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# Plasmabit Anchoring System : Methodology of Assignment Creation

KEYWORDS: Product development, assignment, geothermal well, geothermal power, geothermal energy, Plasmabit


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**ABSTRACT** *When designing new machinery and other products a set of methodologies related to the product type, product severity, inventive steps and other specific aspects concerned to not only the product alone. However, the product development and production environment and operational conditions play a role of great importance as well. The paper deals with an introductory phase related to the above-mentioned product, submission completing and planning, while the anchoring kinetics system, which creates an integral part Plasmabit system, is considered to be an example applied for those purposes. However, that system or device is considered to be a unique and massive technical system applied for providing of ultra-deep geothermal wells as well.*

## INTRODUCTION

The product development is regulated by a set of rules, which create an integral part of an appropriate methodology, which determines a set of steps provided by developers, from product development beginning phase (idea) up to the final product presentation. The methodology depends on the product type, technology state of the art, development team members as well as material and technical possibilities existing with development office. However, a set of conventions valid in the firm or company and other internal and external aspects play a role of great importance as well. On the other hand, the product development methodology has a pre-defined structure, while a need of some problem solution with the use of a suitable technical system stands at the product life-cycle beginning and its material implementation stands at the product life-cycle end (see also Fig.1).

The above-mentioned new product development structure is being respected in a full range within machinery practice, when providing development of a new product. The product being developed based on new needs, which has no compatible or similar precursor or model in the world and is a unique product, is considered to be a new product. The methodology is being simplified and reduced (several steps and phases are left out), when considering products with design signs adapted to new conditions or represent variants or versions of existing products.

This paper deals with development methodology closely related to the unique product, especially the phase of submission and planning. The reason is that, those phases play a role of principle importance within such development. The product to be developed is closely related to Plasmabit anchoring system, which creates an integral part the Plasmabit system being a unique device applied for providing of ultra-deep geothermal wells.

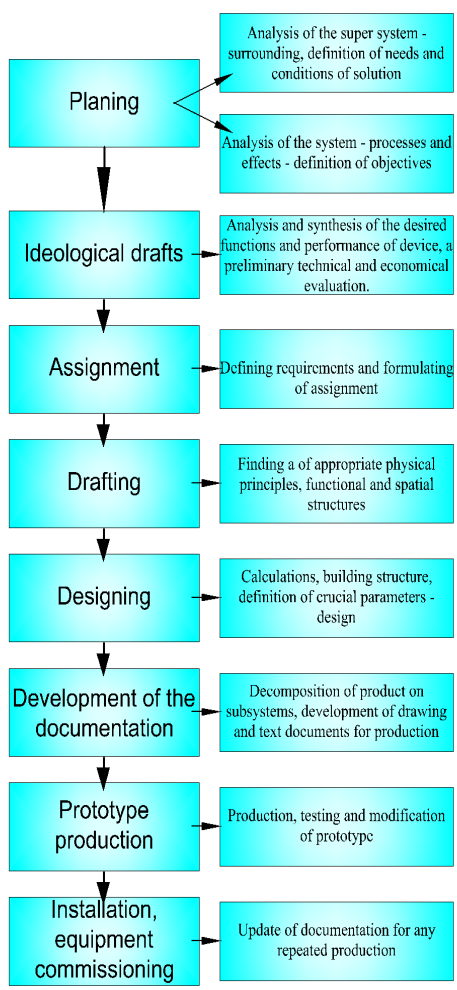


**Figure 1: Product development methodology – a general formulation – it contains development phases (see also**

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**Left column) and the development phase description (see also Right column)**

**Development task planning**
The development task planning deals with a unique device for making geothermal bores (depth up to 10 000 meters), the functionality of which is based on new physical principles and effects not applied in the world at present. There are known several similar devices applied for making bores or wells within gas and oil industry. On the other hand, there are several devices applied for making geothermal bore (3000 meters) and (5000 meters in some specialized cases), while boring operation in those deeps are manageable from technical and economic point of view (Kočiš, 2013). At present, a great deep boring is very difficult, expensive especially and inefficient from economic point of view.

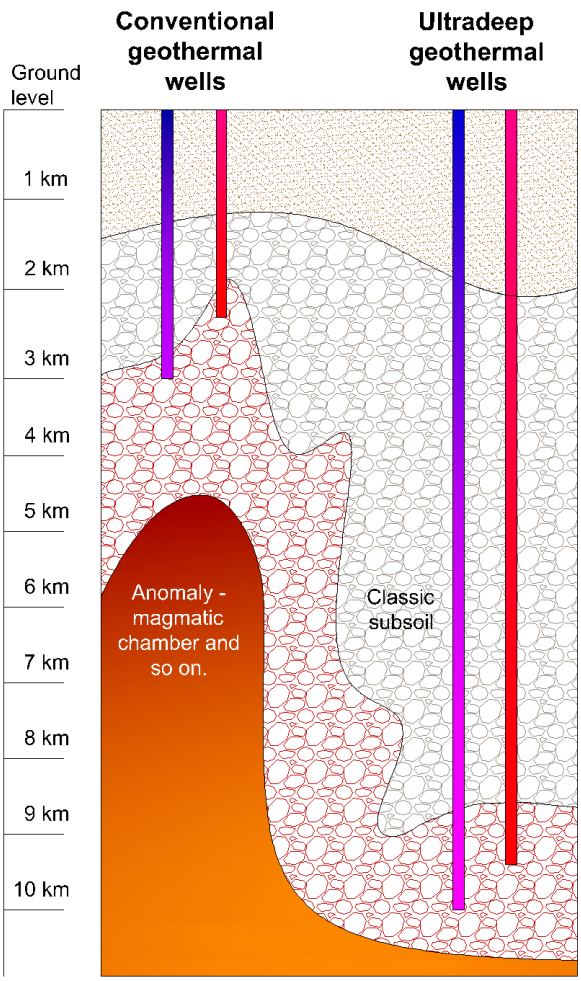


**Figure 2: At present, the geothermal wells are being done within places with geological abnormalities, where the terrestrial crust is tin and magma is nearing to earth surface. Ultra-deep wells represent a subject of research and development related to suitable technical systems, which enable providing the above-mentioned wells (Sokol, 2013).**

At the beginning, the aim or goal function together with several partial functions required by the system to be developed is being postulated (hereinafter known as requirements). At present, no information exists concerned to devices applied for the above-mentioned purposes with disposal of required parameters. However, there are not known appropriate physical, mechanical and other processes, which the device shall manage as well. On the other hand, there exist several imaginations concerned to the final result closely related to technical system applied for boring of ultra-deep geothermal bores – Plasmabit. The above-mentioned device is considered to be a unique device, having no equivalent industrial design. Therefore the task preparation phase demands more time and efforts and plays a role of principle importance as well.

**Specification of assignments of design task**
The outgoing point for these purposes is a general methodology concerned to the product development (See also Fig. 1), (Koller, 1994), (Pahl, 2005), (Ehrlenspiel, 2003), (Hubka, 1991), which is modified related to specific conditions for development of such device types.

Surrounding system[1] analysis incl. its affects and circumstances closely related to development task submission. There are considered technical and non-technical conditions and requirements determined by surrounding system:

**Public demand** – that term defines a demanded research and development task, which creates an integral part of European Structural Funds, the project development team members postulated a set of appropriate reasons concerned to the project public demand and postulated a need of power or energy acquisition based on alternative resources.

**Technological progress and new advanced technologies** open new possibilities for product development via new materials, microelectronic systems, etc. On the other hand, there applied knowledge concerned to plasma applications, while plasma alone is considered to be a rock destruction tool via high temperature delivered to place of well digging, etc. However, there are applied new materials electronic, electro mechanic, and electro hydraulic and mechanic systems.

**Actual and concrete imaginations**, conditions and requirements postulated by potential user in the future with respect to increasing measure in power or energy consumption and energy prices incl. a possibility to obtain geothermal energy anywhere represent a development in market requirement trend concerned to the above-mentioned objective.

**State of the art analysis related to competitive testing devices**. A high level development related to boring technology systems needed for making thermal wells (up to 3000 meters approximately is observed. However, the systems for making deeper wells than 3000 meters are observed in a very few cases as well. There are many technical and economic obstacles especially, because the costs for that type of boring are growing very rapidly (growth might be represented by exponential function). This situation is caused as a result of technical problems concerned to mechanic boring with the use of existing technical devices.

**Legal norms and standards** – are there any adequate legal norms and standards regulating those business objectives?

**Our research and development results** – the task is getting started[2] after having completed several introductory by GA Drilling Company (former Geothermal Anywhere). There are several results achieved based on appropriate information retrieval and presentations.

**Our commercial policy –** is determined by rules for co-operation within specialized European project, when considering financial and check and control rules related to the above-mentioned task especially.

**Possibilities concerned to production, obtaining of new materials and application of new technologies –** there are investigated aspects of production co-operation, qualification of workers, implementation facilities, technology transfers, etc.

**Protection of the environment** - there are investigated as-

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pects of labor conditions, and appropriate devices, as well as risks closely related to environment damages, recycling needs and possibilities (there are not expected any significant problems). However, it is necessary to prevent any manipulation with hazardous compounds and radiation as well.

**System analysis: Anchoring system of Plasmabit.** The analysis aim is concerned to investigation of specific conditions and requirement, while the following question might be postulated:

**For what purposes the device shall be applied and what about effects are being expected-** assurance of stabile position of Plasmabit within appropriate bore or well is considered to be the device objective function

**Wishes and requirements of potential users –** a very careful approach shall be applied when respecting potential user requirements and wishes especially their complexity and economic aspects. In this phase, an appropriate discussion is observed, which is closely related to principal requirements and wishes.

**The development of absolutely new product is required or only an adequate innovation of the existing product is sufficient?** If innovation – the questions what about level and range should be considered? Existing analogies applied in gas and oil industry are being investigated. As for geothermal wells – the question is what about deeps might be achieved with the use of existing devices?

**What about existing solutions are known?** Are there any traditional solutions or solutions applied within competitive firms or companies? Are there any solutions protected by patents, trademarks or utility models?

**Analysis of existing similar or innovated devices**, strengths and weaknesses and factors, which determine them. What about risks do exist there. What about important and decisive and supporting aspects do exist? However, a question concerned to deadwoods and vain or bad efforts plays a role of great importance as well.

**Analysis of actual conditions** related to products production and assembly

**Capabilities of team members** related to design of device, preparation of adequate documents, device assembly and activation and providing an appropriate device operation. However, there shall be considered needs of co-operation physics, hydraulic and other experts, who could manage a solution of adequate and specific tasks as well.

**Interconnection to related systems** – similar processes. The anchoring system is closely related to Plasmabit, which plays a role of that device over system. However, there are other important subsystems and well walls as well.

**Experiences from related work places** – there are no similar experiences within other workplaces.

**Market research** – vendors of hardware and software components, which could be applied for that device design and implementation

**Feasibility study** – concerned to real possibilities of device design and implementation from technical and financial point of view.

**Specification of assignments** – a set of requirements may be denoted as set of restrictions, in a lot of cases. It is necessary to consider, which of the requirements are decisive and which may be compared with wishes only. If we persist in any requirement, a solution of which is not reachable or cannot be real from economic point of view, the solution alone will not become real. A definition of correct and real submission, which is complex as most as possible, is considered to be inevitable step in order to achieve a successful solution. However, the developer plays a role of the submission co-author as well, when considering that type of tasks.

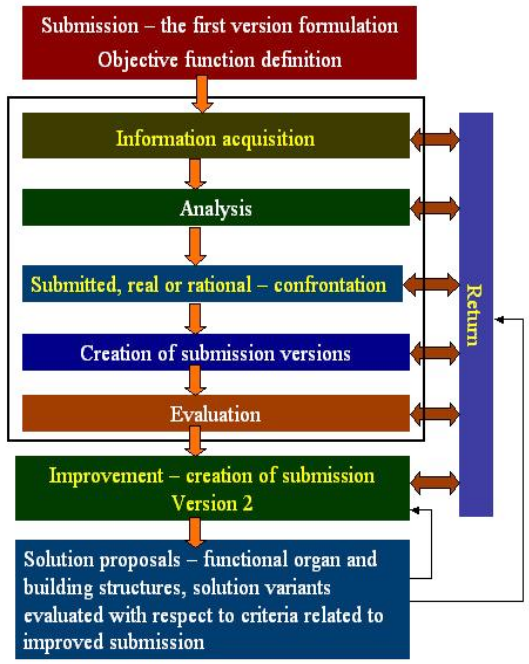


**Figure 3 The submission creation and improvement – when providing development of unique devices a return to task submission and its improvement within further design phase plays a role of great importance.**

## REQUIREMENTS RELATED TO PLASMABIT ANCHORING SYSTEM

Sets of further requirements related to anchoring system design are based on previous analysis. They might be found in tables denoted as Requirement list, which is considered to be a suitable material containing criteria for judgment and evaluation of device to be developed.

**TABLE - 1**
**List of the most important functional requirements**

| Required features and functionalities | Remark |
|---|---|
| A capability to fix Plasmabit at the well walls | Objective function |
| A capability to transfer Plasmabit weight to the well walls | |
| A capability to be fixed and released, with respect to control system commands | |
| A capability to be fixed in the well with curvature | R = 100 m |
| A capability to be fixed in the well with rough and cracked walls | |
| A capability to pull out Plasmabit from the well with use of rope or cable. | |
| A capability to enable passing of cables for power and information transfer purposes. | |
| A capability to enable flow of technological water inside the system | |
| A capability to enable providing transfer of bored rocks upwards near well walls with the use of water | |
| A capability to provide an interconnection to other Plasmabit subsystem | |
| Etc. | |

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**TABLE - 2**
**List of the most important operational conditions**

| Conditions & circumstances | Parameter | Remark |
|---|---|---|
| Vertical well, the cross-section has a ring shape approximately | Ø 280±20mm | Sloping or horizontal in exceptional cases |
| Well depth | Up to 10 km | |
| Supposed wall temperature at the bottom | 400 °C | |
| Supposed water environment temperature | Up to 280 °C | |
| Well walls strong (granite) and smooth (obsidian) | Fortress and friction values are unknown | |
| Rock homogeneity breakdowns | | May be cavities |
| Water cooling | | |
| Routed rock particles | Up to 1,5 mm | |
| Mean time between failures | 3000 hours | |
| Electric power supply from earth surface | DC - 600 V, or AC - 3x400 V | |
| Etc. | | |

A set of complete lists related to the device features and functionalities cannot be described in more details because of a limited paper text range. The same is concerned to detailed description of operational conditions and circumstances.

## Conclusion

The next development steps or phases postulated as concept design, construction design, documentation processing, prototype production, putting in functional operation are pre-determined based on the above-mentioned first stage or phase. As a result of that the product development submission creation and planning is considered to be the most important stage closely related to an adequate studying and research. The reader is kindly recommended to consult further papers or articles in order to get information closely related to Plasmabit anchoring system.

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