



COURSE OUTLINE: HET816 - DRIVE TRAIN SYSTEMS

Prepared: Josh Boucher

Approved: Corey Meunier, Chair, Technology and Skilled Trades

Course Code: Title	HET816: DRIVE TRAIN SYSTEMS
Program Number: Name	
Department:	MOTIVE POWER APPRENTICESHIP
Semesters/Terms:	20W
Course Description:	Upon successful completion of this course the apprentice will be able to recommend repairs for torque converters, fluid couplings, hydraulic retarders and hydrostatic drive systems following manufacturers' recommendations.
Total Credits:	4
Hours/Week:	0
Total Hours:	26
Prerequisites:	There are no pre-requisites for this course.
Corequisites:	There are no co-requisites for this course.
Essential Employability Skills (EES) addressed in this course:	EES 1 Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience. EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication. EES 3 Execute mathematical operations accurately. EES 4 Apply a systematic approach to solve problems. EES 5 Use a variety of thinking skills to anticipate and solve problems. EES 6 Locate, select, organize, and document information using appropriate technology and information systems. EES 7 Analyze, evaluate, and apply relevant information from a variety of sources. EES 8 Show respect for the diverse opinions, values, belief systems, and contributions of others. EES 9 Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals. EES 10 Manage the use of time and other resources to complete projects. EES 11 Take responsibility for ones own actions, decisions, and consequences.
Course Evaluation:	Passing Grade: 50%,
Other Course Evaluation & Assessment Requirements:	Grade Definition Grade Point Equivalent A+ 90 - 100% 4.00 A 80 - 89% B 70 - 79% 3.00 C 60 - 69% 2.00 D 50 - 59% 1.00 F (Fail)49% and below 0.00



SAULT COLLEGE | 443 NORTHERN AVENUE | SAULT STE. MARIE, ON P6B 4J3, CANADA | 705-759-2554

Books and Required Resources:
Course Outcomes and Learning Objectives:

CR (Credit) Credit for diploma requirements has been awarded.
 S Satisfactory achievement in field /clinical placement or non-graded subject area.
 U Unsatisfactory achievement in field/clinical placement or non-graded subject area.
 X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.
 NR Grade not reported to Registrar's office.
 W Student has withdrawn from the course without academic penalty.

Modern Diesel Technology: Heavy Equipment Systems by Robert Huzij, Angelo Spano, Sean Bennett
 Publisher: Cengage Learning Edition: 3rd Edition
 ISBN: ISBN-10: 1-337-56758-2

Course Outcome 1	Learning Objectives for Course Outcome 1
6.1 Torque Converters, Fluid Couplings, and Hydraulic Retarders 6.1.1 Explain the purpose and fundamentals of torque converters, fluid couplings, and hydraulic retarders.	6.1.1 Explain the purpose and fundamentals of torque converters, fluid couplings, and hydraulic retarders. - torque converters • static and dynamic friction • torque multiplication • centrifugal force • centripetal force • vortex and rotary flow • kinetic energy - hydrodynamic drive - multiplication phase - coupling phase - hydraulic retarders 6.1.2 Identify the construction features of torque converters, fluid couplings, and hydraulic retarders. - torque converters • pumps • impeller • stator - o fixed - o rotating • overrunning clutch • flywheel • lock-up device - fluid couplings • impeller • turbine • flywheel - hydraulic retarders • rotor and housing • control valve 6.1.3 Describe the principles of operation of torque converters, fluid couplings, and hydraulic retarders. - torque converters

		• pump • impeller • stator - o fixed - o rotating - overrunning clutch - flywheel - lock-up - fluid couplings • impeller • turbine • flywheel - oil flow action - hydraulic retarders • rotor and housing • control valve 6.1.4 Perform inspection, testing, and diagnostic procedures following manufacturers' recommendations for torque converters, fluid couplings, and hydraulic retarders. - oil level condition check - demonstrate oil leak tests - converter end play check - demonstrate converter: • stall tests • relief valve tests • performance tests - component failure analysis 6.1.5 Recommend reconditioning or repair procedures following manufacturers' recommendations for torque converters, fluid couplings, and hydraulic retarders. - show examples of component failures for: • pumps • impeller • stator • overrunning clutch • lock-up devices • rotors • control valves - identify contamination protection procedures - outline the recommended oil change procedures
	Course Outcome 2	Learning Objectives for Course Outcome 2
	6.2 Hydrostatic Drive Systems Upon successful completion the apprentice is able to recommend repairs for hydrostatic drive systems following manufacturers' recommendations.	6.2.1 Explain the purpose and fundamentals of hydrostatic drives. - application • traction drives • non-traction drives - types • open loop circuits • closed loop circuits - fundamentals

- lubricant types
- hydraulic pressures and output force
- coolers and circuits
- torque multiplication
- hydrodynamic versus hydrostatic drive systems
- charge pump
- charge pump circuits

6.2.2 Identify the types and construction features of hydrostatic drives.

- hydrostatic drives
 - variable displacement pumps
 - fixed displacement pumps
 - variable displacement motors
 - fixed displacement motors
- controls
 - flow limiting
 - flow dividing
 - manual displacement control valves
 - electronic displacement control valves
 - hydraulic displacement control valves
- charge pump
- charge pump circuits
- coolers and circuits

6.2.3 Describe the principles of operation of hydrostatic drives.

- hydrostatic drives
 - variable displacement pumps
 - variable displacement motors
 - fixed displacement pumps
 - fixed displacement motors
- operation of drive systems in neutral, forward, and reverse
- controls
 - flow limiting
 - flow dividing
 - manual displacement control valves
 - electronic displacement control valves
 - hydraulic displacement control valves
- charge pumps
- charge pump circuits
- coolers and circuits

6.2.4 Perform the inspection, testing, and diagnostic procedures following manufacturers' recommendations on hydrostatic drives.

- test pressures of various hydrostatic drive systems
- examine and measure hydrostatic drive motor and pump components
- verify recommended operating functions of hydrostatic drive controls
- outline methods and procedures to diagnose and determine causes of abnormal noises, directional control problems, and malfunctions in hydrostatic drive systems



	- verify recommended operating temperatures of hydrostatic drives • cooler restrictions • filter restrictions 6.2.5 Recommend reconditioning or repairs following manufacturers` recommendations for hydrostatic drives. - demonstrate field adjustments for hydrostatic drive systems - explain the recommended oil levels and grade - outline recommended removal and replacement procedures for hydrostatic motors, pumps, and coolers - Demonstrate the disassembly and reassembly procedures for hydrostatic drive systems								
Evaluation Process and Grading System:	<table> <tr> <th>Evaluation Type</th><th>Evaluation Weight</th></tr> <tr> <td>Assignments/Theory</td><td>10%</td></tr> <tr> <td>Practical Application Testing</td><td>40%</td></tr> <tr> <td>Theory Testing</td><td>50%</td></tr> </table>	Evaluation Type	Evaluation Weight	Assignments/Theory	10%	Practical Application Testing	40%	Theory Testing	50%
Evaluation Type	Evaluation Weight								
Assignments/Theory	10%								
Practical Application Testing	40%								
Theory Testing	50%								
Date:	February 10, 2020								
Addendum:	Please refer to the course outline addendum on the Learning Management System for further information.								