacity where relevant.

3.2 Environmental regulatory requirements should be focussed on minimising the impacts of shallow geothermal energy systems on the environment. This set of requirements should depend on the characteristics of the environment and of the SGE system proposed. As part of this the potential level of deployment (existing or planned) of these systems should also be considered. Regulatory requirements should consider the following:

- System Size (Small Residential, Large Scale Commercial, BTES and ATES)
- System Use – Heating and/or Cooling requirement
- Geological and Groundwater Aquifer Characteristics & Sensitivity
- Borehole Construction
- Thermal Effects of long term operation
- Hydrogeological Effects
- Subsurface Users

3.3 A set of regulatory recommendations is provided below and takes into considerations the preservation of the local environmental conditions based on system type, the size of potential systems and their associated heating and cooling demands and how these may impact the receiving environment.

3.4 System Size

- 3.4.1 Local geological conditions should be used to make recommendations on the appropriate separation distance between neighbouring closed loop collectors for small scale domestic applications on the basis that these may have a limited impact with respect to long term operation. These separation distances should vary based on subsurface geological and hydrogeological information and determined through mapping of these specifically for local conditions. National country reports completed as part of the Regeocities project (Deliverables 2.1 and 2.2) and the Stockholm case study, represent examples of how these distances can be implemented.
- 3.4.2 For small scale open loop systems hydrogeological conditions govern the productivity of an aquifer and regulations for domestic and small scale water abstractions are recommended. These should be in line with existing regulation on the abstraction of groundwater from domestic water supplies.
- 3.4.3 For larger systems including open loop and closed loop systems, ATES and BTES systems, a risk assessment and/or an environmental impact assessment should be required to demonstrate the potential long term operational impacts of the systems on the receiving environment.
- 3.4.4 Regulations should require detailed modelling of the heating and/or cooling mode for large systems to demonstrate the impact of hydrological, chemical, temperature and microbiological changes and how these might impact the receiving environment and other subsurface users. The general rules of thumb and guidance that apply in the case of small scale domestic systems are inadequate for large scale systems.

3.5 Aquifer Characteristics:

- 3.5.1 Regulations for open loop systems in a local area must consider the geology and hydrogeology of the aquifer as well as the hydraulic and hydrothermal properties and the chemical and microbiological conditions that may be affected based on the operation of a system. The regulations should be based on and supported by maps of aquifer vulnerability, the receiving environment and surrounding users, including those areas where public water supplies or other sensitive users may restrict deployment of open loop systems.

These regulations could include (but are not limited to)

- Acceptable temperature changes
- Total Abstraction over the operation of the systems (net abstraction)

- 3.5.2 Regulations for open loop system at a local level should consider providing guidance with respect to technical threshold and/or absolute values for minimum and maximum temperatures permitted and limits for heating and cooling. These values should reflect the properties of the receiving aquifers on a local scale as well as end users and their distribution.
- 3.6 Boreholes Completion and Collector installation
- 3.6.1 The completion of shallow geothermal energy system boreholes is critical to limiting environmental impacts and ensuring adequate operation of systems. Borehole design requirements and borehole drilling and completion methodologies should be focussed on the following key concepts:
- Protection of groundwater bodies
 - The prevention of aquifer cross contamination
 - The protection of groundwater abstractions where these are for public or private water supply
- 3.6.2 Where existing guidance documents or regulations are in place for the design, drilling and/or testing of groundwater wells, these should apply to the completion of any open loop or ATEs system boreholes and local regulations should make reference to these.
- 3.6.3 Similar regulation should apply to closed loop vertical collectors where the final borehole completion (including grouting requirements) should be made based on the nature of the receiving environment.
- 3.6.4 The characteristics of the local subsurface should inform recommendations with respect to the safe distances for siting boreholes for small scale domestic systems from the following:
- Public water supplies
 - Private water supplies
 - Other ground source or other geothermal systems
 - Building and any built infrastructure

- 3.6.5 Specific requirements for pressure and collector integrity testing should be specified to ensure necessary measures for the prevention of leakage or collector fluids are implemented

3.7 Heat transfer fluid & Leakage

- 3.7.1 Recommendations on the type of closed loop ground source collector and the permissible transfer fluid percentage compositions, along with any other requirements that may be applicable in sensitive or protected areas should be made.
- 3.7.2 Leak detection measures for closed loop collectors including pressure drop alarms should be included in the regulations and where relevant recommendations on the installation of shut off mechanisms should be included, in particular in areas where systems are installed in sensitive environments.

3.8 End user & building integration recommendations

- 3.8.1 In support of national, regional, local regulatory requirements for energy auditing, regulatory recommendations should be made to encourage the integration of shallow geothermal systems in new building, in the retrofit of existing buildings and in the industrial commercial or other commercial applications. These recommendations should ensure that the following aspects are covered:

- Detailed energy demand analysis including heating, cooling and domestic hot water
- Building type, fabric, energy saving characteristics, energy distribution infrastructure
- Local climatic conditions

Deliverable 3.3 of the Regeocities project provides guidance on what needs to be considered when determining the suitability of integrating shallow geothermal energy systems.

- 3.8.2 Regulatory recommendations for the integration of shallow geothermal energy and ground source heat pump in buildings should follow the local regulations that transpose the EU Energy Performance of Buildings Directive (EPBD) into law, clearly identifying ground source heat pump and/or shallow geothermal energy as an eligible technology and defining the expected target contributions of heat pumps to the overall heating and cooling demands in existing buildings during renovation and for newly built: Near-Zero-Energy-Buildings (NZEB).

3.9 Land zoning and urban areas

- 3.9.1 Shallow geothermal energy systems can be favourably integrated in many subsurface environments. Regulatory recommendations at local level need to consider land use and underground infrastructures zoning to provide guidance on the deployment options for shallow geothermal energy systems. Deliverable 3.3 of the Regeocities project provides specific considerations when integrating shallow geothermal energy into the built environment.

Recommendations should include consideration of the following items:

- Underground infrastructure
- Archaeology and heritage
- Geological and hydrogeological properties
- Geotechnical properties
- Land use (residential, commercial, industrial etc)
- Climatic constraints
- Environmental constraints
- Legislative limitations.

3.9.2 Regulatory recommendations for shallow geothermal energy systems in urban areas should include specific guidance with respect to connecting to existing district or communal heating and cooling infrastructures that may be present or planned, where this is applicable.

3.10 Energy Contributions

3.10.1 Energy calculations from ground source heat pump systems should be carried out based on the guidelines for Member States on calculating renewable energy from heat pumps from different heat pump technologies set out in the Commission decision 2013/114/EU relating to Article 5 of the RES directive.

3.10.2 Deliverable 3.2 of the Regeocities project provides the basis for recording system installation and operational data that will facilitate the calculation of energy contributions from ground source systems.

4 PERMITTING & LICENSING PROCESS

Permitting and licensing procedure for ground source systems should be focussed on the type and utilisation of the systems considered. The following recommendations are applicable in the cases where licensing is already taking place or where a new licensing and/or registration system is considered.

- 4.1 A dedicated and streamlined application system for shallow geothermal energy systems should cover both open loop systems and closed loop systems ensuring that all necessary permitting requirements relating to applicable regulations are provided as part of a single application. This method would ensure that the permitting and licensing system is clearly outlined to applicants but also that all necessary permits from all necessary authorities are obtained.
- 4.2 Licensing consisting of a comprehensive detailed application outlining the below surface collectors, above ground infrastructures and including any requirements for an Environmental Impact Statement/Study and/or Risk Assessment, should be limited to large installations including Aquifer Thermal Energy Storage (ATES) and Borehole Thermal Energy Storage System (BTES) and any large ground source collectors as defined in the local regulations (refer to section 2.4 above).
- 4.3 A Notification or registration system comprising a simple application using an online application service should be favoured for small (domestic) installations should be favoured for smaller and domestic systems, with the national/ local/ municipal or regional authorities providing the final permission to the applicant. Thresholds and a minimum data registration requirement for these small scale systems should be defined based on local conditions in the regulations.
- 4.4 Any application and registration processes implemented to shallow geothermal energy systems, should ensure that a minimum set of criteria with respect to any installation are recorded in a common database format for all Member States. A template database structure is outlined in Deliverable 3.2 of the Regeocities project and includes:
 - system location information;
 - building information and energy requirements;
 - collector construction and operational details including drilling locations;
 - heat pump type and system performance details
 - information about other permits obtained

The level of detail included in the register may vary in complexity depending on the size and applications of the systems being considered and at the discretion of the permitting authority.

- 4.5 The permitting process should facilitate the collection of spatial data to improve resource management and long term technology deployment. This data collection process should be based on a common data collection structure for any local, regional and national authority of any Member State. The structure should ensure that minimum amount of special data is collected and where appropriate long term operational and ground data are also included. Deliverable 3.2 of the Regeocities project provide a comprehensive structure to achieve this.
- 4.6 The licensing framework and associated permitting process should facilitate the development of a shallow geothermal inventory that will record the location and performance of ground source systems. This should form an integral part of any other underground inventories present at local, regional, municipal or national level.
- 4.7 Short permitting/licensing times are recommended to ensure that these are not dependent on other project outcomes which can delay shallow geothermal energy system applications.
 - 4.7.1 Small scale domestic applications, where a database registration process is in place should have an application time not exceeding 30 days.
 - 4.7.2 Permitting time for larger installations should not exceed the time of between 60 to a maximum of 90 days to obtain other permit or planning consents that may be necessary.
- 4.8 Permitting for all open loop systems should fulfil all permitting and licensing requirements with respect to the abstraction of groundwater and water discharge (irrespective of this being to an aquifer, to surface water or public sewerage system) that is already applicable in a local jurisdiction.
- 4.9 The permitting and application process should fulfil requirements of notification and permitting for borehole drilling and construction that may be already in place at national, regional, municipal or local level. Where this is not applicable, basic information with respect to the collector completion shall be recorded as part of any registration or notification process.
- 4.10 Permitting of larger scale installations (define thresholds in the regulations) should include a careful evaluation of the subsurface conditions and environmental impacts of the installations as part of the application and in cases where this appropriate, include EIS and a detailed risk assessment. It is recommended that the implementation of the permitting process for larger scale installations should include:
 - Early application and consultation with the permitting authority to present a project outline and assess its viability at the early stages;
 - Completion of an initial feasibility study to demonstrate the system completion specifications, intended use and collector loads expected during operations;
 - Full permit application process including an Environmental Impact Assessment & Statement where this is necessary. This should include details of:
 - Collector construction drawings (drilling and completion);

- Completion measures for mitigating any environmental impact (aquifers, subsidence, temperature changes of the ground, neighbouring buildings and structures);
 - Monitoring programme including data submission throughout the operational lifetime of the system.
- Final issue of the permits by the authority with any attached conditions that may be applicable.

5 MONITORING

- 5.1 Monitoring and assessment of performance facilitates further planning and management of resources
- 5.2 The monitoring programme should be based on system size and the receiving environment. Smaller systems should be exempt but the implementation by the end user of a maintenance program should be considered.
- 5.3 Large systems that require monitoring should have a programme that acquires detailed operational data. This monitoring programme should be established in clear guidelines by the permitting authority and be based on any available data on system operation in a local subsurface condition.
- 5.4 The cost of the monitoring measures required should not impact adversely on the long term financial viability of a project.

6 EXISTING LOCAL & NATIONAL POLICY:

- 6.1 Regulation for shallow geothermal energy systems should take into consideration any applicable regulations based on local legislation and transpositions of the following directives and their requirements:
- Water Framework Directive (2000/60/EC)
 - Habitats Directive (92/43/EEC)
 - The Groundwater Directive (2006/118/EC)
 - RES Directive (2009/28/EC)
 - Energy Efficiency Directive (2012/27/EU)
 - Energy Performance Of Buildings – RECAST (2010/31/EU)
 - Environmental Impact Assessment (EIA) Directive (2014/52/EU)
- 6.2 Regulations for shallow geothermal energy systems should take into consideration other local policies and regulations dealing with the following topics:
- Spatial Planning and Urban Development
 - Underground planning
 - Energy Performance in Buildings including any policies relating to the installation of heating and cooling equipment in new and retrofit buildings
 - Archaeological and historical artefacts & antiquities
 - Thermal Regulations

7 INFORMATION

- 7.1 Information on the potential to deploy shallow geothermal energy systems at local level should be available using a holistic approach that encompasses all available geological, subsoil and aquifer property information. It should also incorporate existing subsurface planning and master plan recommendations that may be applicable (refer to Deliverable 3.3 of the Regeocities project for further details).
- 7.2 A central information portal (helpdesk or other) should provide a qualitative or decision making tool that allows potential end users to understand the shallow geothermal collector options in a local area and present the regulatory and permitting requirements based on the collector chosen.
- 7.3 The central information point should be focussed on facilitating technology dissemination and public information.
- 7.4 The data collected on shallow geothermal energy systems as part of the regulations should be used to:
 - Calculate energy savings
 - Inform policy decisions on existing and new deployment options for shallow geothermal systems
 - Facilitate the characterisation of subsurface conditions

8 TRAINING & CERTIFICATION

8.1 Training and certification initiatives for professionals involved in the installation of ground source heat pump systems and shallow geothermal energy installations should be implemented in conjunction with any initiative being undertaken for the implementation of the following pieces of European legislation:

- Articles 14 of the Renewable Energy Sources Directive: Member States shall ensure that certification schemes or equivalent qualification schemes become or are available by 31 December 2012 for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps. Those schemes may take into account existing schemes and structures as appropriate, and shall be based on the criteria laid down in Annex IV. Each Member State shall recognise certification awarded by other Member States in accordance with those criteria.

- Articles 16 and 17 of the Energy Efficiency Directive:

- * Article 16: Availability of qualification, accreditation and certification schemes: Where a Member State considers that the national level of technical competence, objectivity and reliability is insufficient, it shall ensure that, by 31 December 2014, certification and/or accreditation schemes and/or equivalent qualification schemes, including, where necessary, suitable training programmes, become or are available for providers of energy services, energy audits, energy managers and installers of energy-related building elements as defined in Article 2(9) of Directive 2010/31/EU.

- * Article 17: Information and training: Member States shall, with the participation of stakeholders, including local and regional authorities, promote suitable information, awareness-raising and training initiatives to inform citizens of the benefits and practicalities of taking energy efficiency improvement measures.

8.2 Training and educational strategies for shallow geothermal energy system shall include a broad base of professionals involved in key aspects of system installation:

- Design
- Drilling and construction
- Installation and Commissioning
- Maintenance and System Performance Monitoring

8.3 Additional stakeholders at local level including policy makers, planners, energy managers and regulators shall be targeted with specific training initiatives aimed at informing and training on all aspects of shallow geothermal energy technology, installation best practices, resource monitoring and management, with a view to promoting sustainable integration of shallow geothermal energy resources in energy planning strategies and local development.

9 STANDARDS

9.1 Regulatory recommendations should make reference to relevant European, International and/or National standards or applicable guidelines that cover the following aspects of shallow geothermal energy system installations:

- Heat Pumps
- System Design
- Materials
- Drilling and Drilling Equipment
- Installation and Commissioning
- Maintenance

A non exhaustive list of relevant EN and ISO standards is given for reference in Annexe 1 of this document.

10 OTHER MEASURES

10.1 Regulations applied at national regional or local level should make provision for the promotion of research and data sharing amongst relevant authorities focused on improving the understanding of shallow geothermal energy systems and helping to inform policy decisions through:

- Improving the understanding of ground properties through geological, hydrogeological and thermal characterisation;
- Integrating operational data;
- Providing information on the performance of SGE systems in different subsurface settings and
- Providing information on the performance of SGE systems in different end-user and building scenarios.
- Providing information on the performance of ground source heat pump systems based on Life Cycle Cost Analysis.

ANNEXE 1

Standards

- **Heat Pumps**

EN 378-1:2008+A2:2012

Refrigerating systems and heat pumps. Safety and environmental requirements. Basic requirements, definitions, classification and selection criteria

BS EN 378-2:2008+A2:2012

Refrigerating systems and heat pumps. Safety and environmental requirements. Design, construction, testing, marking and documentation

EN 378-3:2008+A1:2012

Refrigerating systems and heat pumps. Safety and environmental requirements. Installation site and personal protection

BS EN 378-4:2008+A1:2012

Refrigerating systems and heat pumps. Safety and environmental requirements. Operation, maintenance, repair and recovery

EN 14511-1:2013

Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling. Terms, definitions and classification

EN 14825:2013

Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling. Testing and rating at part load conditions and calculation of seasonal performance

EN 12171:2002

Heating systems in buildings. Procedure for the preparation of documents for operation, maintenance and use. Heating systems not requiring a trained operator

- **Materials**

EN 12201-1:2011

Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). General

ISO 4427-1:2007

Plastics piping systems -- Polyethylene (PE) pipes and fittings for water supply -- Part 1: General

ISO 4427-2:2007

Plastics piping systems -- Polyethylene (PE) pipes and fittings for water supply -- Part 2: Pipes

ISO 4427-3:2007

Plastics piping systems -- Polyethylene (PE) pipes and fittings for water supply -- Part 3: Fittings

ISO 4427-5:2007

Plastics piping systems -- Polyethylene (PE) pipes and fittings for water supply -- Part 5: Fitness for purpose of the system

- **Design**

EN 12828:2012+A1:2014

BS EN 12828:2012+A1:2014. Heating systems in buildings. Design for water-based heating systems

EN 12828:2003

BS EN 12828:2003. Heating systems in buildings. Design for water-based heating systems

EN 15316-1:2007

BS EN 15316-1:2007. Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies. General

EN 15316-2-1:2007

BS EN 15316-2-1:2007. Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies. Space heating emission systems

EN 15316-2-3:2007

BS EN 15316-2-3:2007. Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies. Space heating distribution systems

EN 15316-3-1:2007

BS EN 15316-3-1:2007. Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies. Domestic hot water systems, characterisation of needs (tapping requirements)

EN 15316-3-2:2007

BS EN 15316-3-2:2007. Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies. Domestic hot water systems, distribution

EN 15316-3-3:2007

BS EN 15316-3-3:2007. Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies. Domestic hot water systems, generation

EN 15316-4-2:2008

BS EN 15316-4-2:2008. Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies. Space heating generation systems, heat pump systems

EN 15450:2007

BS EN 15450:2007. Heating systems in buildings. Design of heat pump heating systems

ISO 7519:1991

Technical drawings -- Construction drawings -- General principles of presentation for general arrangement and assembly drawings

- **Installation and Commissioning**

EN 14336:2004

BS EN 14336:2004. Heating systems in buildings. Installation and commissioning of water based heating systems

ISO 22475-1:2006

Geotechnical investigation and testing -- Sampling methods and groundwater measurements -- Part 1: Technical principles for execution

ISO 21307:2011

Plastics pipes and fittings -- Butt fusion jointing procedures for polyethylene (PE) pipes and fittings used in the construction of gas and water distribution systems

EN 805:2000

BS EN 805:2000. Water supply. Requirements for systems and components outside buildings

- **Maintenance & Testing**

ISO 14686:2003

Hydrometric determinations -- Pumping tests for water wells -- Considerations and guidelines for design, performance and use

ISO 13256-1:1998

ISO 13256-1:1998. Water-source heat pumps. Testing and rating for performance. Part 1: Water-to-air and brine-to-air heat pumps

ISO 13256-2:1998

ISO 13256-2:1998. Water-source heat pumps. Testing and rating for performance. Part 2: Water-to-water and brine-to-water heat pumps

ANNEXE 2

Summary Flow Chart

