NORTHWESTERN POLYTECHNIC

DEPARTMENT OF INDUSTRY PARTNER TRAINING

THINKBIG SERVICE TECHNICIAN COURSE OUTLINE – FALL 2025

HES410 VA41 MACHINE HYDRAULIC SYSTEMS - 3.5 CREDITS (6-0-6)

96 HOURS FOR 8 WEEKS

Northwestern Polytechnic acknowledges that our campuses are located on Treaty 8 territory, the ancestral and present-day home to many diverse First Nations, Metis, and Inuit people. We are grateful to work, live and learn on the traditional territory of Duncan's First Nation, Horse Lake First Nation and Sturgeon Lake Cree Nation, who are the original caretakers of this land.

We acknowledge the history of this land, and we are thankful for the opportunity to walk together in friendship, where we will encourage and promote positive change for present and future generations.

INSTRUCTOR:	Scott Bailer	**PHONE:**	780.835.6639
OFFICE:	FPS130	**E-MAIL:**	sbailer@nwpolytech.ca
OFFICE HOURS:	8 AM to 4:30 PM		

CALENDAR DESCRIPTION:

This course is designed to teach the system operations and the testing and adjusting procedures for the pilot operated hydraulic system, the load sensing, pressure compensated (LSPC) hydraulic system, the electro-hydraulic system, and the hydrostatic system. Students will identify the system components, state the component function and trace the oil flow through the component. This section will be covered on different types of machines.

PREREQUISITE(S)/COREQUISITE:

Successful completion of all block three courses HES321, HES331, HES362, and including HES390, & HES490 Work placement. Successful completion of Second Period AIT Exam.
Please read all modules before they are presented in class.

REQUIRED TEXT/RESOURCE MATERIALS:

Caterpillar Material

Hydraulic Fundamentals

Copyright © 2022, Northwestern Polytechnic and its licensors.

Unit 3: Hydraulic System Components

Lesson 3 – Hydraulic Pumps and Motors

Lesson 4 – Pressure Control Valves

Lesson 5 – Direction Control Valves

Lesson 6 – Flow Control Valves.

Unit 4: Pilot Operated Hydraulic System

Lesson 1 – Pilot Operated Implement Hydraulic System

Machine Hydraulic Systems

Unit 1: Pilot Operated Hydraulic Systems

Lesson 1 – 950G Pilot Operated Implement Hydraulic System

Unit 2: Load Sensing, Pressure Compensated Hydraulic Systems

Lesson 1 – Basic LS/PC Hydraulic Systems

Lesson 2 – LS/PC Hydraulic Pumps and NFC Hydraulic Systems

Unit 3: Proportional, Priority, Pressure Compensated Hydraulic Systems

Lesson 1 – PPPC Hydraulic System

Unit 4: Hydrostatic Systems

Lesson 1 – Basic Hydrostatic Systems

Lesson 2 – Hydrostatic System Controls

Lesson 4 – C Series Skid Steer Loader Hydrostatic Drive System.

Alberta Apprenticeship and Industry Training Individual Learning Modules
Heavy Equipment Technician (HET)

190301a – Hydraulic Principles

190301b – Hydraulic Pump Fundamentals

190301c – Hydraulic Pump Service

190301d – Hydraulic Actuator Fundamentals

190301e – Hydraulic Actuator Service

190301fA – Hydraulic Valve II – Part A

190301fB – Hydraulic Valve II – Part B

190301g – Hydraulic System Types

190301h – Hydraulic System Testing and Service

190301i – Electrohydraulic

650401a – Alberta's Industry Network.

650401b – Workplace Coaching Skills.

650401c – Interprovincial Standards Red Seal Program.

Copyright © 2022, Northwestern Polytechnic and its licensors.

DELIVERY MODE(S):

In person – Onsite. This course is delivered in person at the NWP Fairview campus.

Note: NWP reserves the right to change the course delivery.

LEARNING OUTCOMES:

By the end of this course, students will be able to:

- **Understand Hydraulic System Principles**
  - Explain the principles of hydraulic operation, including pressure, flow, and force relationships.
  - Identify the functions of key hydraulic components such as pumps, motors, valves, and actuators.
- **Analyze and Troubleshoot Hydraulic Systems**
  - Trace oil flow through various hydraulic components and systems.
  - Diagnose and repair common hydraulic system issues using proper testing and adjustment procedures.
- **Work with Pilot Operated Hydraulic Systems**
  - Describe the operation of pilot-operated hydraulic systems in heavy machinery.
  - Inspect and troubleshoot pilot control circuits and components.
- **Understand Load Sensing and Pressure Compensated Systems**
  - Explain the principles of Load Sensing, Pressure Compensated (LSPC) hydraulic systems.
  - Identify the components and operation of LS/PC hydraulic pumps and NFC hydraulic systems.
- **Understand PPPC Systems.**
  - Identify components from mechanically controlled systems and pilot-controlled systems.
  - Explain the operation of mechanically controlled systems and pilot-controlled systems.
  - Perform testing and adjusting procedures.
- **Operate and Diagnose Hydrostatic Systems**
  - Explain the basic principles of hydrostatic drive systems.
  - Troubleshoot and adjust hydrostatic system controls.
- **Understand and Service Electrohydraulic Systems**
  - Identify the functions and components of electrohydraulic systems in modern equipment.
  - Perform testing and service on electronically controlled hydraulic systems.
- **Follow Industry Safety Standards and Best Practices**
  - Adhere to safety protocols when working with high-pressure hydraulic systems.
  - Utilize Caterpillar service materials and diagnostic tools to perform system maintenance safely and effectively.

Copyright © 2022, Northwestern Polytechnic and its licensors.

TRANSFERABILITY: None.

GRADING CRITERIA:
Students must complete all required courses with no failing (F) grades. A passing grade in this course is a **minimum of 70%.** Grades for this course will be assigned as a percentage. Failure to achieve a minimum grade of 70% will result in withdrawal from the Think BIG program.

EVALUATIONS:

Machine Hydraulic Systems **96 hours**

Exams Average =	_____	*x 45%*
Class Assignments /Quizzes =	_____	*x 30%*
Shop Total	_____	*x 25%*

FINAL MARK = _____ %

COURSE SCHEDULE/TENTATIVE TIMELINE:
Will be posted in the classroom.

STUDENT RESPONSIBILITIES: This is an adult education environment. Enrolment at Northwestern Polytechnic assumes that the student will become a responsible citizen of NWP. As such, each student will display a positive work ethic, take pride in, and assist in the maintenance and preservation of Institute property, and assume responsibility for his/her education by researching academic requirements and policies, demonstrating courtesy and respect toward others; and respecting instructor expectations concerning attendance, classroom and shop rules, safety, assignments, deadlines, and appointments. Students are learning skills to prepare them for the work environment. Non-academic misconduct, including the possession, use, or distribution of intoxicants, will be addressed through the Student Rights and Responsibilities policy.

Students are expected to attend all class and shop hours. Students who miss more than 21 hours or 3 days of classes may be removed from the course.

Copyright © 2022, Northwestern Polytechnic and its licensors.

Absences will be monitored and recorded by the instructors.

- Upon reaching 7 hours missed time in a single semester the student will be required to meet with the instructor.
- Upon reaching 14 hours missed time in a single semester the student will be required to meet with the instructor and program Chair.
- Upon reaching 21 hours missed time in a single semester the student will be required to meet with the Instructor, Program Chair, and the Dean to evaluate the students' ability to successfully continue in the Think BIG program.

Following the guidelines in "Student Rights and Responsibilities" in the NWP College calendar assist us all in maintaining an adult learning environment. Please refer to the Student Rights and Responsibilities policy in the Northwestern Polytechnic Calendar or at www.nwpolytech.ca/downloads/documents/StudentRightsandResponsibilities.pdf.

STATEMENT ON ACADEMIC MISCONDUCT:

Academic Misconduct will not be tolerated. For a more precise definition of academic misconduct and its consequences, refer to the Student Rights and Responsibilities policy available at https://www.nwpolytech.ca/about/administration/policies/index.html

**Note: all Academic and Administrative policies are available on the same page.

Copyright © 2022, Northwestern Polytechnic and its licensors.