

GSHPA

Vertical Borehole Standard

Nic Wincott



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- Where Next

History

1985 1990 2000 2004 2006 2010



1988
National
Energy
Foundation

2002
Ground
Source
Heat
Pump
Club

2006
Ground
Source Heat
Pump
Association

Future
Set up a
Limited
Company

Principal aims

- promoting efficient and sustainable use of ground source heat pumps
- raising awareness of the benefits of ground source heat pumps
- assisting in the development and practice of sound industry-related standards

Member Benefits



influence on government policies



Use of the Association logo



“Find a member” enquiry service

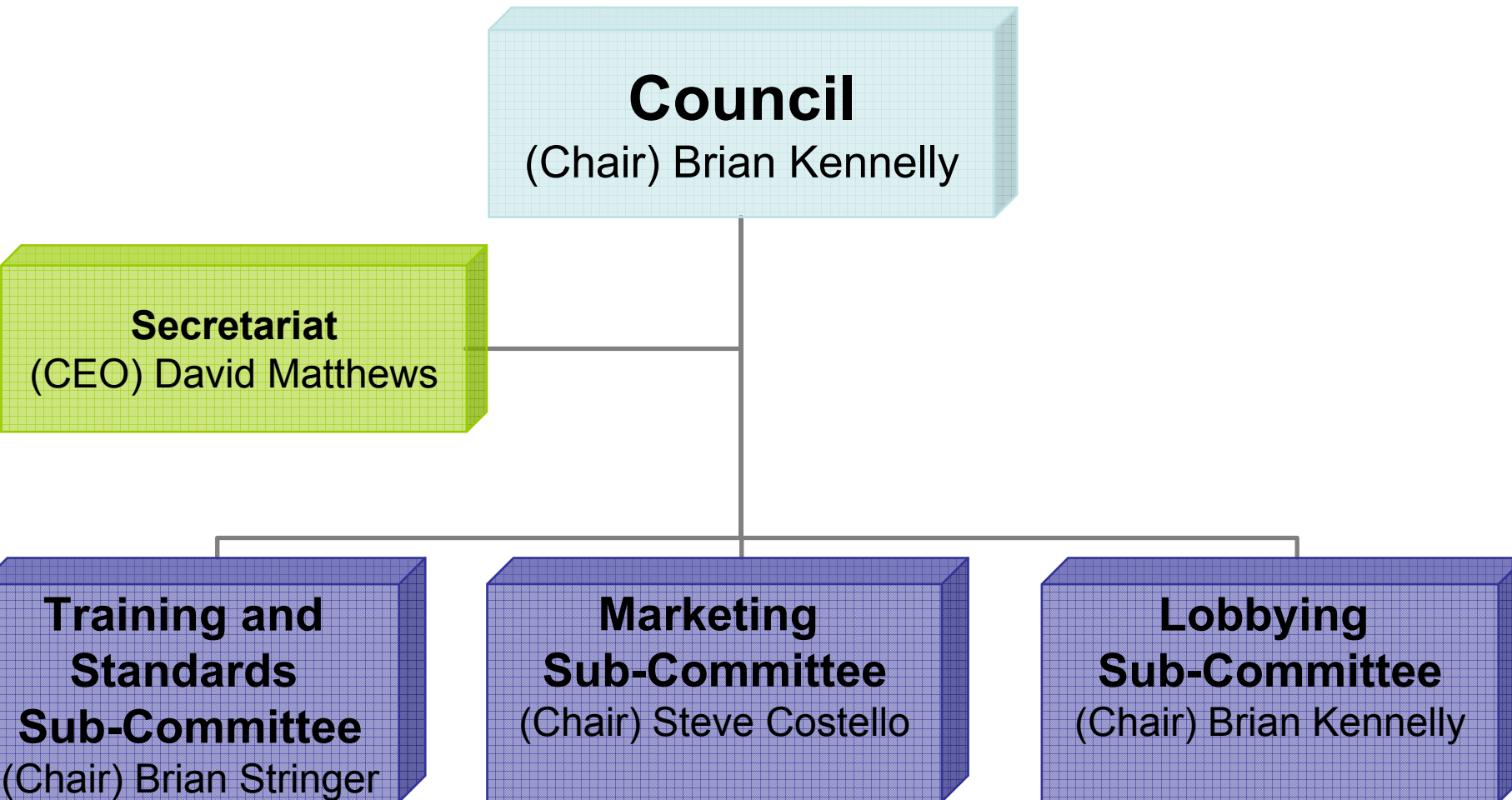


Up to date expert information

Recent achievements

- New website – source of up-to-date relevant industry documents & ‘find a member’ search
- Work with Government & Industry partners including:
 - BDA, HPA, BEAMA, Met Office & BGS
 - EA, DECC, OFGEM
 - Several Universities
- Well respected Code of Ethical Practice
- Industry Standards – first of series of standards to support industry now launched!

Management Structure



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The Scope of the Standards Document #1

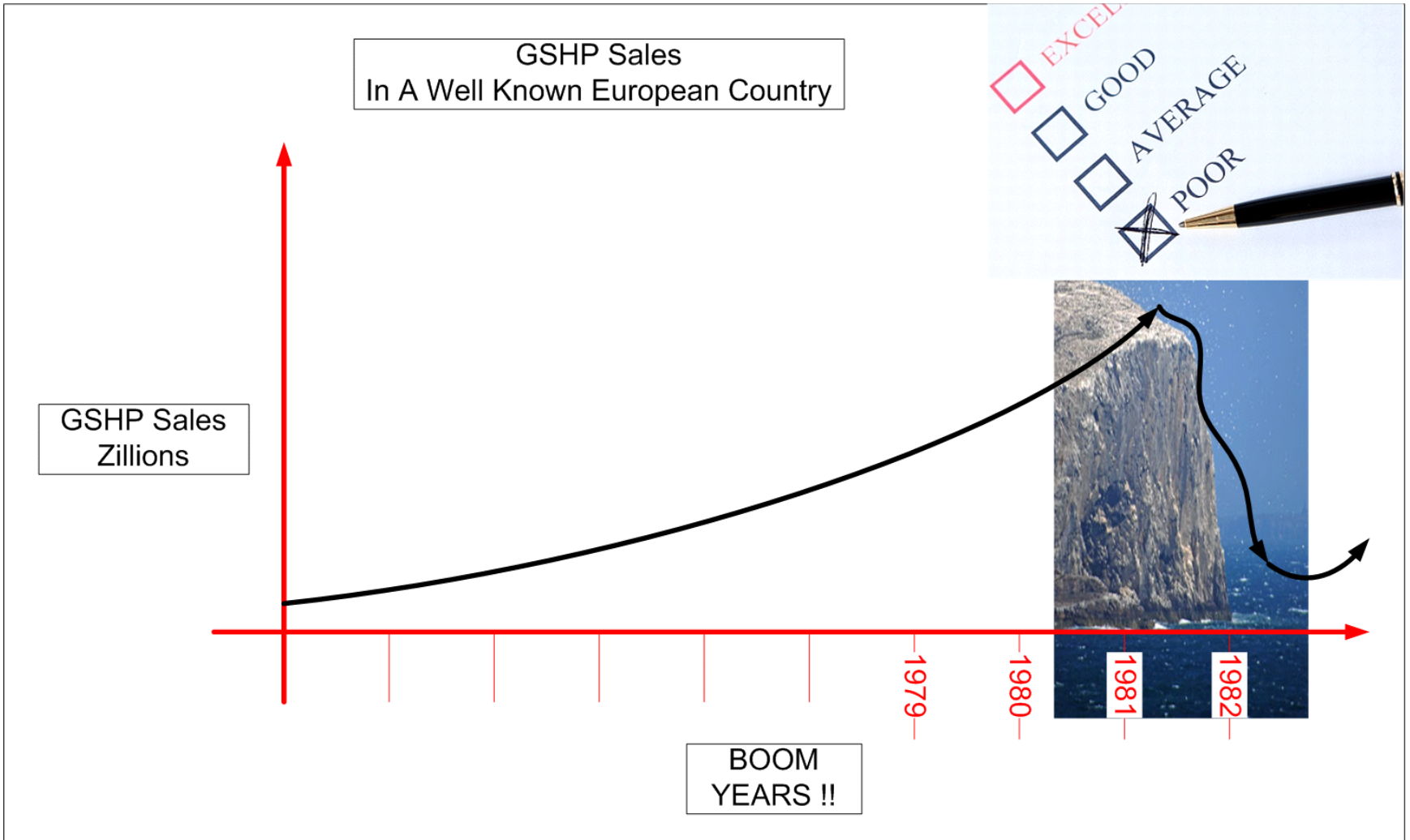
- The GSHPA standards are designed to be a concise document providing information for the materials and general specification of a closed-loop vertical borehole system.
- The standards also cover internal pipe works up to and including manifolds and / or flushing valves / arrangements. The standards do not include the building entry detail as these will be defined elsewhere.
- They are not designed to be an installation or training manual and the standards must be referred to in conjunction with recognised design qualifications and training programmes.

The Scope of the Standards Document #2

- The Standards are designed to enable anybody reading them to quickly reference minimum materials specification, techniques and qualification requirements to be met and ensure that they either comply with the standards (or higher) or are employing companies and personnel who do comply with the standards (or higher).



We like to work on even ground...



Low Consumer Confidence Burst this Bubble

Pipe Materials

PE100+

- Slow crack growth resistance
- Verifiable, virgin grade raw material
- Manufactured to outside diameters, wall thickness and respective tolerance as specified in BS EN 12201 (part 2)



Pipe-work Jointing Techniques



Electro-Fusion



Socket-Fusion



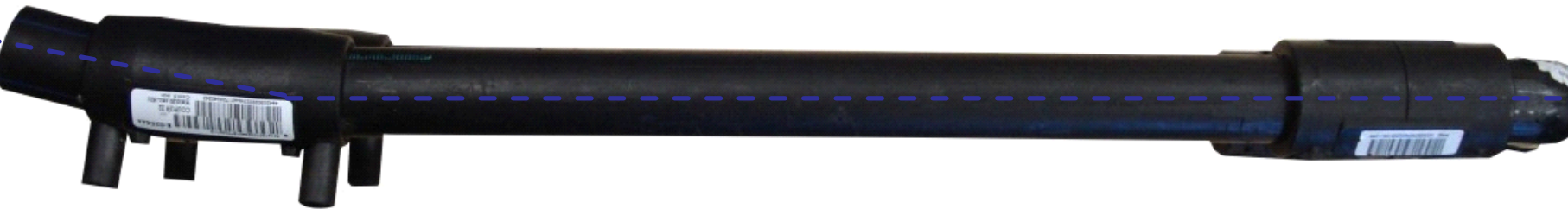
Butt-Fusion

Jointing Quality Control



- Factory manufactured under controlled & quality assured conditions
- Purpose manufactured u-bend fusion-welded to each leg of pipe
- Maximum number of welds = 2 welds to form u-bend

Oops, even the loop manufacturer doesn't bother with clamps.. Good job the driller pressure tested it.



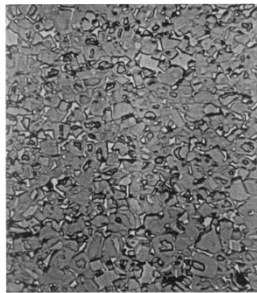
..It failed the test quite convincingly.

Types of Grout

Pliable materials



Bentonite based



Rigid materials



Cement based

Properties of Grout

Known Thermal Conductivity

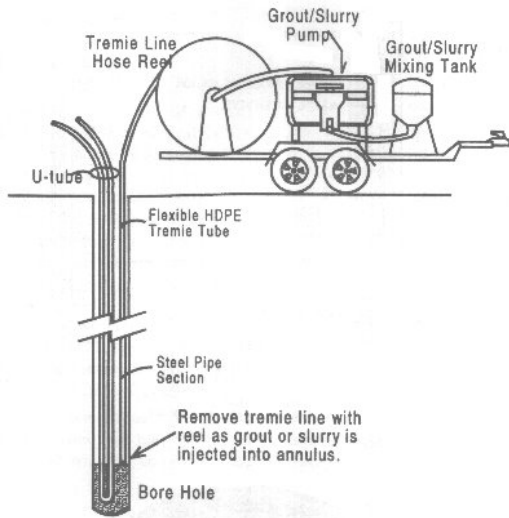
Maximum allowable Hydraulic
Conductivity (hc) $=1 \times 10^{-9}$ m/sec

If cementitious grouts: combined max.
allowable permeability no higher than
surrounding ground

Consider operational temps of grouts –
hydraulic conductivity not to be impaired
by shrinkage or freeze thaw cycles



Grouting QA



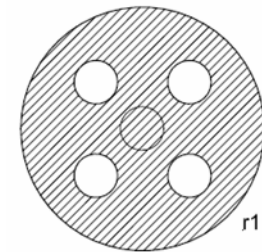
Pipe Placement

- Pipe positioning & quality of backfilling materials.



Pipe Transport, Storage & Installation

- Keep capped to avoid dirt etc. entering pipes
- Take Care to avoid damage & kinks
- Pipe separation can be crucial



Pipe-work Quality Issues



QA - Post Installation Testing

Purge Points



Flow test cart

Pressure Testing



Thermal Transfer Fluid

Hazardous substances

“Substances or groups of substances that are toxic, persistent and liable to bio-accumulate, and other substances or groups of substances which give rise to an equivalent level of concern”.

Water Framework Directive 2000/60/EC

Thermal Transfer Fluid

➤ Requirements

- shall not be harmful by ingestion
- shall not have an acute oral toxicity of less than 2000 mg/kg
- shall not be harmful to the environment
- shall have suitable and appropriate levels of biocide, corrosion and scale inhibitors
- shall be compatible with all materials and components within the ground source system
- shall be non-flammable



O & M Manuals & Commissioning

PC Form: Commissioning Sheet of Heat Pump for Heating/Cooling

Return by fax 00 44 (0) 870 727 0114 or mail to:

Glen Dimplex UK Ltd
Millbrook House, Grange Drive,
Hedge End, Southampton, SO30 2DF

Installation Site:

Name: _____
Street: _____
Postal code, town: _____

Heating System Installation: (Heat Distribution)

Name: _____
Street: _____
Postal code, town: _____

Energy Supply Company:

Name: _____
Address: _____
Off-periods: no yes; max. duration _____h

Heat Source: (e.g. well drilling contractor)

Name: _____
Address: _____

Air (visual inspection of air ducts)

No. of 90° elbows _____
Sight length _____ m
Minimum duct length (inside) _____ m
Rain guard yes no
Max. four 90° bends, total length ≤ 8 m; free cross-sectional area > 80% effective air flow rate. yes no

Geothermal system: Horizontal collectors Vertical collectors
Anti-freeze: Monoethylene glycol Polyethylene glycol
Mean heat exch. capacity _____ W/m
Strainer checked and cleaned
Number of loops: _____
Length per loop: _____ m
Brine pressure _____ bar
Frost protection down to _____ °C
 yes no

Ground Water / Other
Ground water compatibility with regard to the water-to-water heat pump was determined by means of water analysis. Certificate is available. yes no
Intermediate heat exchanger yes no
Strainer checked and cleaned yes no
 Other heat source: _____

Heat Pump

HP type: _____ Heating Heating/Cooling
Serial no.: _____ Manufacturing date: _____
Passive cooling system _____ Serial no.: _____ Manufacturing date: _____
Date of purchase: _____ Delivery date: _____

Water Heating: _____ using heat pump: yes no
Hot water tank: _____
Make/type: _____
No warranty for the proper functioning will be assumed if parts of different makes are used or parts which are not authorized for use with the specific heat pump type. (Impairments of the heat pump operation are possible.)
Heat exchanger surface area: _____ m² Rated capacity: _____ l Electric fan/heater _____ kW

Electrical Installation:

Name: _____
Street: _____
Postal code/town: _____

Heating / Cooling System:

Hydraulic connection of heat pump as per schematics of the project planning and installation in annex.
Project planning and installation. _____ Page/ Pg.: _____
manual, edition: _____
Variations: _____ (drawing to be supplied for special connections)
Buffer tank in: flow circ. return circ. capacity _____ l

Electric supplemental heater in heating circuit _____ kW
Compact manifold no yes
Type of fuel: oil gas solid fuel
heating system: _____

The heating contractor was informed that the heating installation needs to be properly adjusted (overflow valve and hydraulic adjustment): no yes

Heating circulating pump: regulated unregulated Stage _____
Make/type: _____

Hot water circulating pump Stage _____
Make/type: _____

Swimming pool circulating pump Stage _____
Make/type: _____

Auxiliary circulating pump Stage _____
Make/type: _____

Brine/well circulating pump Stage _____
Make/type: _____

Bivalent mixer: no yes; Mixer running time: _____ min

Heating system mixer: no yes; Mixer running time: _____ min

Make/type: _____

Solar water heating: no yes
Solar system controller Make/type: _____

Solar heating back-up: no yes
Solar regulator, make/type: _____

Basically...

To allow anybody such as drillers, ground workers architects, design specification writers, installers, end users, building operators etc etc etc to be able to assess and ensure that the minimum materials standards are being asked for, provided or being adhered to...

But, They Must Be Adopted !

They are not to outline how to design a system, they are not for Mrs Jones to vet or verify that the thermal transfer fluid is correct...

They are **not** to prove how many holes are needed, how to drill a hole or how to install a heat pump system.

Circulator Sizing and System Components



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Where Next?

- **Future Modules to GSHP Standards**
 - Thermal Piles
 - Horizontal Ground Heat Exchangers
 - Open Loop Applications
- 300,000+ GSHP installations by 2020

And now you may go...

Thank you for listening...

http://www.gshp.org.uk/pdf/Vertical_Borehole_Standards_Issue1_September2011.pdf

...Any questions?



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