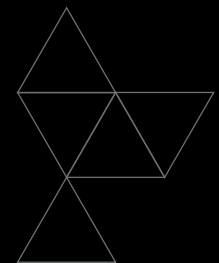
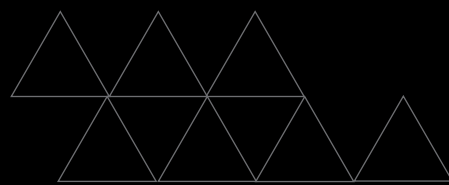
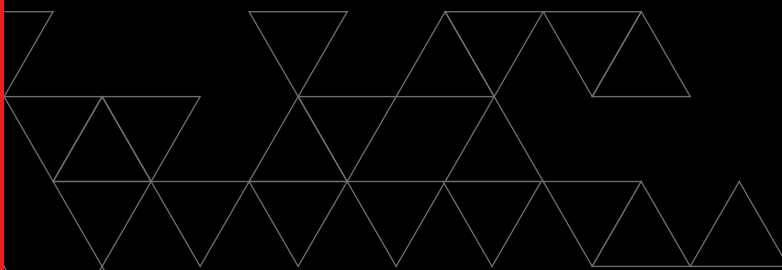




MECHANICAL JOINT INTEGRITY
ROUTE TO COMPETENCE
GUIDANCE DOCUMENT



Improving safety and
affecting change through
collaboration



MECHANICAL JOINT INTEGRITY ROUTE TO COMPETENCE GUIDANCE DOCUMENT

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Overview



This guidance reflects current industry practice guidance as well as a definition of minimum standards of competency for carrying out such work. It has been developed by a joint working group including members from industry and standard setting bodies. In compiling this document, it was recognised that organisations already have processes and procedures. With this in mind, they are designed to provide guidance in two ways:

- To enable you to assess your current working methods against the principles put forward here and so help you identify improvements to those methods in line with current good practice
- To allow companies to adopt improved methods of demonstrating specialist critical bolting and small bore tubing competence, based on current good practice

We recommend the review of company procedures against the principles and practical guidance contained in this publication. An action plan should then be prepared for the implementation of any necessary improvements.

Effective and lasting improvement can be achieved where all concerned, from senior management to those carrying out work on the plant, share a genuine commitment to achieving and maintaining mechanical joint operations procedures to a high standard.

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Introduction



Scope and Target Audience

This guidance sets out a structured approach to the principles of managing competence for those involved in mechanical joint operations. It describes how to train, develop and assure competence, reducing the risk of personal injury and hydrocarbon and non-hydrocarbon release when working with mechanical joint related activities such as construction, maintenance and disassembly operations.

The guidance is intended to reflect industry 'good practice' for the management of competence in relation to mechanical joint operations. It applies to the onshore and offshore oil and gas industry to the extent that it is reasonably practicable to do so. It also has general application to all industries where mechanical joint operations are undertaken.

These guidelines are therefore aimed at all personnel involved in mechanical joint operations, particularly those who are expected to undertake related duties in the workplace. Correspondingly those who are expected to plan these operations and the supervisors of those personnel performing them should be familiar with these principles.

Additionally those involved with the management of training and competence, including the delivery of related material should be aware of

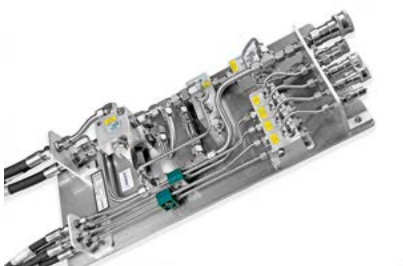
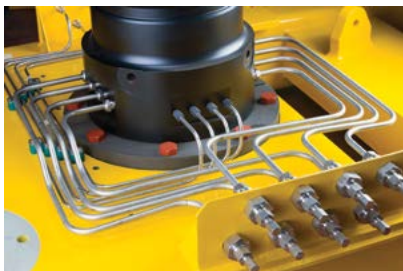
- the importance of utilising good practice in the demonstration of competence of new and existing workers
- a revised and restructured development route

Risk Reduction

The main focus is on risks to the safety of people and avoiding loss of containment, particularly where activities present potential major accident hazards. It will also improve environmental protection and reduce business interruption. For all assembly and disassembly operations the risks should be formally assessed.

Overview of Hazard

- Fire and explosion
- Uncontrolled release of pressure resulting in personal injury through exposure to hydrocarbons or flying components



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Key Stages of Mechanical Joint Integrity Competence

Basic Principles

Control of the training and competence assurance of personnel working on mechanical joints is a critical factor in achieving asset integrity. Therefore an important element of the competence assurance and management system is to ensure that any person working on a given joint has been trained and assessed as competent to perform the task.

All personnel involved in mechanical joint operations should have sufficient knowledge of the specific tasks to be undertaken and the risks which the work will entail, along with sufficient experience and ability to carry out their duties in relation to mechanical joint integrity operations, whilst recognising their limitations and be able to take appropriate action in order to prevent harm to themselves and those affected by the work.

Moreover personnel should be assessed as technically competent. Formal assessment should be underpinned by national occupational standards and provides demonstrable capability for all personnel, including third-party vendors and contractors, who are expected to make, break or maintain mechanical joints.

Personnel Undertaking Mechanical Joint Integrity Operations

The diagrams on pages 5 & 6 shows the four key stages that an individual has to pass through to reach full competency and maintain ongoing performance development.

The chart on page 8 identifies the categories of personnel who undertake or are involved with Mechanical Joint operations and the suggested training and competence assessment for these groups of personnel.

There are a number of training courses available, which are based upon and meet industry occupational standards developed by the ECITB, a training standards organisation.

Four Key Stages in Achieving Competency

The first stage of all training comprises of initial training and assessment. This is normally carried out at a training establishment.

At the completion of **Stage 1**, the level of competency is deemed sufficient for that person to undertake Mechanical Joint Integrity operations under the direct supervision of a competent person as part of their **Stage 2** training.

Stage 2 is consolidation of skills, experience building and the practical application of the learning obtained in **Stage 1**.

Stage 3 is the assessment of technical competency at an approved test centre with **Stage 4** as the ongoing performance development.

These four stages of achieving competency in Specialist Critical Bolting and Small Bore Tubing are shown in Figs 1 & 2.

In order to conduct Mechanical Joint Integrity operations to today's high standards, it is important that employers have a system in operation which permits personnel to progress through the stages to become competent to undertake Mechanical Joint Integrity operations and to maintain this competence.

In the case of non-core personnel employed on short-term contracts, employers must have a system in operation to validate the competency of these personnel and, if necessary, update and refresh the skills and knowledge of such personnel.

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Route to competence

New Workers and Experienced Workers

New Workers who have no experience in working with mechanical joints must start at Stage 1 of the training and progress through Stages 2, 3 & 4 over time.

Experienced workers may go straight to Stage 3 (as shown in Fig. 3) if their company can endorse that the existing worker has previously attended a training course in bolting or small bore tubing and has recent experience in that subject area.

Some experienced workers may require refresher training on the knowledge aspects and computer based training modules will be available that are aligned with ECITB's technical training standards.

Stage 1

Personnel involved in Mechanical Joint Integrity activities will attend an ECITB approved training provider to undertake a period of training in either specialist critical bolting or small bore tubing assemblies. The training will normally take place onshore and consist of classroom and workshop learning activities. The courses are normally from one day to two and a half days depending upon the subject matter. Each person will be taught theoretical and practical skills regarding the relevant subject matter to a technical training standard specified by the ECITB. The training courses require each person to demonstrate the attainment of knowledge and practical skills through an individual knowledge test and practical workshop exercises. Successful personnel will gain a certificate of training and be issued with a Work Based Task Assignment to be used in Stage 2.

Stage 2

Each person after attending an approved training course and attaining the training certificate requires a period of workplace experience to practise new skills and knowledge. This period allows for the consolidation of skills and knowledge against work based tasks. The learner is issued with a Work Based Task Assignment specifying the range of tasks and complex jobs required before the person can move on to Stage 3. A workplace consolidation period of 3 to 12 months is recommended to give the person the opportunity to complete the Work Based Task Assignment. The individual must satisfactorily demonstrate that they have carried out each of the steps indicated in the Work Based Task Assignment on a minimum of three occasions. This may mean in practice that they complete more than three task assignment records as they may not carry out every step on each occasion.

The task assignment record may be verified by any person with overall responsibility for the correct, safe and accurate completion of the task. This could be:

- A supervisor or team leader
- A line manager
- Any other person with responsibility for the final approval and quality assurance for the relevant task, for example a QC Inspector or permit authority

When the person has achieved satisfactory completion of the Work Based Task Assignment they can move onto Stage 3.

Stage 3

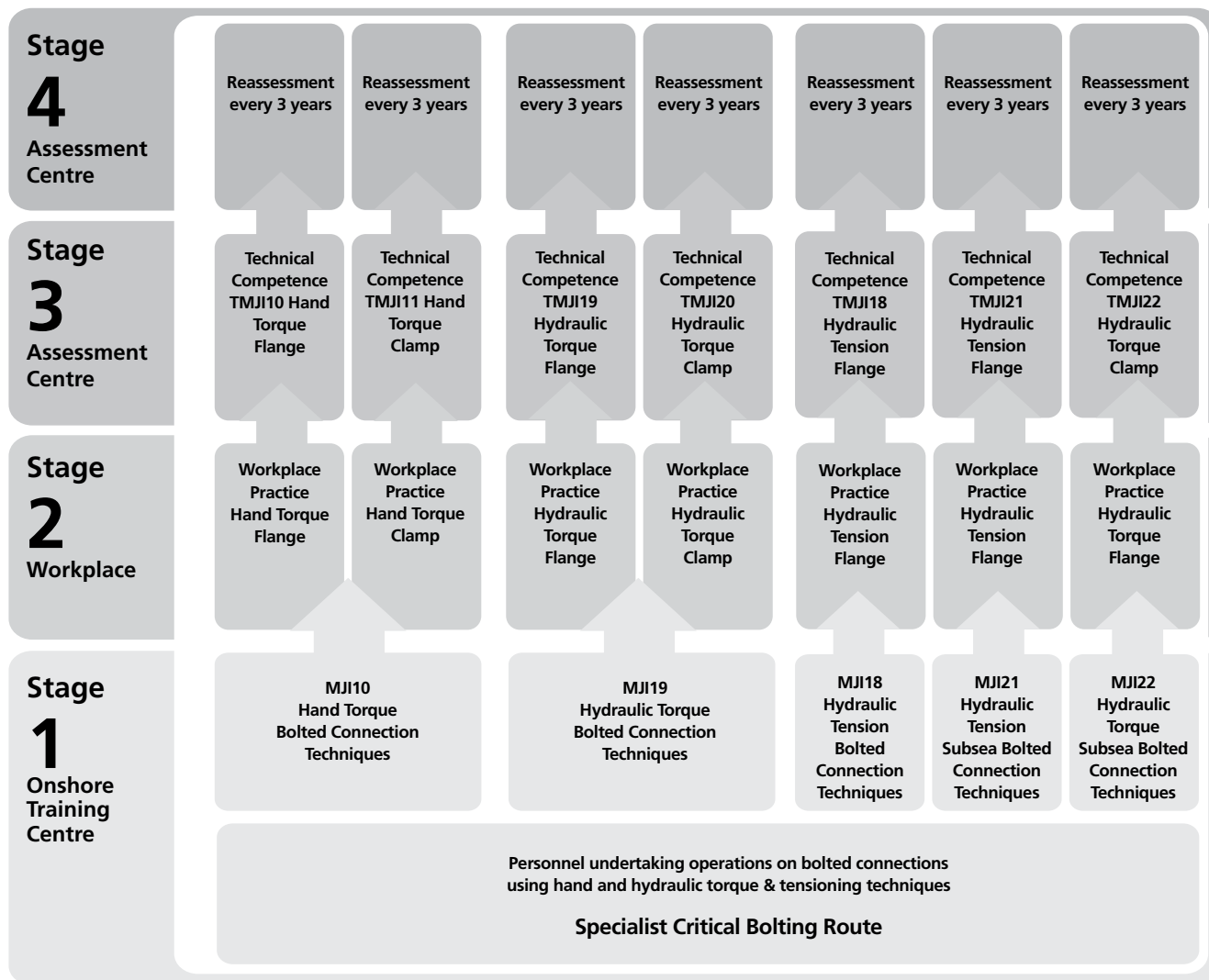
Stage 3 requires each person to complete a formal assessment of their job knowledge, skills and ability in each Mechanical Joint Integrity subject. The ECITB technical competence validation tests are standards based consisting of a bank of online knowledge questions and a practical task to validate the learner's skills, knowledge and ability. Successful learners achieve the certificate of achievement which is valid for a period of 3 years. Unsuccessful personnel must wait a minimum period of 4 weeks between the unsuccessful test session and next test session to allow a period of training to address any skills or knowledge gaps.

Stage 4

To confirm the individual's current skills, knowledge and ability, the ECITB technical competence validation test is undertaken every 3 years to prove ongoing performance development. If required the individual can undertake a short computer based training module to refresh their job knowledge before attempting the technical test.

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Figure 1 Specialist Critical Bolting



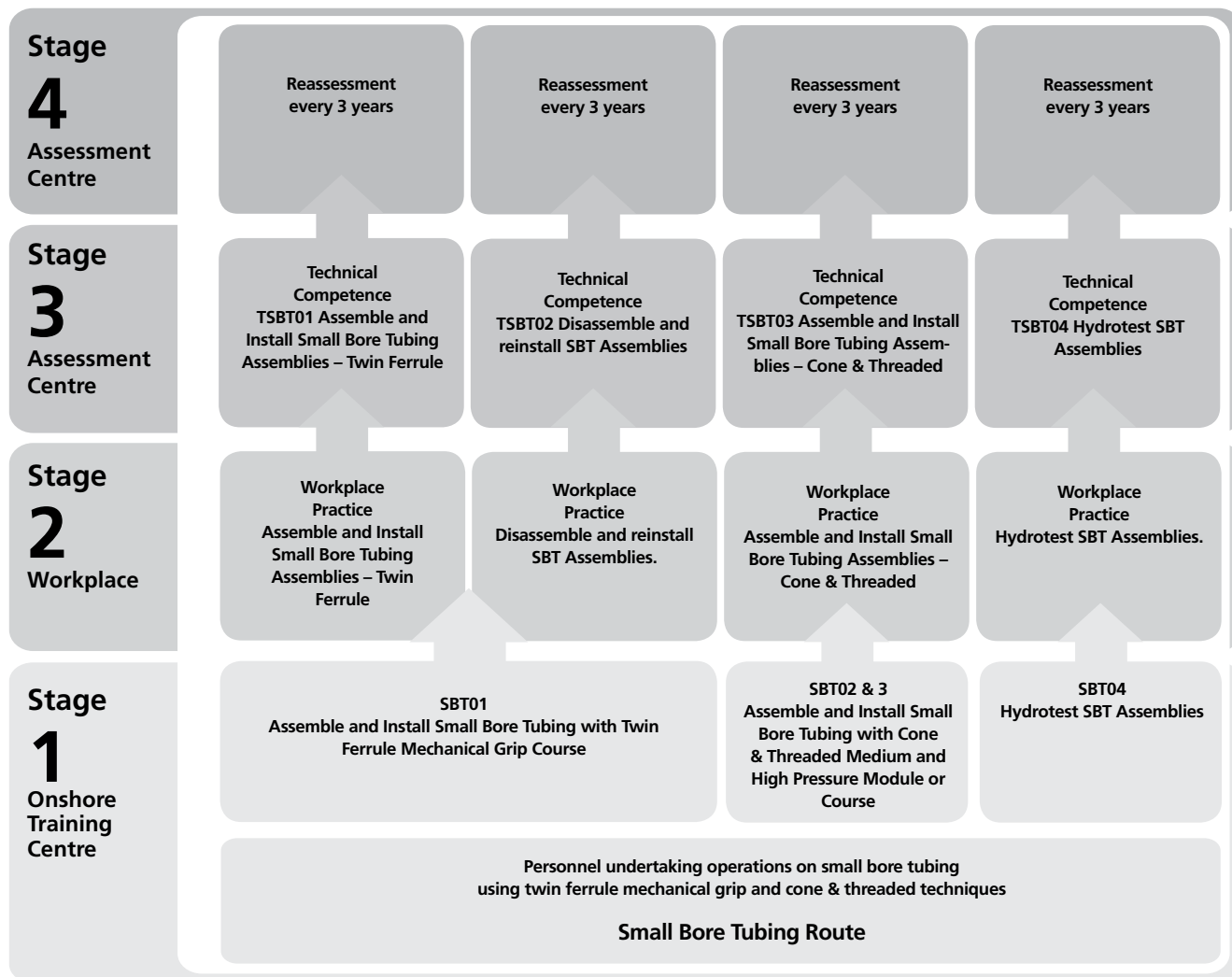
ECITB Approved Courses

The ECITB has approved eight specific courses which are derived from the Training Standards in Mechanical Joint Integrity MJI 10, 18, 19, 21 & 22.

- Hand Torque Bolted Connection Techniques – 1 day duration
- Hydraulically Torque Bolted Connection Techniques – 1.5 days duration
- Hydraulically Torque Bolted Connection Techniques Module – 1 day duration
- Hydraulically Tension Bolted Connection Techniques – 1 day duration
- Hydraulically Torque and Tension Bolted Connection Techniques – 2.5 days duration
- Hydraulically Torque Bolted Connection Techniques – 1.5 days duration
- Hydraulically Tension Subsea Bolted Connections – 1 day duration
- Hydraulically Torque and Tension Subsea Bolted Connections – 2 days duration

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Figure 2 Small Bore Tubing



ECITB Approved Courses

The ECITB has approved four specific courses which are derived from the Technical Training Standards in Small Bore Tubing (training standards SBT02, 3, 4, 5, 6 & 8).

SBT01 - Assemble and Install Small Bore Tubing with Twin Ferrule Mechanical Grip Fittings – 2 days duration

Note: This 2 day Twin Ferrule Mechanical Grip Fittings course is aimed at learners with no previous small bore tubing training.

SBT02 - Assemble and Install Small Bore Tubing with Cone & Threaded Medium and High Pressure Module – 1 day duration

Note: Learners can only access this module if they hold an ECITB SBT Twin Ferrule Approved Course certificate taken in the previous 6 months or have attained the TSBT01 Assemble and Install Small Bore Tubing Assemblies – Twin Ferrule technical test.

SBT03 - Assemble and Install Small Bore Tubing with Cone & Threaded Medium and High Pressure – 2 days duration

Note: This 2 day Cone & Threaded Medium and High Pressure course is aimed at learners with no previous small bore tubing training.

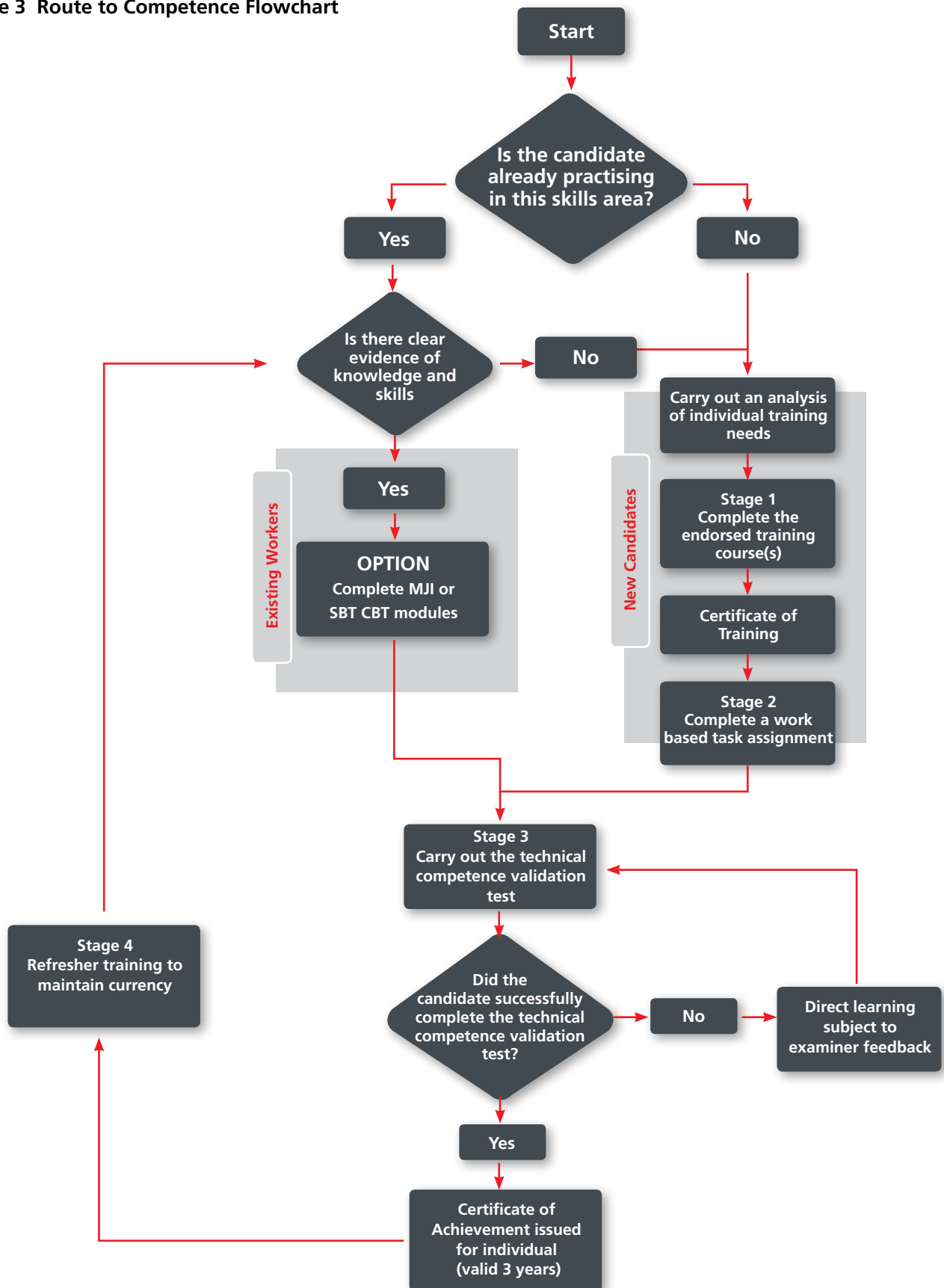
SBT04 - Hydrotest SBT Assemblies

Note: Learners can only access this course if they hold one of the following ECITB technical tests:

- TSBT01 Assemble and Install Small Bore Tubing Assemblies – Twin Ferrule
- TSBT02 Disassemble and reinstall SBT Assemblies
- TSBT03 Assemble and Install Small Bore Tubing Assemblies – Cone & Threaded

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Figure 3 Route to Competence Flowchart



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Competence Management of Mechanical Joint Integrity

Roles & Responsibilities

The following matrices provide guidance on the roles and responsibilities in Mechanical Joint Integrity operations to be applied in conjunction with the training and competence Fig. 1 & 2. The numbers refer to the 4 stage model described on page 3.

Specialist Critical Bolting		Key role – stages required					
Activity	Supervisor	Decommissioning Operative	Maintenance Technician	Production Operator	Construction Craftsperson	Bolting Technician / Supervisor	Inspector
Work safely and minimise risk in Mechanical Joint Integrity operations	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Identify and deal with hazards and emergencies in Mechanical Joint Integrity operations	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Prepare the work area, materials and equipment in accordance with health and safety and quality stipulations for Mechanical Joint Integrity operations	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Ensure intended task conforms to related specification, methods, processes, techniques and procedures	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Dismantle bolted connections (torque or tension)	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Remove components from bolted connection systems	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Replace components in bolted connection systems	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Assemble, secure and hand torque bolted connections	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Assemble, secure and hydraulically tension bolted connections	1	1,2,3	1,2,3,4	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4
Assemble, secure and hydraulically torqued bolted connections	1		1,2,3,4	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4
Verify the integrity of the assembled joint	1		1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4

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Small Bore Tubing		Key role – stages required						
Activity	Designer	Supervisor	Decommissioning Operative	Maintenance Technician	Production Operator	Construction Craftsperson	SBT Technician / Supervisor	Inspector
Work safely and minimise risk in Mechanical Joint Integrity operations	1	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Identify and deal with hazards and emergencies in Mechanical Joint Integrity operations	1	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Plan and configure small bore tubing assemblies in the engineering construction industry	1	1	1,2,3	1,2,3,4	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4
Dismantle and remove components from small bore tubing assemblies in engineering construction	1	1	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Shape small bore tubing components in the offshore/ engineering construction industry	1	1		1,2,3,4	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4
Replace components in small bore tubing assemblies in engineering construction	1	1		1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Assemble small bore tubing components to meet specification in the engineering construction industry	1	1		1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Install small bore tubing in the engineering construction industry	1	1		1,2,3,4	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4
Test small bore tubing assemblies in the engineering construction industry	1	1		1,	1,2,3	1,	1,2,3,4	1,2,3,4
Inspect small bore tubing in the engineering construction industry	1	1		1,	1,2,3	1,	1,2,3,4	1,2,3,4

SBT Qualification – A vocational qualification Installing Engineering Construction Plant and Systems Small Bore Tubing Assemblies is available from the ECITB.

MECHANICAL JOINT INTEGRITY ROUTE TO COMPETENCE GUIDANCE DOCUMENT

Training and Competence Management responsibility

The right person for the right task

Level	The task	Training and supervision	Measuring performance
New Worker	Specify the tasks for the new worker, the tools, PPE and equipment, specify limits on tasks, assign to a supervisor	Provide approved training provision and supervision in accordance with 4 stage model; provide opportunities to consolidate skills and knowledge in the workplace using the work based task assignments to a satisfactory standard ready to undertake the technical competence validation test.	Set and monitor training targets, monitor performance and behaviours of new worker and supervisor. Achievement of technical test in relevant subject area.
Experienced Worker	Specify and authorise tasks that can be undertaken, according to valid technical test certificates and experience.	Check technical test certificates, provide refresher training and ongoing performance development.	Confirm validity of technical test certificates; carry out assessments against company/client competence management systems.
Designer	Awareness and knowledge of SBT systems, components and materials to aid design skills.	Provide approved SBT Assemblies training provision and supervision in design project tasks.	Set and monitor training targets, monitor performance and behaviours in design project tasks.
Supervisor	Specify the awareness and knowledge of tasks and associated risks.	Check qualifications and task experience, relevant approved course training, provide management and technical support to workers	Set, monitor performance and behaviours of workers in tasks, task completed safely with a do it right first time approach, HCR reduction target met.
Decommissioning Operative	Specify the awareness and knowledge of tasks and associated risks when destructing plant and systems.	Provide approved relevant training provision and supervision in decommissioning tasks.	Set and monitor training targets, monitor performance and behaviours in decommissioning tasks..
Maintenance Technician	Specify and authorise tasks that can be undertaken, according to valid technical test certificates and experience.	Check technical test certificates, provide refresher training and ongoing performance development.	Confirm validity of technical test certificates; carry out assessments against company/client competence management systems.
Production Operator	Awareness and knowledge of MJJ systems, components and materials to aid basic maintenance task skills.	Provide approved training provision and supervision in accordance to 4 stage model if technical test certificate required; provide opportunities to consolidate skills and knowledge in the workplace using the work based task assignments to a satisfactory standard ready to undertake the technical competence	Set and monitor training targets, monitor performance and behaviours in basic maintenance task skills.
Construction Craftsperson	Specify and authorise tasks that can be undertaken, according to valid technical test certificates and experience.	Check technical test certificates, provide refresher training and ongoing performance development.	Confirm validity of technical test certificates, carry out assessments against company/client competence management systems.
SBT/Bolting Technician	Specify and authorise tasks that can be undertaken, according to valid technical test certificates and experience.	Check technical test certificates, provide refresher training and ongoing performance development.	Confirm validity of technical test certificates; carry out assessments against company/client competence management systems.
Inspector	Specify and authorise tasks that can be undertaken, according to valid technical test certificates and experience.	Check technical test certificates, provide refresher training and ongoing performance development.	Confirm validity of technical test certificates; carry out assessments against company/client competence management systems.

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Recommended Courses and Technical Tests

Mechanical Joint Integrity (MJI)

Key Role	Training Course	Technical Test
Pipefitter, Plater, Mechanical Fitter/Technician, Instrument Technician, Production Operator	Hand Torque Bolted Connection Techniques	TMJ10, TMJ11
Pipefitter, Plater, Mechanical Fitter/Technician	Hydraulically Torque Bolted Connection Techniques	TMJI19, TMJI20
Pipefitter, Plater, Mechanical Fitter/Technician	Hydraulically Tension Bolted Connection Techniques	TMJI18
Pipefitter, Plater, Mechanical Fitter/Technician, Bolting Technician/Supervisor	Hydraulically Torque and Tension Bolted Connection Techniques	TMJ10, TMJ11, TMJI18 TMJI19, TMJI20
Diver, Diving Support	Hydraulically Tension Subsea Bolted Connections	TMJI21
Diver, Diving Support	Hydraulically Torque and Tension Subsea Bolted Connections	TMJI21, TMJI22

Small Bore Tubing (SBT)

Key Role	Training Course	Technical Test
Instrument Technician, Production Operator – staff that only dismantles and reassemble SBT fittings and do not fabricate tubing.	SBT01 - Assemble and Install Small Bore Tubing with Twin Ferrule Mechanical Grip Fittings – 2 days duration	TSBT2
Pipefitter, Plater, Mechanical Fitter/Technician, Instrument Technician, SBT Technician/Supervisor – staff that fabricate tubing and install SBT fittings	SBT01 - Assemble and Install Small Bore Tubing with Twin Ferrule Mechanical Grip Fittings – 2 days duration	TSBT01, TSBT2
Pipefitter, Plater, Mechanical Fitter/Technician, Instrument Technician, SBT Technician/Supervisor – staff that fabricate tubing and install SBT fittings	SBT02 - Assemble and Install Small Bore Tubing with Cone & Threaded Medium and High Pressure Module	TSBT03
Pipefitter, Plater, Mechanical Fitter/Technician, Instrument Technician, SBT Technician/Supervisor – staff that fabricate tubing and install SBT fittings	SBT03 - Assemble and Install Small Bore Tubing with Cone & Threaded Medium and High Pressure – 2 days duration	TSBT03
Pipefitter, Plater, Mechanical Fitter/Technician, Instrument Technician, SBT Technician/Supervisor	SBT04 - Hydrotest SBT Assemblies	TSBT04



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