



COV-TEN-CON 514 - Stack Raise Works Bolt Tension/Torque Settings

Field	Detail	Field	Detail
Document No.	COV-TEN-CON-514-SRG-QA-PRO-001	Revision	Rev 2
Project	COV-TEN-CON 514 - Stack Raise Works	Date	15 June 2026
Applies To	Structural bolting, hold-down bolts, stack flange bolting	Prepared For	Covalent / SRG Construction Team

1. Purpose

This procedure defines the method, inspection requirements and records for bolt snugging, structural bolt tensioning by part-turn, and stack flange torque tightening for COV-TEN-CON 514.

2. Scope

- Grade 4.6 hold-down/baseplate bolts - snug tight only.
- Grade 8.8 structural bolts nominated as TB - snug tight followed by part-turn tensioning in accordance with AS/NZS 5131 and AS/NZS 1252 bolt assembly requirements.
- Stack / pipe segment gasketed flange bolts - torque tightening using ASME PCC-1 legacy cross-pattern/Alternate method where adopted by the project, and the project-approved target torque.
- Inspection, witness, hold points and record requirements for the above bolting activities.

3. Reference Documents and Definitions

Reference	Application in this Procedure
AS/NZS 5131:2016 - Structural steelwork - Fabrication and erection	Structural steel erection, snug-tightening, minimum bolt tension, part-turn method, inspection of bolted connections.
AS/NZS 1252.1 / AS/NZS 1252 bolt assemblies	High-strength structural bolt/nut/washer assemblies for tensioned bolting.
ASME PCC-1-2019 - Guidelines for Pressure Boundary Bolted Flange Joint Assembly	Guideline for stack/gasketed flange bolt installation, staged torque passes and legacy cross-pattern tightening where adopted by the project.
Covalent / Carnac engineering directions and approved RFIs/TQs	project-specific requirement.

Term	Meaning
Snug tight	The tightness in the bolts in a bolted connection attained by a few impacts of an impact wrench or by the full effort of a person using a standard podger spanner to bring the plies into firm contact.
TB structural bolt	Tensioned bearing bolt. The bolt is brought to minimum required bolt tension but the connection is designed as bearing type.
Part-turn method	Structural bolt tensioning method where bolt/nut is match-marked after snug tight and then rotated by the specified turn amount.
Target torque	The final torque nominated by the project-approved flange bolting procedure / torque table. For this project the stack flange target currently understood as 300 Nm minimum, subject to project confirmation.
Legacy cross-pattern/start method	ASME PCC-1 tightening pattern bolt sequence before final circular passes.

4. Responsibilities

Role	Responsibility
Superintendent / Supervisor	Confirm correct work pack, drawings, bolt schedule, access and hold points before bolting starts. Ensure only approved methods are used.
Verifier	Verify bolt grade, size, calibration records, inspection points and completed bolting/torque records. Coordinate witness points.
Installer	Install bolts, nuts and washers correctly. complete snugging/tensioning/torquing to this procedure. mark bolts and report defects.
Engineer / Covalent Representative	Review and accept deviations, non-conformances, or cases where fit-up/bolting requirements cannot be achieved.
Third-Party Witness	Witness the SRG installer during structural bolt tensioning and provide witness sign-off as the agreed verification for close-out of tensioning.

5. General Pre-Bolting Requirements

- Confirm latest approved drawings, bolt schedule/MTO, ITP and torque/tensioning requirements are available at the work front.
- Confirm bolts, nuts and washers are the correct grade, diameter, length, coating and quantity for the connection.
- Check material certificates and batch are available for tensioned structural bolts and critical flange bolts.
- Inspect bolts, nuts and washers for damaged threads, coating damage, contamination, corrosion, wrong markings or wrong length. Damaged items shall be quarantined and replaced.
- Connection surfaces shall be free from loose scale, weld spatter, excessive galvanising runs, burrs, debris or paint build-up that prevents proper seating.
- Washers and nuts shall seat flat/square against the plate or washer face. Nut/washer bearing faces shall not sit on dags, burrs or plate edges.
- Nuts should be installed with grade/manufacturer markings visible where practicable. If not possible due to access/orientation, verify nut grade before installation and record if required.
- Torque tools shall have current calibration certificates. Calibration details shall be recorded for stack flange torquing and any torque-controlled verification.

6. Hold-Down / Baseplate Bolts - Grade 4.6 Snug Tight

Step	Activity	QA / Acceptance
1	Verify bolt grade, diameter, nut/washer arrangement, thread condition and drawing requirement.	Correct Grade 4.6 hold-down bolts installed in correct locations.
2	Install washers/nuts and bring baseplate/packer arrangement into firm contact.	Washer and nut seated flat, no rocking or uneven.
3	Snug tighten progressively around baseplate to firm contact only.	No part-turn/tensioning unless engineering directs.
4	Record completion in baseplate/hold-down bolt inspection checklist.	Supervisor sign-off or next hold point where required.

7. Structural Bolts - Grade 8.8 TB Part-Turn Method

Structural bolts nominated as Grade 8.8 TB shall be installed and tensioned using the part-turn method unless the approved project documentation nominates a different method, such as direct tension indicators. Stack flange bolts are excluded from this section.

7.1 Minimum Bolt Tension

Nominal Bolt Diameter	Minimum Tension for Grade 8.8
M16	95 kN
M20	145 kN
M24	210 kN
M30	335 kN

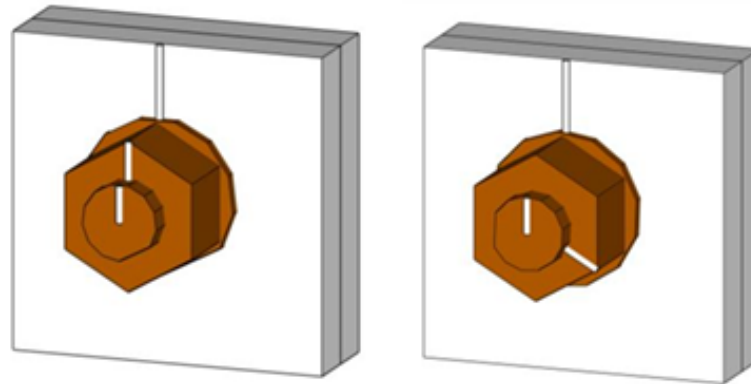
7.2 Part-Turn Rotation from Snug Tight

Bolt Length	Both outer faces normal to bolt axis	One face normal / other sloped	Both faces sloped
Up to and including 4 diameters	1/3 turn	1/2 turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	1/2 turn	2/3 turn	5/6 turn
Over 8 diameters but not exceeding 12 diameters	2/3 turn	5/6 turn	1 turn

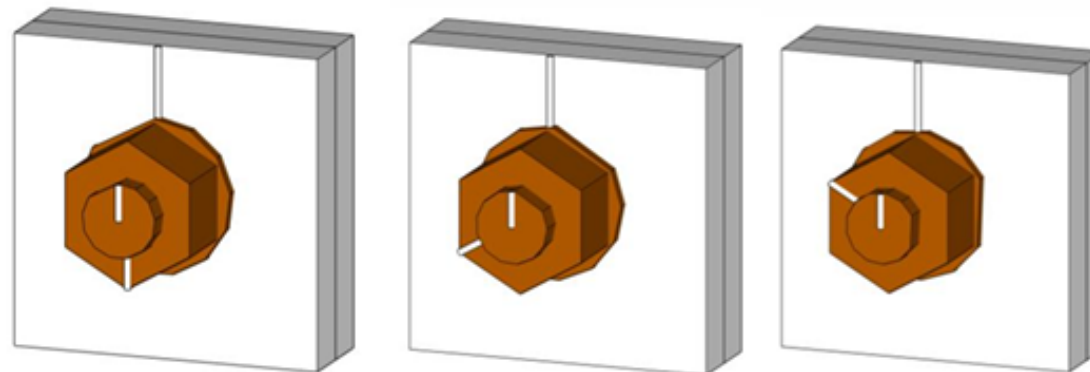
For M20 x 90 mm bolts, the bolt length is approximately 4.5 diameters. If both outer faces are normal to the bolt axis, the typical part-turn requirement is 1/2 turn from snug-tight. Confirm actual bolt length, grip condition and face condition before applying this value.

7.3 Structural Bolt Installation Sequence

Step	Activity	QA / Acceptance
1	Install bolt, nut and washer assembly in accordance with drawing and access requirements.	Correct bolt grade/length/coating, washer/nut seated flat, minimum thread engagement achieved.
2	Bring connection to snug-tight condition progressively across the connection.	All plies in firm contact, no visible gaps unless shown on drawings or accepted by engineer.
3	Match-mark the nut and bolt/plate after snug-tight to show relative starting position.	Match marks clear and visible for inspection.
4	Apply required part-turn rotation from snug-tight using calibrated/controlled equipment or agreed site method.	Correct rotation observed/measured, no under-turn, over-turn within permitted tolerance.
5	Re-check bolts initially tensioned first, because later bolt tensioning may relax earlier bolts.	All bolts fully tensioned, visual scan complete.
6	Complete structural bolt tensioning record.	Record connection ID, bolt size/grade, method, rotation, installer, date and witness sign-off.



(a) Marking at snug tight (b) Marking at 120 deg turn



(c) Marking at 180 deg turn (d) Marking at 240 deg turn (e) Marking at 300 deg turn

Figure 23 Clear location marking of bolt assembly



COV-TEN-CON 514 - Stack Raise Works Bolt Tension/Torque Settings

7.4 Part Turn Orientation for COV-TEN-CON 514 - Stack Raise Works

Bolt Diameter	Length (mm)	Qty	Required Orientation
20	50	32	1/3 turn
20	65	64	1/3 turn
20	75	64	1/3 turn
20	80	392	1/2 turn
20	85	2696	1/2 turn
24	65	64	1/3 turn
24	80	18	1/3 turn
24	90	1152	1/3 turn
24	100	36	1/2 turn
24	120	18	1/2 turn
30	140	108	1/2 turn
30	150	24	1/2 turn

8. Stack Flange Bolts - ASME PCC-1 Legacy Cross-Pattern/Alternate Torque Method

Target torque shall be the project-approved value from Covalent/Carnac. The current project value understood for the stack flange is 300 Nm minimum. If a different torque is issued, calculate the pass ranges from the approved target torque.

8.1 Pre-Flange Tightening Checks

- Confirm flange faces are clean and free from burrs, weld spatter, coating build-up, galvanising dags, damage or contamination that may affect gasket seating.
- Confirm gasket type, condition and installation orientation are correct. Do not reuse damaged gaskets unless approved.
- Confirm bolt holes align without forcing. Do not use bolts to pull flanges into unacceptable alignment.
- Confirm all bolts, nuts and washers are correct grade, diameter, length and coating. Threads shall be clean and undamaged.
- Confirm lubrication requirements.
- Number bolts clockwise 1 to 24 from an agreed reference point and mark numbers clearly for the bolting crew as per ASME PCC-1.

8.2 24-Bolt Legacy Cross-Pattern Sequence

Cross-Pattern Group	Tightening Sequence
Group 1	1 - 13 - 7 - 19
Group 2	4 - 16 - 10 - 22
Group 3	2 - 14 - 8 - 20
Group 4	5 - 17 - 11 - 23
Group 5	3 - 15 - 9 - 21
Group 6	6 - 18 - 12 - 24



COV-TEN-CON 514 - Stack Raise Works Bolt Tension/Torque Settings

8.3 Torque Passes for 300 Nm Target Torque

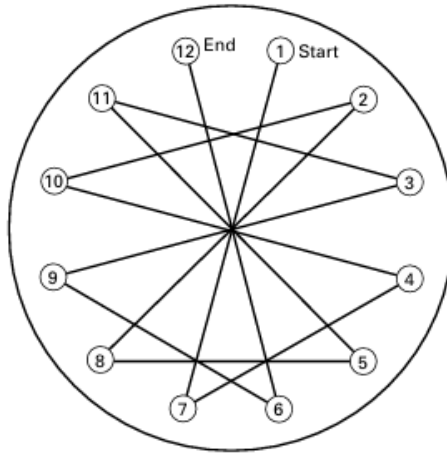
Pass	Torque Requirement	Torque for 300 Nm Target	Pattern
Install / Snug	Hand tight, then snug up to approx. 15-30 Nm, not exceeding 20% of target torque	15-30 Nm	Progressive / even seating
Round 1	20-30% of target torque	60-90 Nm	24-bolt legacy cross-pattern
Round 2	50-70% of target torque	150-210 Nm	Same legacy cross-pattern
Round 3	100% of target torque	300 Nm	Same legacy cross-pattern
Round 4	100% of target torque in circular clockwise pattern until no further nut rotation occurs	300 Nm	1-2-3-...-24, repeat until no further rotation
Round 5	Optional / if required: wait minimum 4 hours and repeat the final round.	300 Nm	Circular clockwise

8.4 Alternative to Legacy Cross-Pattern Tightening Sequence and Bolt-Numbering System When Using a Single Tool

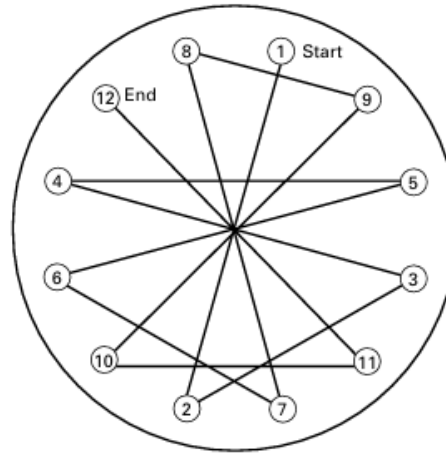
Alternate Method	Tightening Sequence
24 Bolts	1,17,9,5,13,21,3,19,11,7,15,23,2,18,10,6,14,22,4,20,12,8,16,24

Note that in the number assigned at each bolt location represents the sequential order for tightening the bolt

Figure 3 Example Legacy and Alternative to Legacy Numbering Sequences for 12-Bolt Joint



(a) Legacy (see Table 3)



(b) Alternative to Legacy (see Table 3.1)

8.5 Flange Torque Execution Requirements

- Check flange gap uniformity after snugging and early passes. If gap is not reasonably uniform, stop and correct by selective tightening/loosening as directed before proceeding.
- Use calibrated torque wrench equipment suitable for the target torque and access constraints. Record tool serial number and calibration expiry.
- Use one tool sequence unless a separate approved multi-tool procedure is issued.
- Do not exceed final target torque without engineering/Covalent approval.
- If a bolt/nut galls, thread strips, seizes, washer distorts, or rotation is abnormal, stop, quarantine affected item and notify Supervisor.
- After final pass, complete torque register with bolt numbers, pass values, final torque, date/time, installer and witness sign-off.



COV-TEN-CON 514 - Stack Raise Works Bolt Tension/Torque Settings

9. Nut, Washer Orientation / Seating & Torque Requirements

Item	Requirement/ QA Acceptance
Nut orientation	Install nuts on the most accessible side for tightening and inspection unless drawings require otherwise. Nut grade/manufacturer markings should be visible where practicable.
Washer placement	Install washers as required by the bolt assembly/drawing/procedure. For structural part-turn bolting, washer arrangement shall suit the rotated element and project bolting procedure.
Bearing face	Nut and washer must sit square/flat against the washer/plate. No bearing on burrs, galv dags, weld spatter, plate edges or paint runs.
Thread protrusion	Provide full nut engagement and adequate thread protrusion after tightening. If bolt is too short/long, replace with correct length.
Different visual appearance	Visual difference alone is not automatic rejection, but grade, size, coating, length, batch/certification and compatibility to be verified before installation.
Final Torque	Final Torque must be recorded equal or greater than 300 Nm.

10. Witness Verification and Close-Out

The verification methodology in this section has been agreed with Covalent and applies to the close-out of structural bolt tensioning carried out under this procedure.

A third-party inspection company engaged by Covalent shall witness the SRG installer carrying out structural bolt tensioning in accordance with Section 7 (Grade 8.8 TB part-turn method). Witnessing of the SRG installer during tensioning is the approved verification method for this activity and has been agreed with the Covalent representative. No change to the SRG tensioning method described in Section 7 is required.

For each connection, tensioning is verified and closed out once the SRG installer has completed the part-turn tensioning under witness and the witness sign-off has been recorded on the Structural Bolt Tensioning Record (Section 12). Where witnessing cannot be arranged for a nominated connection, the Superintendent / Supervisor shall notify Covalent before proceeding so that an alternative witness or hold-point arrangement can be agreed.

11. Non-Conformance / Stop Work Triggers

- Wrong bolt grade, size, length & coating.
- Holes do not align without excessive force.
- Nut/washer cannot seat flat or connection plates show visible distortion.
- Torque tool out of calibration or no calibration certificate available.
- Bolt/nut thread galling, stripped threads, damaged galvanising affecting fit-up, or abnormal torque response.

12. Records Required

Record	Minimum Content
Material Traceability	Bolt/nut/washer grade, size, coating, batch/lot.
Structural Bolt Tensioning Record	Connection ID, bolt size/grade, snug date, match-mark status, part-turn rotation, installer, witness sign-off, comments.
Hold-Down Bolt Snug Checklist	Baseplate/location, bolt grade, snug completion, seating condition, Supervisor sign-off.
Stack Flange Torque Register	Flange ID, bolt numbers, target torque, pass values, final torque, tool serial/calibration, installer, witness sign-off.
NCR / TQ / Engineering Acceptance	Required for deviations, damaged components, hole modifications, forced fit-up or non-standard bolting method.