

Norsk Standard NS-EN 1591-4:2013 mot Plan for opplæring Flensearbeider

Kap. 8.2.2 - table 1 foundation level training matrix

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Types of bolted connections		X	Kompetansemål 1.4
Functionality of gaskets		X	Kompetansemål 2.2
Types of gaskets and their relative features		X	Kompetansemål 2.2
Relationship between bolt elongation (strain), bolt load and gasket stress		X	Kompetansemål 1.4
Common causes of the failure of gasketed bolted connections		X	Kompetansemål 2.2
Bolt load loss and implications		X	Kompetansemål 2.2
Applied and residual bolt loads		X	Kompetansemål 6.3
General health and safety precautions	X		Kompetansemål i emne 1 dekker dette
Safe joint disassembly	X		Kompetansemål i emne 3 dekker dette
Seal face preparation	X		Kompetansemål 6.4
Identification of defects and faults	X		Kompetansemål 4.2
Face alignment and gap uniformity	X		Kompetansemål 5.1
Gasket storage, handling, preparation and placement	X		Kompetansemål 2.2
Effect of thread friction on load when using torque tightening	X		Kompetansemål 6.1
Importance of using the specified thread lubricant	X		Kompetansemål 6.1
Bolt tightening methods and their relative accuracies		X	Kompetansemål 6.2 i PLO
The need for bolt tightening patterns	X		Kompetansemål 6.2
Bolt tightening patterns	X		Kompetansemål 6.2
Tightness level		X	Ikke relevant
Requirement to meet a specific class of tightness	X		Ikke relevant
Manual torque tightening	X		Kompetansemål 6.2
Maintenance and calibration of manual torque wrenches	X		Ikke relevant

Requirements for hydraulic torquing and tensioning		X	Kompetansemål 7.1
Confirming that joint can return to service	X		Kompetansemål i emne 7
Recording of work carried out	X		Kompetansemål 7.3
Reporting of variance or irregularity	X		Kompetansemål 7.3
Emission monitoring and leakage management		X	Ikke relevant

Kap. 8.2.3 - table 2 training matrix for hydraulic tension tightening

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Permanently installed hydraulic tensioning nuts	X		Ikke relevant
Fundamentals of hydraulic tensioning	X		Kompetansemål 7.1
Understanding when to use hydraulic tensioning equipment	X		Kompetansemål 6.2
Types of hydraulic tensioners	X		Kompetansemål 7.1
Methods of hydraulic tensioning	X		Kompetansemål 7.1
Maintenance of pump and hydraulic tensioner	X		Ikke relevant
Calibration of hydraulic tensioners	X		Ikke relevant
Hose configuration	X		Ikke relevant
Methods of calculating correct bolt load and associated formulae	X		Ikke relevant
Understanding gross load/residual load	X		Kompetansemål 6.3
Number of hydraulic tensioners, percentage cover and effect on load loss	X		Kompetansemål 7.1 Percentage cover and effect on load loss er ikke relevant
Hydraulic tensioning pressure/load conversion	X		Ikke relevant
Hydraulic tensioning procedures	X		Kompetansemål 7.1
Hydraulic tensioning tightening patterns	X		Kompetansemål 7.1
Tool fit and clearance issues	X		Kompetansemål 7.1

Bolt coatings and their effect on thread security in both nut and puller sleeve	X		Ikke relevant
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Kap. 8.2.4 - table 3 training matrix for hydraulic torque tightening

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Safe use and handling of hydraulic hoses	X		Kompetansemål 1.2 og 7.1
Correct socket usage, wear/damage of sockets	X		7.1 trekkeverktøy skal dekke dette
Risk of pressure injection injuries – avoidance and action	X		Kompetansemål 1.2 og 7.1
Good working practices to avoid finger/hand pinch points	X		7.1 eller 1.2 trekkeverktøy skal dekke dette
Safe use of a backing wrench	X		Kompetansemål 7.1
Types of hydraulic torque wrenches	X		Kompetansemål 7.1
Selection of tool pressure to provide required torque for a particular tool	X		Kompetansemål 7.1
Use of single and multiple tools to tighten a joint	X		Kompetansemål 7.1
Numbering of bolts when single and multiple tools are used	X		Kompetansemål 7.1
Understanding when to use hydraulic torque equipment	X		Kompetansemål 6.2
Fundamentals of hydraulic torqueing	X		Kompetansemål 7.1
Tool fit and clearance issues	X		Kompetansemål 7.1
Identifying good reaction points	X		Kompetansemål 6.2
Torque tightening patterns	X		Kompetansemål 6.2
Importance of lubrication and control of friction	X		Kompetansemål 6.1
Effects of bolt coatings	X		Kompetansemål 6.1

Kap. 8.2.5 - table 4 training matrix for heat exchangers and pressure vessels

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Types of exchangers/TEMA designations	X		Ikke relevant
Interaction of seals during assembly	X		Ikke relevant
Gasket types	X		Ikke relevant
Confined gaskets	X		Ikke relevant
Handling and storage of gaskets	X		Ikke relevant
Bolting load requirements	X		Ikke relevant
Joint configuration and terminology	X		Ikke relevant
Flange surface inspection	X		Ikke relevant
Gap measurement	X		Ikke relevant
Bundle and channel orientation	X		Ikke relevant
Damage risks	X		Ikke relevant
Tube sheets considerations	X		Ikke relevant
Tightening shoulder type bolts	X		Ikke relevant
Alignment of primary and secondary seals prior to tightening	X		Ikke relevant
Tightening method preference relative to bolt length and tools access	X		Ikke relevant

Kap. 8.2.6 - table 5 training matrix for flanges made from brittle materials

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Types of brittle flanges	X		Kompetansemål 2.1
Brittle flange materials		X	Kompetansemål 2.1
Interaction of seals during assembly	X		Ikke relevant
Gasket types	X		Kompetansemål 2.2
Handling and storage of flanges and gaskets	X		Ikke relevant
Load requirements	X		Kompetansemål 6.1
Tightening methods for brittle flanges	X		Kompetansemål 6.5
Joint configuration and terminology	X		Ikke relevant
Flange surface inspection	X		Kompetansemål 4.2 og 6.2

Gap measurement	X		Kompetansemål 5.1 og i emne 7
Tightening method preference relative to bolt length and tool access	X		Ikke relevant
Safe disassembly of brittle flanges	X		Kompetansemål 3.1

Kap. 8.2.7 - table 6 training matrix for bolt load determination after assembly

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Methods of measuring bolt load post assembly	X		Ikke relevant
Measuring bolt load by extension measurement	X		Ikke relevant
Measurement of bold load by Torque application	X		Ikke relevant
Measurement of bolt load by Tension application	X		Ikke relevant
Measurement of bolt load by Ultrasonic measurement	X		Ikke relevant
Proprietary devices for bolt load indication (indicating rod type and indicating washer type)	X		Ikke relevant
Measurement of bolt load using extensometer	X		Ikke relevant

Kap. 8.2.8 - table 7 training matrix for compact flanges

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Compact flange types	X		Kompetansemål 2.1
Assembly requirements for each type of compact flange	X		Kompetansemål 6.1
Identification of seal ring types and materials	X		Kompetansemål 2.2
Bolt load determination	X		Ikke relevant
Tightening methods	X		Kompetansemål 6.2
Tightening patterns	X		Kompetansemål 6.2

Inspection of components pre-assembly	X		Kompetansemål 6.1 & 6.4
Inspection of flange post-assembly	X		Kompetansemål i emne 7 & 7.2
Gap measurement	X		Ikke relevant
Safe disassembly of compact flanges	X		Kompetansemål 3.1

Kap. 8.2.9 - table 8 training matrix for clamp connectors

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Clamp connector types	X		Kompetansemål 2.1
Assembly requirements for each type of clamp connector	X		Kompetansemål 2.1
Identification of seal rings and materials	X		Kompetansemål 2.2
Bolt stress and load determination	X		Ikke relevant
Tightening method	X		Kompetansemål 6.2
Tightening patterns	X		Kompetansemål 6.2
Inspection of components pre-assembly	X		Kompetansemål 4.2
Inspection of connectors post-assembly	X		Kompetansemål 7.2
Safe disassembly of clamp connectors	X		Kompetansemål 3.1

Kap. 8.2.10 - table 9 training matrix for special connectors/flanges

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Special connectors/flanges and types of special connectors/flanges	X		Kompetansemål 2.1
Assembly of special connectors/flanges	X		Ikke relevant
Identification of gaskets, seal rings and materials	X		Ikke relevant
Bolt stress and bolt load determination	X		Ikke relevant
Tightening method	X		Ikke relevant

Tightening patterns	X		Ikke relevant
Inspection of components pre-assembly	X		Ikke relevant
Inspection of components post-assembly	X		Ikke relevant

Kap. 8.2.11 - table 10 training matrix for small bore tubing connections

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Types of small bore tubing connections	X		Ikke relevant
Seals and gasket types	X		Ikke relevant
Inspection of components pre-assembly	X		Ikke relevant
Assembly of small bore flanged connections	X		Ikke relevant
Identification of pressure ratings and seal materials	X		Ikke relevant
Tightening methods for specific small bore fittings	X		Ikke relevant
Avoidance of over-tightening flanges on small bore tubing	X		Ikke relevant
Importance of avoiding stress within tubing and on fittings	X		Ikke relevant
Inspection of components-assembly	X		Ikke relevant
Safe disconnection of flanges on small bore tubing	X		Ikke relevant

Kap. 8.3 - table 11 training matrix for responsible engineer

Topic	Core	Awareness	Referanse - kompetansemål i PLO Flensearbeider
Health and safety considerations	X		Ikke relevant
Generation of safety rules	X		Ikke relevant
Generation of work instructions	X		Ikke relevant
Methods of determination of the gasket stress for a given tightness class	X		Ikke relevant

Provision of bolt load/gasket stress, value for a flange/gasket combination	X		Ikke relevant
Confirmation that a bolted connection can be returned to operation	X		Ikke relevant
Tightness measurement and leakage management		X	Ikke relevant