

Total Integrated Solutions

Petracarbon (Thailand) Co., Ltd is a hi-tech company with their primary goal to promote advanced repair & maintenance technologies for oil & gas, chemical, petrochemical, oil refining industries in Thailand and in neighbouring countries.

Beside the usual services, we are also an approved training provider from ECITB (Engineering Construction Industry Training Board) for delivering the Mechanical Joint Integrity (MJ) training courses, that is in line with industry standards and practices.

This ECITB MJ course which focus on skills in performing various techniques using range of bolting tools, which enable delegates to learn isolation, dismantling, alignment and tightening techniques on various type of flanges, as well as inspection of components as per industry requirements.

- MJ10: Hand Torque Bolted Connection
- MJ18: Hydraulically Tensioned Bolted Connections
- MJ19: Hydraulically Torqued Bolted Connection

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Personnel Competence Qualification

Correct installation of the bolted connection is essential in order to have it optimal with safe operation and in achieving the highest performance from a pressurised bolted connection. If improperly assembled, even with the most performing seal, it will not work as it should be. Improper assembly of the joint connection will cause not only leaks, but also stop the production process – that means high costs due to downtime – or even worse, a catastrophe. Studies have shown that the main cause for flange joint failures are due to improper handling of the sealing elements and incorrect assembly technique.

Standard industrial practise for pressurised bolted connections require controlled bolt tightening. Therefore, competent bolting technicians are required to achieve the specified bolt load and tightness requirement where appropriate.

At present, there are three standards with reference to qualification of personnel competency in the assembly of the bolted connections. Namely;

1. BS EN 1591-4 (13th Edition 2019) Flanges and their joints Part 4: Qualification of personnel competency in assembly of the bolted connections of critical service pressurized systems.
2. ASME PCC-1-2019 (Edition 2019) Guidelines for pressure boundary bolted flange joint assembly. Appendix A (Training and qualification of bolted joint assembly personnel)
3. ECITB MJ TS (2020) Engineering Construction Industry Training Standard

BS EN 1591-4:2019

According to this standard, there are 2 key aspects for achieving proper competency:

- theoretical knowledge combined with practical experience gained onsite or by simulated workshop activities;
- assessment by a competent assessor to verify that the required knowledge, skill and ability has been gained and can be applied in accordance with an operating procedure.

This BS EN 1591-4:2014 sets out the training syllabus for the bolting technicians, who actually disassemble, assemble and tighten bolted joints that in service will be pressurized and also the syllabus for the personnel who supervise those technicians and responsible engineers.

The aim of this European standard is to establish the skills required to safely and successfully disassemble, assemble and tighten pressurized bolted joints of a joint capable of maintaining a leak-free status throughout its' service life.

Bolting technicians have to assemble bolted connections of different levels of complexity. For this reason, training matrices dealing with bolted connections of various levels of complexity and for different types of pressurised bolted connections are given in this standard. The modular structure created allows a bolting technician, once competency in the foundation level has been achieved, to obtain competency in higher levels as required.

Higher levels of competency can be referred to special applications such as: heat exchangers, fragile flanges,

ECITB MJI Trainings



ASME PCC-1:2019 (Appendix A)

This appendix is not mandatory, but provides guidelines for establishing uniform criteria for the training and qualification of personnel competency in the assembly of the bolted connections. It also provides guidelines for quality control program. The recommendations presented in this appendix is intended to be a guide and can be applied differently by each user. The decision that these guidelines to be applied or not lies entirely with the user. The appendix provides for the qualification of operators three components for the operators qualification:

1. training
2. practice
3. experience.

This appendix may be applied to personnel involved in the assembly/disassembly or quality control for pressure vessels, pipes and tanks with bolted joints. Depending on the requirements of training and qualifications and also on the duties and responsibilities the provisions of this norm are addressed to:

- Qualified Bolting Specialists
- Qualified Senior Bolting Specialists
- Qualified Bolting Specialists Instructors

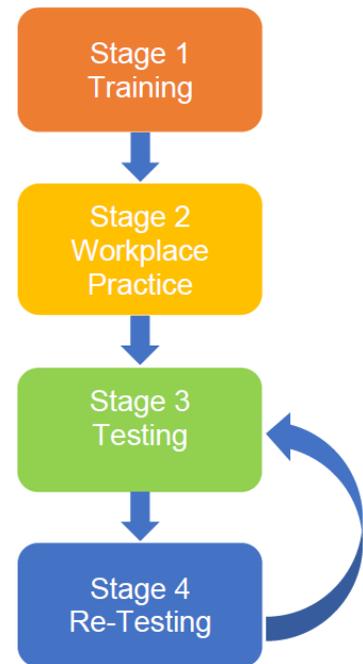
Additional qualifications may be obtained for power equipment, heat exchangers and special joints.

ECITB Mechanical Joint Integrity

The Mechanical Joint Integrity (MJI) model was originally developed by ECITB in 2011 with industry experts to address a need to resolve hydrocarbon release issues experienced in North Sea operations. This model of training has since been adopted by many UK oil and gas operators and contracting companies.

The MJI model is intended to reflect “good practice” for the training and competence of workers in relation to mechanical joint operations, both on and offshore. Primarily aimed at those workers required to undertake mechanical jointing tasks the model is also relevant for planners and supervisors of such operations.

The MJI model comprises a four stage model of training and competence that can be used by both new entrants and experienced workers involved in mechanical joint operations. Each stage is outlined below:



The 4 Stage MJI Model

Training Standard

ECITB MJI Training Standard sets out the training necessary to develop the knowledge required to dismantle, prepare, secure and reassemble mechanical joint connections system. This Training Standard is aligned with the training requirement as stipulated by BS EN1591-4 & ASME PCC-1 Appendix A.



Petracarbon is an ECITB MJI approved training provider for courses on tightening techniques in specialist critical bolting applications.



**MECHANICAL
JOINT
INTEGRITY
TRAINING**



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Trainer to Learner Ratio in MJI Courses

The support the MJI trainer provides to a learner throughout the MJI training course is of critical importance, therefore to ensure high quality instruction and the safety of learners whilst using hand and hydraulic equipment in MJI courses, a maximum ratio of 1 trainer to 6 learners is the requirement.

Stage One – Training

A new or relatively inexperienced worker will attend an ECITB approved training provider to gain knowledge, skills and practice on mechanical joint operations. The training will normally take place onshore and consist of classroom and workshop learning activities. The courses are normally from 1 to 2.5 days depending upon the subject matter.

Some courses from approved providers may be delivered in a blended learning format where the theory is covered by e-learning or virtual classroom with the learner attending the training provider's premises to take the knowledge test and practical training.

Each person will be taught theoretical and practical skills in the relevant subject matter to a technical training standard specified by the ECITB, which is then followed by a knowledge test and practical exercises.

ECITB Approved MJI Courses

The ECITB has the following MJI training standards:

- MJI-01 Mechanical Joint Integrity First Principles
- MJI-10 Hand Torqued Flange Bolted Connections
- MJI-11 Hand Torqued Clamp Connectors
- MJI-18 Hydraulically Tensioned Bolted Connections
- MJI-19 Hydraulically Torqued Bolted Connections
- MJI-20 Hydraulically Torqued Clamp Connectors
- MJI-21 Hydraulically Tensioned Subsea Bolted Connections
- MJI-22 Hydraulically Torqued Subsea Bolted Connections
- MJI-23 Powered Torque Gun Bolted Connections

All MJI courses include MJI-01 Mechanical Joint Integrity First Principles. Details for each of the other MJI courses offered by the ECITB's approved training providers are listed below:

Hand Torque Bolted Connection Techniques (MJI10 & 11) – 1 day duration

This course covers the theory of mechanical joint operations - safety, flanges, clamp connectors, gaskets, seal rings, bolts, nuts, washers, equipment, hand torque, isolations, dismantling, assembly and securing. Each learner will complete the Knowledge Test (20 MCQ) and 2 x flange and 1 x clamp connector exercises using a hand torque wrench. This course prepares the learner for the TMJI 10 and 11 technical tests..

Hydraulically Torqued Bolted Connection Techniques (MJI10, 11, 19 & 20) – 1.5 days duration

This course covers the theory on mechanical joint operations -safety, flanges, clamp connectors, gaskets, seal rings, bolts, nuts, washers, hand and hydraulic equipment, hand torque, hydraulic torque, isolations, dismantling, assembly and securing. Each learner will complete the Knowledge Test (30 MCQ), 2 x flange and 1 x clamp connector exercises using a hand torque wrench and 2 x flange and 1 x clamp connector exercises using a hydraulic torque wrench. This course prepares the learner for the TMJI 10, 11, 19 and 20 technical tests.

Hydraulically Torqued Bolted Connection Techniques Module (MJI19 & 20) – 1 day duration

This course covers the theory on mechanical joint operations - safety, flanges, clamp connectors, gaskets, seal rings, bolts, nuts, washers, hydraulic equipment, hydraulic torque, isolations, dismantling, assembly and securing. Each learner will complete the Knowledge Test (20 MCQ), 2 x flange and 1 x clamp connector exercises using a hydraulic torque wrench. This course prepares the learner for the TMJI 19 and 20 technical tests.

Course entry requirement – The learner must have completed a MJI10 & 11 (Hand Torque Bolted Connection Techniques) Course or hold a TMJI10 Test Certificate.



Hydraulically Tension Bolted Connection Techniques (MJI18) – 1 day duration

This course covers the theory on mechanical joint operations - safety, flanges, gaskets, bolts, nuts, washers, hydraulic equipment, hydraulic tension, isolations, dismantling, assembly and securing. Each learner will complete the Knowledge Test and complete 2 x flange exercises using hydraulic tensioning equipment. This course prepares the learner for the TMJI 18 technical test.

Hydraulically Torque and Tension Bolted Connection Techniques (MJI10, 11, 18, 19 & 20) – 2.5 days duration

This course covers the theory on mechanical joint operations - safety, flanges, clamp connectors, gaskets, seal rings, bolts, nuts, washers, hand and hydraulic equipment, hand torque, hydraulic torque, hydraulic tension, isolations, dismantling, assembly and securing. Each learner will complete the Knowledge test (40 MCQ), 2 x flange and 1 x clamp connector exercises using a hand torque wrench, 2 x flange and 1 x clamp connector exercises using a hydraulic torque wrench and 2 x flange exercises using hydraulic tensioning equipment. This course prepares the learner for the TMJI 10, 11, 18, 19 and 20 technical tests.

Hydraulically Tensioned Subsea Bolted Connections (MJI21) – 1 day duration

This course covers the theory on subsea mechanical joint operations - safety, flanges, gaskets, bolts, nuts, washers, sub-sea hydraulic equipment, hydraulic tension, isolations, dismantling, assembly and securing. Each learner will complete the Knowledge Test (20 MCQ) and 2 x flange exercises using sub-sea hydraulic tensioning equipment. This course prepares the learner for the TMJI 21 technical test. (Recommended for divers).

Hydraulically Torqued Subsea Bolted Connections (MJI22) – 1 day duration

This course covers the theory on subsea mechanical joint operations - safety, flanges, gaskets, seal rings, bolts, nuts, washers, subsea hydraulic equipment, hydraulic torque, isolations, dismantling, assembly and securing. Each learner will complete the Knowledge Test (20 MCQ), 2 x flange exercises using a sub-sea hydraulic torque wrench. This course prepares the learner for the TMJI 22 technical test. (Recommended for divers).

Powered Torque Gun Bolted Connections (MJI23) – 0.5 day duration

This course covers the theory on mechanical joint operations - safety, flanges, clamp connectors, gaskets, seal rings, bolts, nuts, washers, hydraulic equipment, hydraulic torque, isolations, dismantling, assembly and securing. Each learner will complete the Knowledge Test (10 MCQ) and 1 x flange and 1 x clamp connector exercise using a powered torque gun.

Course Entry requirement – The learner must have completed a course that covered MJI 19. (Hydraulic Torque Bolted Connection Techniques) or hold a TMJI19 Test Certificate





ECITB Certificate of Training

Successful personnel will gain the ECITB Certificate of Training (below) and be issued with a Work Based Task Assignment to be used in Stage 2.



If you are presented with an ECITB Certificate of Training and believe that the certificate is not genuine you can contact ECITB to confirm the validity of the certificate at prog.admin@ecitb.org.uk

Stage 2 - Workplace Practice

Each new worker, after attending an approved course and gaining a training certificate, requires a period of workplace experience to practise new skills and knowledge. This will allow consolidation of skills and knowledge through work based tasks.

The learner will be given a Work Based Task Assignment, specifying a range of tasks and complex jobs to be completed before they can move on to Stage 3 (Technical Testing).

The Work Based Task Assignment will typically take between 3 and 12 months to complete. The learner 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.

Experience Record				
Course Completed by Candidate:				
Candidate Name			Signature	
Telephone Number				
Provider				
Course date			Certificate number	
Task	Date	PTW Number	Task Title	Site Location
1				
	Supervisor Name:		Position:	
	Contact address/telephone:		Signature:	
Comments:				
2				
	Supervisor Name:		Position:	
	Contact address/telephone:		Signature:	
Comments:				
3				
	Supervisor Name:		Position:	
	Contact address/telephone:		Signature:	
Comments:				
4				
	Supervisor Name:		Position:	
	Contact address/telephone:		Signature:	
Comments:				
Employer Verification				
By signing below, you are confirming the criteria set out on page 2 (employer verification section)				
Employer Name:				
Name	Position	Date	Signature	

Each task must have satisfactorily covered the following activities:

- Observe health and safety requirements and approved work practices.
- Prepare work area, equipment and materials.
- Follow and interpret technical information, permits and isolations.
- Dismantle bolted connections using correct techniques.
- Remove components, inspect and replace components.
- Assemble and secure the assembled flanged joints.
- Check integrity of assembled joint and complete task documentation.
- Achieve accuracy and quality standards.



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

- A supervisor or team leader holding MJI certification
- A line manager holding MJI certification.

The Training Provider will issue the relevant Work Based Task Assignments (Template) to each learner at the end of each approved training course and explain its purpose and use.

Stage 3 - Technical Testing

Stage 3 requires each individual to complete a formal assessment of their job knowledge, skills and ability in each Mechanical Joint Integrity subject. The ECITB technical competence validation tests comprise two elements:

Knowledge Tests

The candidate will take a “closed book” online test, consisting of 20 multiple-choice questions per technical standard to assess theoretical knowledge. The pass mark is 80% to enable progression onto the practical test. The test can be re-sat after 4 weeks.

Practical Tests

The candidate will undertake a highly specified practical assessment with candidate instructions in various prescribed stages under continuous observation by an examiner. All parts of the practical test must be completed to the required standard; the candidate will be given access to reference materials for the practical element of the test. All test criteria must be met to achieve a pass. Any test criteria not achieved to the specified standard will result in a requirement to re-sit the test after 4 weeks.

List of ECITB MJI Technical Tests

- TMJI10 Dismantle, Assemble and Hand Torque Flanged Joints
- TMJI11 Dismantle, Assemble and Hand Torque Clamp Connector
- TMJI18 Dismantle, Assemble and Tensioning Bolted Connections (Hydraulic Tensioning)
- TMJI19 Dismantle, Assemble and Hydraulically Torque Flanged Joints
- TMJI20 Dismantle, Assemble and Hydraulically Torque Clamp Connector Joints
- TMJI21D Dismantle, Assemble and Hydraulically Torque Flanged Joints Sub Sea

- TMJI21W Dismantle, Assemble and Hydraulically Torque Flanged Joints Sub Sea
- TMJI22D Dismantle, Assemble and Tensioning Bolted Connections (Hydraulic Tensioning) Sub Sea Connections
- TMJI22W Dismantle, Assemble and Tensioning Bolted Connections (Hydraulic Tensioning) Sub Sea Connections

Testing Procedures

The Test Centre must confirm the following information with the employer/candidate before arranging the test session:

Newly Trained Workers

The Test Centre must ensure the newly trained worker has successfully completed Stages 1 and 2 of the ECITB’s MJI Model. The relevant course certificate serial numbers will be recorded on the completed Work Based Task Assignment. The completed Work Based Task Assignment will be stored by the Test Centre along with the completed paper Examiner’s Results sheet for audit purposes.

Experienced Workers

An experienced worker is defined as having a mechanical background, typically from an apprenticeship route such as mechanical, pipefitting or plating. They will also have experience in the engineering construction industry, with verifiable and recent experience in mechanical joint integrity activities. The individual will hold safety certificates such as the CCNSG Safety Passport/IHSP or BOISET/MIST certificates. Once these criteria are met, the following procedures apply:

- Experienced Workers will require a company letter of endorsement confirming attendance at hand/hydraulic torque and/or tensioning training, or copies of relevant ECITB certificates as well as evidence that the individual has workplace experience in MJI.
- Experienced Workers that attend one of the MJI training courses as “refresher training” should wait a minimum period of four weeks before being granted access to the relevant technical test. The experienced worker will require a company letter of endorsement, a copy of the ECITB certificate and evidence of workplace experience in MJI.
- Private individuals will be required to submit a detailed CV detailing MJI experience and containing two referees who can vouch for their experience in MJI to the Test Centre. They will also need to provide to the Test Centre copies of ECITB certificates or other training certificates before the test session. This will indicate that the individual has previous hand/hydraulic torque and/or tensioning



ECITB Certificate of Achievement

Successful personnel will be awarded an ECITB Certificate of Achievement (shown below) at Stage 3 testing and Stage 4 Re-testing. The certificate is valid for three years.



If you are presented with an ECITB Certificate of Achievement and believe that the certificate is not genuine you can contact ECITB to confirm the validity of the certificate at prog.admin@ecitb.org.uk

Stage 4 - Retesting

To confirm the individual's current skills, knowledge and ability, the ECITB Technical Competence Validation Test is undertaken every 3 years to prove continued skill levels.

If required, the individual can undertake a short computer based training module to refresh their theory knowledge before attempting the technical test. A number of approved MJJ providers can offer computer based modules taking 2 to 5 hours in the following subjects:

- Hand Torque Bolted Connection Techniques
- Hydraulically Torqued Bolted Connection Techniques
- Hydraulically Tension Bolted Connection Techniques
- Hydraulically Torque and Tension Bolted Connection Techniques

The Test Centre must confirm the following information with the employer/candidate before arranging the re-test session:

- Previous Certificate of Achievement – the Test Centre must carry out a check to confirm the certificate is genuine before arranging the re-test.
- Candidates with expired TMJI test certificates – the candidate will require a company letter of endorsement confirming MJJ activities are regularly carried out by the individual. Private individuals will be required to submit a detailed CV with two referees to the same effect. This information is submitted to

