

Engineer in Training: A guide

So you're a recently qualified Chemical Engineer who's just started that first job as a Trainee Engineer. You may be wondering what it takes to become a competent engineer and what steps to take to become a Professional Engineer (Pr Eng). This guide sets out to demystify the whole process and give you a step by step guide to become a competent Chemical Engineer.

This guide draws on both ECSA (Engineering Council of SA) and IChemE (UK Institute of Chemical Engineers) guidelines for training of chemical engineers.

Note that whilst the terminology in this guide is strictly applicable for training of graduate engineers, the competencies and training listed are also applicable for Diplomats and BTech qualifications.

As mentioned this is a simple step by step guide and for more details and background reading, it is recommended that you read the ECSA website (www.ecsa.co.za) and the IChemE website (www.icheme.org).

Important: This document can be used by a trainee engineer to provide a guide as to the steps that could be taken by the trainee, in order to become competent. The document can also be used by companies wishing to improve their engineer training procedures. However, these are merely guidelines and it is the responsibility of the trainee and /or trainee's company, **not SAIChE**, to put in place specific measures to ensure training is achieved.

1) Apply to ECSA to be a candidate engineer.

A first step in the process is to apply to ECSA and register as a Candidate Engineer (CE).

Registration is simple and all details and forms can be found at www.ecsa.co.za

If you are not a member of Saiche, this is the correct time to apply to become a member and details are available on the Saiche website.

2) Mentoring

The next key step is to get a mentor. This mentor should be a chemical engineer, preferably a Pr Eng, and can either be someone from within your company, or someone external. The mentor should not be your direct line manager. Should you wish to obtain an external mentor, contact ECSA or Saiche who can assist with providing a mentor.

What is mentoring? It is an objective and confidential one-on one relationship independent of line management relationship. It aims at the promotion of the Candidate Engineer (CE) in terms of career development, insights, networking, and organisational know-how.

Role of the mentor: A mentor is expected to act as an experienced and trusted advisor, guiding the CEs through their training period, checking that the training requirements described in the chemical engineering training guideline are fulfilled and recommending suitable continuing learning programmes. A mentor is not responsible for the day-to-day supervision of the CE; that responsibility lies with the CE's immediate supervisor, preferably a professional engineer. A mentor should be in contact regularly with each mentored CE (ECSA recommends quarterly) to discuss progress and problems encountered.

Duties of the CE: It must be stressed that while the employer is responsible for training the CE to carry out his work effectively, long term career development is a personal responsibility, requiring professional experience before definite sights can be set. The CE should complete ECSA form A2.1 for each quarterly training period between mentorship meetings and bring the completed document to the quarterly mentorship meeting.

3) Competencies

In order to become a Professional Engineer, certain ECSA prescribed competencies need to be met. These are as follows:

- Problem solving
- Management
- Communication
- process plant operation
- process design
- research & development
- lectureship.

Refer to ECSA website for more details of these competencies and their requirements.

In addition to these ECSA competencies, the IChemE has a more comprehensive list of competencies which are very useful when considering a training scheme whose aim is develop one to become a competent engineer, whilst also meeting ECSA's aims. These competencies can be found on the IChemE website under the section titled ACTS (Accredited Company Training Scheme)

The following table is designed as a guide to inspire your training framework by mapping practical situations against the IChemE Competence and Commitment report standards. The table lists key competencies, which meets both ECSA and IChemE's requirements. The CE should sit with their mentor and line manager and agree on the ways that the competencies can be met via informal (on the job) and/or formal training.

Note that whilst some examples have been provided below to aid the process, one should develop items that are specific and relevant to your company and your career.

Reference	Report Title	Training Required	How this can achieved at Your company via formal courses	How this can achieved at Your company via On the Job training	Signed
Section A: Applying knowledge and understanding of engineering or science to practical and chemical situations.					
AI	Apply appropriate theoretical and practical methods to identifying or identifying a problem, opportunity or project.	Problem solving. Opportunity to identify a problem then calculations, research and analysis modelling used in overcoming the problem	e.g. Structured Problem Solving techniques, Troubleshooting courses	e.g. Technical Research material, Report and present solutions to management	
All	Combining ideas and contributions from different people and disciplines to arrive at appropriate engineering technical or scientific solutions	Team working. Working with other engineers, scientists, sales or marketing professionals in order to arrive at an outcome. Showing individual contribution and benefiting from others' expertise.	E.g. How to build and work in effective teams.	E.g. Task Team member taking part in Root Cause Analysis. (RCA). Process Hazard Reviews (e.g. Hazop)	
AllI	Creativity and innovation;	Individual creativity. Opportunity to improve		e.g. Project execution from initiation through to operation	

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	developing your own ideas to produce new engineering, technical or scientific solutions, new designs and new technological approaches.	efficiency, reduce costs or develop designs.		and audit. Plant modifications. Process design work.	
AIV	Scientific or technical evaluation and optimisation(of product, process, equipment etc) against the requirements you identified, or brief you were given	The trainee must be able to ensure their solutions are safe and feasible before implementation. Pilot studies, analysis and testing are some examples of how this could be achieved.	e.g. Unit Operation Training (e.g. Heat Exchangers, Pump training). Process Technology Training Technical Standards,	e.g. Design and Operability Review, Test runs Industry best practise Simulations	
AV	Planning and execution of projects: organising or performing	Contribution to delivery of projects. Ideally, a few years into career when the trainee is at the	e.g. Project Management course, MS Projects , Excel advanced	e.g. project execution	

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	technical work to implement or validate solutions, designs etc.	level of leading a small project.			
Section B: Candidate's ability to handle the wider implications of their work as an engineer					
BI	Ability to handle health, hazard and safety aspects.	Applying appropriate principles, good practice, meet legislative requirements etc. HAZOP participation, updating safety documents or signing permits to work are some examples.	e.g. Hazop, Risk Assessment techniques, SIL	e.g. Hazop, SIL, Risk assessments,	
BII	Ability to handle sustainability aspects.	Examples of work could be preparing environmental impact assessments, awareness of public concern, ISO 14000 implementation or recognition		e.g. Environmental Impact Assessments (EIA), Pollution impact awareness , Iso 14001 Catalyst recycle and disposal National Environmental Management Act. Scheduled trade permit, Water and Waste permit.	

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		of risks.			
BIII	Ability to handle Commercial and economic aspects			e.g. Capex project justifications	
Section C: Effective personal, leadership and communication skills.					
CI	Developing personal, social skills and work relationships	Evidence of liaising with external clients or ability to communicate with professionals at all levels. Leading team building, problem solving or involvement with applicant interviews are some examples of work.	e.g. Assertiveness training, Conflict management, Diversity Management	e.g. Contractor / Client liaison Liaising with Specialist vendors, Presentations to management	
CII	Demonstrating leadership in a professional role	Training others, contributing technical knowledge to a project or introducing new systems.		e.g. Task Team members ECSA Membership SAICHe participation University open days Career days. Training to other engineers	

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		Whynotchemeng is a campaign run by IChemE in schools which would satisfy experience for this section.		and also Operator training.	
CIII	Communication of ideas via report writing and oral communication		e.g. Presentation Skills, Report Writing	e.g. Capex presentations, Initiative and testrun presentations.	

3.1) Formal training

Formal training is via Training courses which can be either classroom or web-based. There are many training companies both in South Africa and worldwide. Please refer to the links on the “Saiche Courses” webpage <http://www.saiche.co.za/course.asp> for more information. The IchemE website offers online courses that can be accessed via the public.

3.2) In service training

In service training is “on the job training”. In order to meet the competencies above, it may be necessary to develop a Rotation scheme for trainee engineers. In this way the engineer can be exposed to other types of engineering experience and the competencies can be achieved without the engineer needing to move companies in order to achieve the competencies.

Key elements of a rotation scheme would comprise the following:

- It is recommended that the rotations only start once the engineer has had meaningful experience in their “home department”. This would typically be after 2 years.
- Exposure to other departments for a minimum period of 3 months, in order to make a meaningful contribution and obtain the competency.
- The departments should have a structured program for the trainee on entering the rotation with an assessment on completion of the rotation

4) Records & documentation

a. Individual Development Programme (IDP).

Once the trainee has agreed on ways of meeting the competencies in the table above, these developmental actions should be recorded. A typical method of capturing this is on an IDP (Individual Development Programme). This document should list the developmental goals for the upcoming year as well as longer term goals and should be signed off by the trainee engineer, the mentor and line manager.

b. ECSA Forms A2.1 & A2.2.

As discussed in the Mentoring section above, the CE should complete ECSA forms A2.1 & 2 to capture all experience obtained between quarterly mentorship meetings.

c. Annual reporting

- *ECSA Training report*: It is recommended that the engineer update their ECSA Training report under the competencies required by ECSA on an annual basis.
- *Icheme reports* – Should the trainee want to follow the Icheme competency table, then it is recommended that the engineer also complete an annual training report, listing work completed under the various competencies.

5) Completion & exit of Training Programme

The engineer, together with the mentor and line manager should discuss and agree when the competencies above have been met and the engineer can apply to ECSA for Pr Eng status. This typically takes around 4 years but can vary depending on the opportunities to gain the various competencies required. To apply for Pr Eng status, refer to ECSA website for forms and detailed guide to application process.

If one has met the competencies listed in the table above and has an approved Chemical Engineering qualification, it is also possible to apply to the UK Engineering council to obtain UK Chartered Engineering status.

6) Assistance

As mentioned previously **this is a guideline** and **SAIChE is not responsible for engineers' development**. That is the responsibility of the individual. However, SAIChE are willing to assist should you require clarification with any of the steps listed above. Please send a request via the "Saiche Contacts" webpage.