



Australian Government

Department of Education, Employment and Workplace Relations

RIINHB412B Construct geothermal wells

Release: 1

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Modification History

Not applicable.

Unit Descriptor

This unit covers the construction of geothermal wells in the drilling industry. It includes planning and preparing for construction of geothermal wells, designing geothermal wells, constructing geothermal wells, developing the bore, carrying out well maintenance and rehabilitation, and decommissioning test/bore holes. Licensing, legislative, regulatory and certification requirements that apply to this unit can vary between states, territories, and industry sectors. Relevant information must be sourced prior to application of the unit.

Application of the Unit

This unit is appropriate for those working as a technical specialist, at worksites within:

- Drilling

Licensing/Regulatory Information

Refer to Unit Descriptor.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan and prepare for the construction of geothermal wells	1.1. Access, interpret and apply compliance documentation relevant to the work activity 1.2. Obtain, confirm and apply work instructions for the allocated task 1.3. Identify, manage and report all potential hazards 1.4. Resolve coordination requirements with others at the site prior to commencing and during work activities 1.5. Discuss scope of work with client to gain general agreement on drilling plan 1.6. Communicate regular up to date information on progress, and/or problems encountered to client and/or other relevant parties 1.7. Provide details of the completed well to the appropriate authorities as required by the relevant state/territory legislation
2. Design geothermal wells	2.1. Determine most appropriate construction methods from the reading and interpretation of all available documented information and local geographic/geological knowledge 2.2. Determine a drilling fluid program to suit the expected down-hole conditions and anticipated pressures/temperatures 2.3. Select appropriate bore/surface casing for the anticipated ground conditions and construction techniques 2.4. Ensure all necessary materials anticipated for the job are available and on site prior to commencement of construction phase
3. Construct geothermal wells	3.1. Use approved procedures to assemble and insert casing 3.2. Use equipment for assembly safely and in accordance with approved procedures 3.3. Grout or otherwise seal surface casing 3.4. Conduct grouting operations to seal intermediate and/or production casing strings or to seal selected zones 3.5. Construct well in accordance with any

	applicable regulations, minimum construction requirements and the organisation's internal procedures 3.6. Maintain plumbness and alignment of the hole within the required limitations 3.7. Recognise symptoms of a formation kick and take action to control the well 3.8. Maintain adequate supplies of water on site to quench the well if required 3.9. Collect, record and label formation samples 3.10. Maintain records accurately and legibly 3.11. Accurately calculate hole, annular, grout and mud pit volumes in cubic metres or litres 3.12. Comply with relevant workplace occupational health and safety requirements for both the drilling equipment and construction materials 3.13. Maintain tool string inventories
4. Develop bore	4.1. Use development techniques with care to prevent collapsing of casing or blow outs
5. Carry out well maintenance and rehabilitation	5.1. Undertake a process of diagnosis to determine likely cause of well deterioration 5.2. Devise a program of rehabilitation to ensure that the well is restored to a reasonable condition
6. Decommission test/bore holes	6.1. Determine suitable decommissioning procedures and select appropriate materials 6.2. Carry out the decommissioning (abandonment) of test holes or wells in geothermal systems 6.3. Verify position/location of hole for future reference 6.4. Dispose of drill and other fluids safely

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Specific skills are required to achieve the performance criteria of this unit, particularly for its application in the various circumstances in which this unit may be used. This includes the ability to carry out the following, as required to construct geothermal wells:

- apply legislative, organisation and site requirements and procedures
- calculate grout component quantities, i.e. cement powder, water and other additives as required
- calculate hole and annular volumes
- calculate grout specific gravity
- calculate drilling fluid specific gravity to control formation fluid pressure
- use Blow Out Preventers
- apply writing skills to complete a range of documents including:
 - state/territory bore completion report
 - daily drill operation report
 - diagrams
 - brief descriptions
- apply reading and interpreting of materials including:
 - plans
 - diagrams
 - drill log
 - graphs

Note: licences required may include:

- Water Well licence (Class 3)
- Licence for particular drilling method:
 - rotary mud
 - Bore Construction Permit
 - Bore Development/Works Approval

Required knowledge

Specific knowledge is required to achieve the performance criteria of this unit, particularly for its application in the various circumstances in which this unit may be used. This includes knowledge of the following as required to construct geothermal wells:

- legal requirements under the relevant state/territory Water Act
- equipment - characteristics, technical capabilities and limitations

- basic geological formations, i.e. basic knowledge of both soil and rock classifications and various formations which permit groundwater movement and factors affecting groundwater quality, geothermal systems, drillability and stability
- potential safety hazards when siting a well
- the necessity of having a signed agreement/contract with the client
- Blow Out Prevention procedures and techniques
- appropriate casing materials for various applications
- hole preparation for cementing (grouting) operations
- effects of various cement (grout) additives
- pressure cementing methods
- casing collapse characteristics
- appropriate headworks design for geothermal well applications
- types of drilling fluids
- problem solving techniques
- grout placement methods and procedures
- range of numerical calculations including:
 - volume (e.g. mud pits, drums, tanks or wells of given dimensions)
 - up hole velocity
 - cement/water/additives quantities
 - flow rates (e.g. L/sec, GPM)
 - conversion from imperial to metric and vice versa
 - required mud weight to control formation fluid pressures
- relevant occupational health and safety requirements including principles of duty of care
- appropriate fishing operations for the type(s) of drilling being undertaken
- use of materials safety data sheets (MSDS)

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	The evidence required to demonstrate competency in this unit must be relevant to worksite operations and satisfy all of the requirements of the performance criteria, required skills and knowledge and the range statement of this unit and include evidence of the following: • knowledge of the requirements, procedures and instructions for the construction of geothermal wells • implementation of requirements, procedures and techniques for the safe, effective and efficient completion of the construction of geothermal wells • working with others to plan, prepare and conduct the construction of geothermal wells • evidence of the consistent successful construction of geothermal wells
Context of and specific resources for assessment	• This unit must be assessed in the context of the work environment. Where personal safety or environmental damage are limiting factors, assessment may occur in a simulated environment provided it is realistic and sufficiently rigorous to cover all aspects of workplace performance, including task skills, task management skills, contingency management skills and job role environment skills. • Assessment of this competency requires typical resources normally used in a resources and infrastructure sector environment. Selection and use of resources for particular worksites may differ due to the site circumstances. • The assessment environment should not disadvantage the participant. For example, language, literacy and numeracy demands of assessment should not be greater than those required on the job. • Customisation of assessment and delivery environment to sensitively accommodate

	cultural diversity. • Aboriginal people and other people from a non English speaking background may have second language issues. • Where applicable, physical resources should include equipment modified for people with disabilities. Access must be provided to appropriate learning and/or assessment support when required.
Method of assessment	This unit may be assessed in a holistic way with other units of competency. The assessment strategy for this unit must verify required knowledge and skill and practical application using more than one of the following assessment methods: • written and/or oral assessment of the candidate's required knowledge • observed, documented and/or first hand testimonial evidence of the candidate's: • implementation of appropriate requirement, procedures and techniques for the safe, effective and efficient achievement of required outcomes • consistent achievement of required outcomes • first hand testimonial evidence of the candidate's: • working with others to undertake and complete the construction of geothermal wells
Guidance information for assessment	Consult the SkillsDMC User Guide for further information on assessment including access and equity issues.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Relevant compliance documentation may include:	• legislative, organisational and site requirements and procedures • manufacturer's guidelines and specifications • Australian standards • code of practice • Employment and Workplace Relations legislation • Equal Employment Opportunity and Disability Discrimination legislation
Work instructions may come from briefings, handovers, plans and work orders and may be written or verbal, formal or informal and may include:	• nature and scope of tasks • specifications • quality of finished works • achieved targets • operational conditions • obtaining of required permits • site layout • out of bounds areas • worksite inspection requirements • lighting conditions • plant of equipment defects • coordination requirements or issues • contamination control requirements • environmental control requirements • barricade and signage requirements
Hazards may include:	• working in proximity to drilling rig
Coordination requirements may include:	• discussion of scope of work with client and other relevant parties to gain general agreement on drilling plan, and regular communication about progress, and/or problems encountered • other equipment operators • maintenance personnel • supervisors • site personnel

Documented information may include:	• results of test hole • geothermal data and reports • geological data • old bore hole logs
Local geographic/geological knowledge may include:	• interpretation of soft/hard zones • losses of drilling fluid
Procedures to assemble and insert casing may include:	• welding (steel)
Equipment for assembly may include:	• hand tools • power driven (electric, hydraulic or air) hand tools • welder

Unit Sector(s)

Drilling (General)

Competency field

Refer to Unit Sector(s).

Co-requisite units

Not applicable.