

Basic Technical Training (Onshore/Offshore)

Basic Hydraulics Standard

Foreword

This document has been developed in the project ATTP (Adapting a Transparent Training Programme for wind energy) with the support from EU Lifelong Learning Programme, Leonardo da Vinci. The Standard has been made together with global wind turbine owners and manufacturers (Vestas, Siemens, ENERCON, Gamesa and DONG Energy).

This Standard describes the requirements for Basic Technical Training in the wind industry that are recommended by ATTP. Where national legislation sets higher re-quirements for the training, the Training Provider shall incorporate these require-ments in the training programme. In this document the learning outcomes and the single elements of the lessons are all described according to Blooms taxonomy, please see appendix A.

All together there are the following four appendixes to this document:

- A. Blooms Taxonomy Action Verbs
- B. Basic Hydraulics Test
- C. Hydraulic Diagram
- D. Checklist for Learning Outcomes

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List of abbreviations

BTT	Basic Technical Training
WTG	Wind Turbine Generator
PPE	Personal Protection Equipment
LOTO	Lock Out Tag Out
ATTP	Adapting a Transparent Training Program for wind energy

Introduction

This module is part of a course of training that prepares candidates for work in the Wind Power Industry both on and off shore. It is not a stand-alone qualification but can be delivered independently of the other modules.

Target Group

The Basic Hydraulics module is targeted at candidates who have no previous experience of hydraulic systems but may also be used to up skill candidates who have some knowledge of hydraulics in other spheres not specifically wind turbines.

Section 1 – The Basic Technical Training (BTT) - Basic Hydraulics

1.1 Duration of the BTT Module Basic Hydraulics

The optimal total time for completing this Module is estimated to be 24 hours, including meals and breaks.

The practical skills shall be trained and demonstrated, and all elements of the course shall be covered by demonstration where possible.

If this training is part of a program of longer duration, the total contact time per day shall not exceed 8 hours and the total training day shall not exceed 10 hours. The total training day includes contact time, refreshment and meal breaks and travel between training sites where applicable. It shall be ensured that everybody is given the opportunity to share their opinions and experiences where possible.

Ensure that participants with prior experience share their experiences in a way that is constructive for the entire class.

The course will still be taught as per lesson plan whether the participant has prior experience or not.

1.2 Target Group for the Module Basic Hydraulics

The Basic Technical Training (BTT) is designed to provide participants with the basic technical skills that – together with the needed safety courses - will enable the participants to work onsite, supervised by an experienced technician.

This Module in Basic Hydraulics is targeted at personnel with little or no previous experience of hydraulic systems. It will give them the basic skills and knowledge to carry out basic maintenance tasks using safe working procedures and the correct PPE.

1.3 Participant prerequisites for the Module Basic Hydraulics

There are no prerequisites for this module but some sort of practical mechanical or electrical technical background would be useful.

All personnel working in the wind service industry shall be medically fit and capable of performing work under demanding situations. This includes being able to

- Work at heights
- Work in a wind turbine environment

- Not suffer from seasickness (offshore)

Furthermore personnel in the wind service industry must be able to read and write to a sufficient standard to be able to carry out instructions and complete the required documentation. Furthermore it is an advantage if participants are able to read, speak and write English.

Participants must have undertaken a pre-induction process to ensure they are aware of the working conditions and demands in the industry.

1.4 Physical and stressful demands of the Module Basic Hydraulics

The working environment in a wind turbine can be restricted for space, so a candidate will have to be agile enough to safely carry out maintenance tasks. Because the access to turbines off shore often is by boat transfer, the candidate will have to be physically fit enough to withstand the rigours of this, and be able to climb the ladders within the turbine when there is no elevator use available.

1.5 Aims and objectives of the Module, Basic Hydraulics

The aims of this course are to give the participants the knowledge and skills to carry out basic maintenance tasks (supervised by an experienced technician), using safe working procedures and the correct PPE.

The objectives of the BTT Module Basic Hydraulic are to ensure that the participants are able to:

- a) Describe how power transmission and transmission ratio affects the hydraulic system
- b) Demonstrate knowledge of risks and hazards associated with hydraulic work, including demonstration of how to relieve system pressure
- c) List and use PPE correctly when operating hydraulic systems
- d) Explain the importance of Lock Out Tag Out and demonstrate the procedure needed
- e) Demonstrate knowledge about Hydraulic Systems and the symbols used in hydraulic circuit diagrams, and be able to identify several hydraulic components within a diagram
- f) Demonstrate knowledge about different types and function of pumps in the hydraulic system
- g) Demonstrate knowledge about different types and function of cylinders in the hydraulic system
- h) Demonstrate knowledge about different types and function of valves in the hydraulic system

- i) Demonstrate knowledge about different types and function of accumulators in the hydraulic system, including demonstration of safe working procedures
- j) Demonstrate knowledge about the different types of sensors in the hydraulic system, their location and function
- k) Demonstrate knowledge about pipes, hoses and fittings in the hydraulic system
- l) Demonstrate knowledge of hydraulic fluids, filters and the prevention of failures in the system.
- m) Demonstrate how to use pressure gauges

1.6 Learning outcomes of the BTT Module Basic Hydraulics

Lesson 1 Introduction

30 min

The aim of this lesson is to give the participants the required information to make them aware of the course content and the facilities involved. The participants will know what to expect and what is expected of them.

To successfully complete this Module, participants shall be aware of:

- 1) Who the instructor and other participants are
- 2) Facilities
- 3) The aims and main learning objectives
- 4) On-going assessment
- 5) Motivation on the course

Note: The administrative part of the registration must be carried out before the course commences.

Lesson 2 Hydraulic introduction

30 min

The aim of this lesson is to give the candidates sufficient knowledge about the hydraulic systems.

To successfully complete this Module, participants shall be able to:

- 1) Explain the components present in a hydraulic system
- 2) Explain hydraulic power transmission/Pascal's Law
- 3) Give examples of transmission ratio

Lesson 3 Risks and hazards

90 min

The aim of this lesson is to give the candidates the knowledge of possible hydraulic hazards in a wind turbine.

To successfully complete this Module, participants shall be able to:

- 1) Describe how to check pipes, hoses and fittings
- 2) Describe how to check a faulty cylinder
- 3) Describe the function of a parking brake
- 4) Demonstrate how to relieve the system pressure

Lesson 4 Hydraulic PPE

90 min

The aim of this lesson is to train the participants to be able to choose the right PPE for working with hydraulics and to test it before use.

To successfully complete this Module, participants shall be able to:

- 1) Explain which PPE can be used for hydraulic work
- 2) Demonstrate how to test that the PPE is fit for use
- 3) Demonstrate the correct use of PPE

Lesson 5 Prevention of un-expected start-up

90 min

The aim of this lesson is to train the participants to follow the safety procedure for lock out tag out.

To successfully complete this Module, participants shall be able to:

- 1) Explain the importance of lock out tag out
- 2) Demonstrate the correct procedure for log out tag out

Lesson 6 Symbols and diagrams

90 min

The aim of this lesson is to train the participants to be able to recognize and find the different elements of a hydraulic installation.

To successfully complete this Module, participants shall be able to:

- 1) Identify the main elements of a hydraulic circuit in a diagram.
- 2) Identify the measuring points of an installation in the diagram.

Lesson 7 Pumps

90 min

The aim of this lesson is to train the participants to be able to recognize the main type of pumps of hydraulic circuits and how to check the start and stop pressure on pumps.

To successfully complete this Module, participants shall be able to:

- 1) Explain the principle of working of piston pumps.
- 2) Explain the principle of working of gear pumps.
- 3) To check the start and stop pressure of a pump following the instructions.

Lesson 8 Cylinders

30 min

The aim of this lesson is to train the participants to be able to recognize the main type of cylinders in a hydraulic circuit.

To successfully complete this Module, participants shall be able to:

- 1) Explain the different types of cylinders, and their use
- 2) Describe the maintenance process of the cylinders.

Lesson 9 Directional control valves

30 min

The aim of this lesson is to train the participants to be able to operate the directional control valves in a hydraulic circuit.

To successfully complete this Module, participants shall be able to:

- 1) Recognize the different types of directional valves, and describe the principle of operation of the different directional valves.
- 2) Describe the operation of the directional valves.

Lesson 10 Proportional valves

30 min

The aim of this lesson is to enable the participants to understand the proportional valves in a hydraulic circuit.

To successfully complete this Module, participants shall be able to:

- 1) Describe the function of a proportional valve in a circuit, and the principle of working

Lesson 11 Pressure and flow valves

120 min

The aim of this lesson is to enable the participants to understand the function and operation of the different valves in a circuit.

To successfully complete this Module, participants shall be able to:

- 1) Recognize the different pressure and flow valves in a circuit.
- 2) Check the pressure relief valve.
- 3) Describe the principle of operation of a pressure reduction valve.
- 4) Operate a needle valve.
- 5) Describe the principle of operation of a non-return valve.
- 6) Describe the principle of operation of a Throttle valve

Lesson 12 Accumulators

120 min

The aim of this lesson is to train the participants to be able to check and refill accumulators under safe conditions.

To successfully complete this Module, participants shall be able to:

- 1) Recognize the different types of accumulator and their different parts.
- 2) Describe the accumulator operation and tighten procedures.
- 3) Check the pre-charge pressure in the accumulator process.
- 4) Describe the safety conditions required to operate the accumulator.

Lesson 13 Sensors

30 min

The aim of this lesson is to enable the participants to be able to recognize the different sensors in a hydraulic circuit.

To successfully complete this Module, participants shall be able to:

- 1) Identify the different types of sensors and their symbols.
- 2) Describe the function of the pressure sensors.
- 3) Describe the function of a temperature sensor.
- 4) Describe the function of a flow sensor.

Lesson 14 Pipes, hoses and fittings

90 min

The aim of this lesson is to enable the participants to be able to identify the pipes system and its elements.

To successfully complete this Module, participants shall be able to:

- 1) Identify the transfer fluid network.
- 2) Describe the pipes and hoses fitting systems.
- 3) Describe the clamping elements.
- 4) Use the quick release couplings.

Lesson 15 Oil and oil filters

120 min

The aim of this lesson is to train the participants to be able to carry out the maintenance of the oil system.

To successfully complete this Module, participants shall be able to:

- 1) Describe the handling of oil procedures and cleanliness.
- 2) Collect an oil sample from the hydraulic circuit.
- 3) Check oil level.
- 4) Describe the oil refilling procedures.
- 5) Describe how to change the oil filter
- 6) Describe the filter conditions and its mesh.

Lesson 16 Pressure gauges

30 min

The aim of this lesson is to train the participants to be able to measure the hydraulic pressure accurately.

To successfully complete this Module, participants shall be able to:

- 1) Understand the gauges principle of working.
- 2) Check that gauges are calibrated.
- 3) Measure the hydraulic pressure with a gauge.

Lesson 17 Hydraulic Theory Test

60 min

The aim of this lesson is to test the participants' theoretical knowledge of hydraulic systems, and to discuss the result of the test with the participants.

A proposal for the theoretical theory test is shown in appendix B.

Lesson 18 Evaluation

15 min

The aim of this lesson is to summarize the Module and to give the participants the opportunity to conduct an open-minded review of the training and the instructor.

To successfully complete this Module, participants shall be able to demonstrate:

- 1) Active participation in the evaluation

1.7 Participant Performance Assessment

Assessment of learning outcomes:

Participants will be assessed according to the learning outcomes stated in section 1.6 by means of

- direct observation including supplementary oral questions when appropriate
- a written test to cover the hydraulic theory

At least 70% of the questions in the written test must be answered correctly for passing the test.

The direct observation is to be conducted by practical scenarios on a WTG environment. Each participant is to demonstrate:

- a) Safe working procedures for hydraulic work
- b) Correct and proper methods of working with hydraulic systems

Appendix D includes a checklist, which the training staff might use for the direct observation of each participant.

The formal assessment shall be in accordance with the written theoretical test and the Practical Assessment Measures in section 3.5.

Training provider shall have a documented procedure in place for dealing with persons not meeting the stated learning outcomes.

1.8 Time Table, BTT Module Basic Hydraulics

The order in which the elements of the training Module are delivered may vary.

Lesson		Element		Approximate Duration
1	Introduction	1.1	Introduction	
		1.2	Facilities	
		1.3	Aims and main learning objectives	
		1.4	On-going assessment	
		1.5	Motivation	
			TOTAL	30 min
2	Hydraulic introduction	2.1	The hydraulic system	
		2.2	Pascal's law	
		2.3	Transmission ratio	
			TOTAL	30 min
3	Risks and hazards	3.1	Pipes, hoses and fittings	
		3.2	Hydraulic cylinders	
		3.3	Parking brake	
		3.4	System pressure*	
			TOTAL	90 min
4	Hydraulic PPE	4.1	Types of PPE	
		4.2	Proper inspection	
		4.3	Correct use*	
			TOTAL	90 min
5	Prevention of unexpected start-up	5.1	Importance of lock out tag out	
		5.2	Lock out tag out procedure*	
			TOTAL	90 min
6	Symbols and diagrams	6.1	Symbols and main elements	
		6.2	Identify measuring points	
			TOTAL	90 min
7	Pumps	7.1	Piston pumps	
		7.2	Gear pumps	

		7.3	Pumps exercise*	
			TOTAL	90 min
8	Cylinders	8.1	Types	
		8.2	Maintenance	
			TOTAL	30 min
9	Directional control valves	9.1	Types	
		9.2	Operation*	
			TOTAL	30 min
10	Proportional valves	10.1	Principle of operation	
			TOTAL	30 min
11	Pressure and flow valves	11.1	Classification	
		11.2	Pressure relief valve*	
		11.3	Pressure reduction valve	
		11.4	Needle valve*	
		11.5	Non return valve	
		11.6	Throttle valve	
			TOTAL	120 min
12	Accumulators	12.1	Use and types	
		12.2	Operation and tighten	
		12.3	Pre-charge pressure*	
		12.4	Safety*	
			TOTAL	120 min
13	Sensors	13.1	Types and symbols	
		13.2	Pressure	
		13.3	Temperature	
		13.4	Flow	
			TOTAL	30 min
14	Pipes, hoses and fittings	14.1	Transfer	
		14.2	Fixing	
		14.3	Clamping	
		14.4	Quick release couplings*	
			TOTAL	90 min
15	Oil and oil filters	15.1	Handling oil procedures/cleanliness	
		15.2	Collecting an oil sample*	
		15.3	Check oil level *	
		15.4	Oil refilling procedure	
		15.5	Change oil filter	
		15.6	Filter checking	
			TOTAL	120 min
16	Pressure gauges	16.1	Pressure gauge characteristics	
		16.2	Check calibration*	
		16.3	Pressure measuring*	
				30 min

17	Hydraulic Theory Test		Test	
			TOTAL	60 min
18	Evaluation		Summary and evaluation Certificates	
			TOTAL	15 min
GRAND TOTAL		1185 min = 19 hours & 45 min		

* The element includes a practical workshop for the participants

1.9 ELEMENTS, BTT Module Basic Hydraulics

Lesson 1: Introduction

ELEMENT 1.1 Introduction

Training staff is to **give**:

- 1.1.1 A short presentation of himself including his background as an instructor

Participants are to **give**:

- 1.1.2 A short introduction of themselves including (former) job function and expectation for the course

Training staff is to **explain**:

- 1.1.3 The programme of the Module including time of breaks and meals

ELEMENT 1.2 Facilities

Training staff is to **explain**:

- 1.2.1 General description of the on-site facilities (Administration, dining area, restrooms, toilets, etc-)

ELEMENT 1.3 Aims and main objectives

Training staff is to **explain**

- 1.3.1 Scope and main objectives of the module

ELEMENT 1.4 On-going assessment

Training staff is to **explain**:

- 1.4.1 The reasons for the on-going assessment
- 1.4.2 Control Measures and their use

ELEMENT 1.5 Motivation

Training staff is to **explain**:

- 1.5.1 The importance of personal involvement

Lesson 2: Hydraulic introduction

ELEMENT 2.1 The hydraulic system

Training staff shall **explain and demonstrate**:

- 2.1.1 Explain the principle of a basic hydraulic system
- 2.1.2 Explain and show the individual components used in a hydraulic system

ELEMENT 2.2 Pascal's law

Training staff shall **explain**:

- 2.2.1 The basic concept regarding the incompressibility of fluid and how force can be transferred from one cylinder to another
- 2.2.2 Practical examples of Pascal's law

ELEMENT 2.3 Transmission ratio

Training staff shall **lead discussions of**:

- 2.3.1 How it is possible to increase and decrease the force by using the same pressure

Participants shall **engage in discussions of**

- 2.3.2 How power transmission and transmission ratio affects the hydraulic system

Lesson 3: Risks and hazards

ELEMENT 3.1 Checking pipes, hoses and fittings

Training staff shall **explain and illustrate**:

- 3.1.1 Show different types of unreliable pipes, hoses and fittings
- 3.1.2 Explain the hazards which may occur

ELEMENT 3.2 Hydraulic cylinders

Training staff shall **explain**:

- 3.2.1 Give examples of faulty cylinders (pistons)
- 3.2.2 Explain the hazards which may occur (causes of leaks and pressure drop)

ELEMENT 3.3 Parking brakes

Training staff shall **explain**:

- 3.3.1 The function of a parking brake
- 3.3.2 The hazards which may occur

Participants shall **engage in discussions of**

- 3.3.3 Risks and hazards associated with hydraulic work

ELEMENT 3.4 Relieving system pressure

Training staff shall **explain and demonstrate**:

- 3.4.1 The correct procedure for relieving system pressure

Participants are to **practice and demonstrate**:

- 3.4.2 Checking the pressure of the system
- 3.4.3 Use of a needle valve to depressurize the hydraulic system

Lesson 4: Hydraulic PPE

ELEMENT 4.1 Types of PPE

Training staff shall **explain and demonstrate**:

- 4.1.1 Show the participants a glove suitable for hydraulic work
- 4.1.2 Explain to the participants that not all gloves are suitable for hydraulic work
- 4.1.3 Explain the consequence of not wearing the right PPE
- 4.1.4 Show which goggles can be used for hydraulic work
- 4.1.5 Explain the importance of wearing goggles when working with hydraulic systems

ELEMENT 4.2 Proper inspection

Training staff shall **explain and demonstrate**:

- 4.2.1 Show the participant how to test if the glove is fit for use
 - Check the glove for holes
 - Check that the glove is suitable for hydraulic oil

ELEMENT 4.3 Correct use

Participants are to **practice and demonstrate**

- 4.3.1 Choose the right PPE to wear for hydraulic work
- 4.3.2 Show how to wear hydraulic PPE correctly

Lesson 5 Prevention of un-expected start-up

ELEMENT 5.1 Importance of lock out tag out

Training staff shall **explain**:

- 5.1.1 The importance of lock out tag out
- 5.1.2 The right procedure for lock out tag out

Participants shall **engage in discussions** of:

- 5.1.3 Why it is important to prevent unexpected start-up
- 5.1.4 Listing the correct procedure for lock out tag out

ELEMENT 5.2 Lock out tag out procedure

Training staff shall **demonstrate**:

- 5.2.1 The right procedure for lock out tag out

Participants shall **practice and demonstrate**:

- 5.2.2 The correct procedure for lock out tag out

Lesson 6 Symbols and diagrams

ELEMENT 6.1 Symbols and main elements

Training staff shall **explain and demonstrate**:

- 6.1.1 The symbols that represent each element of a hydraulic circuit
- 6.1.2 The symbol of the main element in a diagram
- 6.1.3 Show the symbol of the same element in different diagrams

ELEMENT 6.2 Identify measuring points

Training staff shall **explain and demonstrate**:

- 6.2.1 The accurate measuring points in a circuit

Participants shall **engage in discussions** of:

- 6.2.2 Hydraulic systems and the symbols used in hydraulic circuit diagrams
- 6.2.3 Identifying accurate measuring points, using the numbers in a diagram

Lesson 7 Pumps

ELEMENT 7.1 Piston pumps

Training staff shall **explain and demonstrate**:

- 7.1.1 Show participants the parts of a piston pump
- 7.1.2 How a piston pump works

ELEMENT 7.2 Gear pumps

Training staff shall **explain and demonstrate**:

- 7.2.1 Show participants the parts of a gear pump
- 7.2.2 How a gear pump works

ELEMENT 7.3 Pumps exercise

Training staff shall **explain and demonstrate**:

- 7.3.1 The process to check the start and stop pressure on a pump

Participants are to **practice and demonstrate**:

- 7.3.2 Checking the start and stop pressure on a pump following the instructions from the trainer

Lesson 8 Cylinders

ELEMENT 8.1 Types

Training staff shall **explain and demonstrate**:

- 8.1.1 The different types of cylinders
- 8.1.2 The use of each type of cylinder

ELEMENT 8.2 Maintenance

Training staff shall **explain and demonstrate**:

- 8.2.1 The maintenance procedures of the cylinders

Participants are to **describe**:

- 8.2.2 The inspection procedure of a hydraulic cylinder and the rubber sleeves

Lesson 9 Directional control valves

ELEMENT 9.1 Types

Training staff shall **explain and demonstrate**:

- 9.1.1 The different types of directional valves.
- 9.1.2 The principle of operation of each directional valve

ELEMENT 9.2 Operation

Training staff shall **explain and demonstrate**:

- 9.2.1 The operation of the directional valves

Participants are to **practice and demonstrate**:

- 9.2.2 The operation of a directional valve in a circuit

Lesson 10 Proportional valves

ELEMENT 10.1 Principle of operation

Training staff shall **explain and demonstrate**:

- 10.1.1 The use of proportional valves in a hydraulic circuit
- 10.1.2 The principle of operation of the proportional valves

Participants are to **engage in discussions** of:

- 10.1.3 The operation of a proportional valve in a circuit

Lesson 11 Pressure and flow valves

ELEMENT 11.1 Classification

Training staff shall **explain and demonstrate**:

- 11.1.1 The different types of pressure and flow valves

ELEMENT 11.2 Pressure relief valve

Training staff shall **explain and demonstrate**:

- 11.2.1 The function of the pressure relief valve
- 11.2.2 The parts of the pressure relief valve
- 11.2.3 How to check the pressure relief valve

Participants are to **practice and demonstrate**:

- 11.2.4 Checking the pressure relief valve ~~checking~~ in a circuit

ELEMENT 11.3 Pressure reduction valve

Training staff shall **explain and demonstrate**:

- 11.3.1 The function of the pressure reduction valve
- 11.3.2 The principle of operation of the pressure reduction valve

ELEMENT 11.4 Needle valve

Training staff shall **explain and demonstrate**:

- 11.4.1 The parts of a needle valve
- 11.4.2 The function of the needle valve in a circuit
- 11.4.3 The operation of the needle valve

Participants are to **practice and demonstrate**:

- 11.4.4 The operation of the needle valve in a circuit

ELEMENT 11.5 Non return valve

Training staff shall **explain and demonstrate**:

- 11.5.1 The parts of a non-return valve
- 11.5.2 The position in a circuit of a non-return valve
- 11.5.3 The principle of working of the non-return valve

ELEMENT 11.6 Throttle valve

Training staff shall **explain and demonstrate**:

- 11.6.1 The parts of a throttle valve
- 11.6.2 The position in a circuit of a throttle valve
- 11.6.3 The principle of operation of a throttle valve

Lesson 12 Accumulator

ELEMENT 12.1 Use and types

Training staff shall **explain and demonstrate**:

- 12.1.1 The different types of accumulators (bladder, piston and diaphragm)
- 12.1.2 The function of the accumulators in the circuit

ELEMENT 12.2 Operation and tighten

Training staff shall **explain and demonstrate**:

- 12.2.1 Show and explain an example of a working instruction for tightening the accumulators
- 12.2.2 Accumulator operation procedures
- 12.2.3 Temperature correction chart

ELEMENT 12.3 Pre-charge pressure

Training staff shall **explain and demonstrate**:

12.3.1 Checking points of the accumulator system

12.3.2 Use of the tools for the checking procedures of the accumulator

Participants are to **practice and demonstrate**:

12.3.3 Checking the accumulator pressure

12.3.4 Checking the damping accumulator procedure

12.3.5 Checking of burst disc accumulator procedure

12.3.6 Checking of brake accumulator procedure

ELEMENT 12.4 Safety

Training staff shall **explain and demonstrate**:

12.4.1 Principal characteristics of Nitrogen

12.4.2 Nitrogen behavior into the nacelle

12.4.3 Procedures to carry out when working with Nitrogen

12.4.4 Nitrogen bottles manipulation

12.4.5 Use of the correct PPE

Participants are to **practice and demonstrate**:

12.4.6 The appropriate manipulation of the Nitrogen bottles

Lesson 13 Sensors

ELEMENT 13.1 Types and symbols

Training staff shall **explain and demonstrate**:

13.1.1 A general classification of the sensors used in the hydraulic circuits

13.1.2 The symbols of the sensors

ELEMENT 13.2 Pressure

Training staff shall **explain and demonstrate**:

13.2.1 Function of the pressure sensor

13.2.2 Position in the circuit

ELEMENT 13.3 Temperature

Training staff shall **explain and demonstrate**:

13.3.1 Function of the temperature sensor

13.3.2 Position in the circuit

ELEMENT 13.4 Flow

Training staff shall **explain and demonstrate**:

13.4.1 Function of the flow sensor

13.4.2 Position in the circuit

Participants shall **engage in discussions** of:

13.4.3 Different types, locations and functions of sensors

Lesson 14 Pipes, hoses and fittings

ELEMENT 14.1 Transfer

Training staff shall **explain and demonstrate**:

14.1.1 Hydraulic pipes

ELEMENT 14.2 Fixing

Training staff shall **explain and demonstrate**:

14.2.1 Fixing systems

ELEMENT 14.3 Clamping

Training staff shall **explain and demonstrate**:

14.3.1 Clamping elements

ELEMENT 14.4 Quick release couplings

Training staff shall **explain and demonstrate**:

14.4.1 Quick release couplings connection

Participants shall **describe and demonstrate**:

14.4.2 The pipes, hoses and fittings

14.4.3 The use of the quick release coupling

Lesson 15 Oil and oil filters

ELEMENT 15.1 Handling oil procedures/cleanliness

Training staff shall **explain and demonstrate**:

15.1.1 Handling oil procedures

15.1.2 Cleanliness

ELEMENT 15.2 Collecting an oil sample

Training staff shall **explain and demonstrate**:

15.2.1 Collection of an oil sample procedure

Participant are to **practice and demonstrate**:

15.2.2 The procedure for collection of an oil sample

ELEMENT 15.3 Check oil level

Training staff shall **explain and demonstrate**:

15.3.1 Oil level checking with a dip stick

- 15.3.2 Oil level checking with a sight glass
- 15.3.3 Oil level checking with a filling hole

Participants are to **practice and demonstrate**:

- 15.3.4 Checking oil level with the three procedures

ELEMENT 15.4 Oil refilling procedure

Training staff shall **explain and demonstrate**:

- 15.4.1 Oil refilling procedures

ELEMENT 15.5 Change of oil filter

Training staff shall **explain and demonstrate**:

- 15.5.1 Filter changing procedures

Participants shall **engage in discussions** of:

- 15.5.2 How to change the oil filter

ELEMENT 15.6 Filter checking

Training staff shall **explain and demonstrate**:

- 15.6.1 Filter checking procedures
- 15.6.2 Mesh sizes

Participants shall **engage in discussions** of:

- 15.6.3 Checking of oil filter conditions and its mesh

Lesson 16 Pressure gauges

ELEMENT 16.1 Pressure gauge characteristics

Training staff shall **explain and demonstrate**

- 16.1.1 Pressure gauge characteristics

Participants shall **engage in discussions** of:

- 16.1.2 How to use the pressure gauge

ELEMENT 16.2 Check calibration

Training staff shall **demonstrate**

- 16.2.1 How to check that a pressure gauge is calibrated

Participants are to **practice and demonstrate**:

- 16.2.2 Checking the calibration of pressure gauges

ELEMENT 16.3 Pressure measuring

Training staff shall **demonstrate**:

16.3.1 Calibration of pressure gauges.

Participants are to **practice and demonstrate**:

16.3.2 How to measure the hydraulic pressure accurately

Lesson 17 Hydraulic Theory Test

ELEMENT 17.1 Test

Training staff is to:

17.1.1 Hand out a written test to the participants

Participants are to

17.1.2 Conduct the written test within 30 minutes

Training staff is to:

17.1.3 Check the test results and give feedback to the participants about the test result

Lesson 18 Evaluation

ELEMENT 18.1 Summary and evaluation

Training staff is to:

18.1.1 Summarize the Module and give the participants final feedback

18.1.2 Encourage the participants to give their evaluation of the Module

Participants are to:

18.1.3 Take part in the evaluation

Training staff is to:

18.1.4 Give necessary feedback to the participants on their evaluation

ELEMENT 18.2 Certificates

Training staff is to:

18.2.1 Issue certificates and ensure that all participants have the correct personal information on the certificate

Section 2 – Resources for Basic Hydraulics

2.1 Trainer/Participant Ratio

- (a) The ratio shown for theory sessions indicates the maximum number of participants that shall attend the course
- (b) The ratio shown for practical sessions indicates the maximum number of participants to be supervised by one instructor during each practical workshop
- (c) Practical sessions must always be supervised by an instructor, while supervision of an instructor is not mandatory to all theoretical sessions

Unit	Sessions	Ratio
BTT Basic Hydraulics	Theory	1:12
	Practical	1:6

2.2 Facilities

It is important to ensure that the full range of facilities is made available to ensure that the participants benefit most from their training. The following criteria shall be adhered to.

Administration arrangements appropriate for the enrolment and certification of participants and all aspects of the delivery of training shall be in accordance with this document.

Theory training area(s) shall be designed to enable each participant to see, hear and participate fully in the taught subject matter.

A room is required that has projection facilities, a white board and desks for the participants to write on.

Practical training area(s) shall be designed to enable each participant to see, hear and participate fully in the taught subject matter.

A practical workshop is required that has enough space to accommodate 6 candidates, with a respective work area each of approximately 3 square meters.

2.3 Equipment

There will need to be basic tool kits for the candidates that contain spanners, torque wrenches, and any other equipment associated with hydraulics. All necessary PPE must be provided (goggles, specific gloves, overalls and boots). There must be hydraulic rigs where components can be assembled to produce simple hydraulic circuits. There must be a rig with pre-built electrical control of a hydraulic circuit that contains the following components:

- (a) LOTO equipment
- (b) Tank
- (c) Pump
- (d) Valves
- (e) Cylinders
- (f) Accumulator
- (g) Hoses
- (h) Standard connectors
- (i) Fluid
- (j) Filters
- (k) Pressure gauge

All suitable documentation shall be accessible and completed such as risk assessment, approved working procedure, and completion sheet.

Appendix C shows a hydraulic diagram, with the minimum components needed for conducting the practical workshops in this Module.

Section 3 – Administration and Certification

3.1 Participant Performance Assessment

Participants shall be assessed according to the learning outcomes by means of direct observation including oral questions where appropriate, and by a theoretical test.

Training Providers shall have a documented procedure in place for dealing with persons not meeting the stated learning outcomes.

3.2 Certification

Training Providers are responsible for issuing a certificate directly to the participant upon completion of the programme and to a sponsoring company when required. Each certificate shall indicate that the participant has been assessed according to the learning outcomes and shall contain the following:

- (a) Training Provider's name
- (b) Full course title
- (c) Name of the participant
- (d) Course dates
- (e) Training Provider's signature

3.3 Records

The Training Provider shall keep a record of the participants that have completed the BTT Module Basic Hydraulic for a period of min. 5 years.

On request from a relevant body, The Training Provider shall be able to verify the training and competence records of any participant by name.

3.4 Measures

The Trainer keeps the Control Measures Forms until the completion / evaluation of the Module. If a participant fails to meet the demands, they shall attend a new BTT Module Basic Hydraulics.

3.5 Control Measures

Please find the Control Measures Form on next page.

Practical Assessment Measures

Name: _____

Course: BTT Module Basic Hydraulics

Date: _____

Training Provider: _____

Scenario Organisation	Violation of Assessment Measures			0-2 Passed/ 3 Failed	Instructor Remarks
Aware of personal and group safety at all times					
Organized and utilized correct equipment for given scenario					
Organized individuals and groups as required					
Scenario Management					
Established and maintained control of the exercise scenario at all times					
Fully participated in the exercise scenario					
Followed directions when required					
Demonstrate correct and safe manual handling in exercise scenario					

Knowledge and Understanding					
Applied subject knowledge correctly in given scenario					
Demonstrated understanding of subject					
Total Marks	0 – 9	Pass			
	10 – 27	Fail			

Instructor: _____ Pass/ Fail (Delete as appropriate)

The practical Assessment Measures Form is a final evaluation tool for the instructors to assess participants during practical elements. It allows measurement of the number of violations in regard to safety, competency, or attitude. It can be used as a progressive evaluation tool to discuss the performance of a participant in guiding them to success and it also serves as supporting documentation when the participant fails the module.