



COURSE OUTLINE: HET712 - FLUID POWER SYSTEMS

Prepared: Josh Boucher

Approved: Corey Meunier, Chair, Technology and Skilled Trades

Course Code: Title	HET712: FLUID POWER SYSTEMS
Program Number: Name	
Department:	MOTIVE POWER APPRENTICESHIP
Semesters/Terms:	21F, 22W, 22S
Course Description:	This course Fluid Power Systems will provide the apprentice with the ability to be able to interpret schematics and perform pressure, force, and area calculations related to hydraulics, be able to describe the service procedures of hydraulic fluids, reservoirs, and conditioners, to be able to replace hydraulic lines and fittings, be able to recommend repairs of hydraulic control valves and able to recommend repairs to a hydraulic pumps following manufacturers recommendations and safe work practices.
Total Credits:	7
Hours/Week:	7
Total Hours:	56
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:	<p>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.</p> <p>EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication.</p> <p>EES 3 Execute mathematical operations accurately.</p> <p>EES 4 Apply a systematic approach to solve problems.</p> <p>EES 5 Use a variety of thinking skills to anticipate and solve problems.</p> <p>EES 6 Locate, select, organize, and document information using appropriate technology and information systems.</p> <p>EES 7 Analyze, evaluate, and apply relevant information from a variety of sources.</p> <p>EES 8 Show respect for the diverse opinions, values, belief systems, and contributions of others.</p> <p>EES 9 Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.</p> <p>EES 10 Manage the use of time and other resources to complete projects.</p> <p>EES 11 Take responsibility for ones own actions, decisions, and consequences.</p>
Course Evaluation:	<p>Passing Grade: 50%, D</p> <p>A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.</p>

In response to public health requirements pertaining to the COVID19 pandemic, course delivery and assessment traditionally delivered in-class, may occur remotely either in whole or in part in the 2021-2022 academic year.



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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

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.

Course Outcomes and Learning Objectives:

Course Outcome 1	Learning Objectives for Course Outcome 1
Upon successful completion the apprentice is able to interpret schematics and perform pressure, force, and area calculations related to hydraulics.	<p>Explain the fundamental principles of hydraulic circuit schematics:</p> <ul style="list-style-type: none"> - Graphic symbols - Hydraulic circuit layouts - Pictorial drawings - Diagrams - Schematics - Society of Automotive Engineers (SAE) - International Standards Organisation (ISO) <p>Identify hydraulic component on diagrams and schematics:</p> <ul style="list-style-type: none"> - Pumps - Valves - Actuators - Conductors <p>Draft a sample of a basic hydraulic system schematic:</p> <ul style="list-style-type: none"> - Open centre circuit - Closed centre circuit <p>Draft a sample of a basic hydraulic system schematic:</p> <ul style="list-style-type: none"> - Open centre circuit - Closed centre circuit <p>Perform basic mathematical calculations and identification for hydraulic system applications:</p> <ul style="list-style-type: none"> - Pressure - Force - Area - Imperial - System international d'units (s.i.) - Flow rate - Fluid velocity - Rod velocity

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	<ul style="list-style-type: none"> - Head pressure calculation <p>Identify components using manufacturers schematics. Locate system test points and components on equipment.</p>
Course Outcome 2	Learning Objectives for Course Outcome 2
Upon successful completion the apprentice is able to describe the service procedures of hydraulic fluids, reservoirs, and conditioners following manufacturers recommendations.	<p>Explain the purpose and fundamental information of hydraulic fluids and conditioners:</p> <ul style="list-style-type: none"> - Fluid type - Petroleum base - Fire resistant - Synthetic - Viscosity/index - Friction - Cavitation - Velocity - Laminar flow - Turbulent flow - Pressure and force - Flow rate - Aeration - Wear prevention - Oxidation inhibitors - Rust and corrosion inhibitors - Anti-foaming - Water control - Energy transmission - Pascal's Law - Potential, heat, and kinetic - Displacement - Thermal expansion - Contamination - Sources - Oil analysis - Post failure cleanout - Procedures - Equipment - Clean out filters - Auxiliary filtration - Identify the purpose and fundamentals of fluid conditioners. - Filter requirements - Cleanliness requirements - Schematics/symbols - Filters - Flow capacity - Element rating - Micron rating - Beta ratio - Type and location - Pressure drop - Indicators - Coolers - Flow capacity

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- Oil to air
- Oil to oil
- Oil to coolant
- Pressure drop
- Indicators
- Reservoirs
- Vented
- Pressurized
- Physical features
- Oil heaters
- Electrical immersion
- Electrical surface mount

Coolant to oil

Describe the construction features of fluid conditioners.

filters and strainers

surface media elements

depth media elements

type and location

pressure drop

restriction indicators

oil coolers

air to oil

coolant to oil

oil to oil

tube

tube and fin

radiator

oil heaters

reservoirs

capacity

baffles

outlet and return

drain plugs

intake filter

venting

pressurized

Describe the principles of operation of hydraulic fluid conditioners.

filters and strainers

surface media elements

depth media elements

micron rating

beta ratio

type and location

pressure drop

restriction indicators

oil coolers

air to oil

coolant to oil

oil to oil

tube

tube and fin

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	<ul style="list-style-type: none"> radiator oil heaters electrical immersion electrical surface mount coolant to oil reservoirs pressurized cooling aeration venting Demonstrate the inspection and testing procedures following manufacturers' recommendations for oil conditioners. the removal and replacement of filters and strainers oil filters strainers coolers heaters oil sampling
Course Outcome 3	Learning Objectives for Course Outcome 3
Upon successful completion the apprentice is able to replace hydraulic lines and fittings following manufacturers recommendations.	<p>Explain the purpose and fundamental information of hydraulic fluid conductors.</p> <p>[1/0] - pipes</p> <ul style="list-style-type: none"> - tubes - hoses - fittings - adapters - Society of Automotive Engineers (SAE) - systeme international d' units (s.i.) <p>2.3.2 Identify the types and construction features of hydraulic fittings and conductors.</p> <p>[3.5/0] - pipe</p> <ul style="list-style-type: none"> - schedules - threading - sizing - tubing - plastic - steel - sizing - bending - fabricating - sizing - hoses - sizing - pressure/vacuum ratings - non-braiding types - braiding types - spiral wraps - fittings - permanent - reusable - hose assembly

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- adapters
- thread forms
- sealing element
- fittings identification
- Society of Automotive Engineers (SAE)
- Joint Industry Conference (JIC)
- O-Ring Face Seal (ORFS)
- O-Ring Boss (ORB)
- National Pipe (NP)
- adapters
- British Standard Pipe/Japanese Industrial Standard (BSP/JIS)
- System International d`Units (s.i.)

Describe the principles of operation of hydraulic conductors and fittings.

[2/0] - sealing methods

- minimum bend radius
- operating pressure ratings
- burst pressure ratings

Demonstrate inspection, testing, and diagnostic procedures following manufacturers` recommendations for hydraulic conductors.

[.5/2.5] - identify potential for oil injection injuries

- cracks
- leaks
- use a mechanical device to move hydraulic lines when looking for leaks.
- hydraulic conductor failures
- fractures
- restrictions

Recommend reconditioning or repairs following manufacturers` recommendations for hydraulic conductors.

[0/1] - demonstration of repairing and replacing hydraulic conductors

- depressurizing system
- accumulator circuits
- pressurized reservoirs
- vacuum transducers
- mechanical lock-outs
- hose replacement
- ocontamination prevention

Course Outcome 4	Learning Objectives for Course Outcome 4
Upon successful completion the apprentice is able to recommend repairs of hydraulic control valves following manufacturers`	2.4.1 Explain the purpose and fundamentals of hydraulic control valves. [1/0] - pressure control - flow control - directional control

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recommendations.

- fundamentals enhancement
- contamination and importance of cleanliness
2.4.2 Identify the types and construction features of hydraulic control valves.

[3/0]

- pressure control valves
- direct-acting relief
- pilot-operated relief
- pressure reducing
- unloading
- sequence
- counter balance
- brake valve
- flow control valves
- flow dividers
- priority
- proportional
- pilot-operated
- pressure compensated
- restrictors
- check valves
- directional control valves
- mono-block
- sectional
- serial/ parallel passage (normally open)
- activation
- manual
- solenoid
- pilot
- pneumatic
- spool
- poppet
- cartridge
- rotary

2.4.3 Describe the principles of operation of hydraulic control valves.

[4/0]

- pressure control valves
- simple relief
- pilot-operating relief
- pressure reducing
- unloading
- sequence
- counterbalance
- brake valve
- flow control valves
- flow dividers
- priority
- proportional
- pilot-operated
- pressure compensated
- restrictors

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		<ul style="list-style-type: none"> - check valves - directional control valves - oil flow circuit - parallel passage - centre types - poppet - cartridge - rotary - monoblock - sectional - parallel passage <p>2.4.4 Demonstrate inspection and diagnostic procedures following manufacturers` recommendations for hydraulic control valves.</p> <p>[1/3]</p> <ul style="list-style-type: none"> - inspect and examine control valves for physical damage - identify primary causes of failure - disassemble and reassemble hydraulic control valves - recommend reconditioning or repairs of hydraulic control valves
	Course Outcome 5	Learning Objectives for Course Outcome 5
	<p>Upon successful completion the apprentice is able to recommend repairs of a hydraulic pump following manufacturers` recommendations.</p>	<p>2.5.1 Explain the purpose and fundamentals of hydraulic pumps.</p> <p>[2/0]</p> <ul style="list-style-type: none"> - inlet pressure parameters - internal oil flow - internal lubrication - pressure management - seals - bearing load - wear points - fundamentals enhancement - energy - contamination and importance of cleanliness - displacement calculations - delivery calculations - power calculations - Imperial - system international d`units (s.i.) <p>2.5.2 Identify the types and construction features of hydraulic pumps.</p> <p>[3/0]</p> <ul style="list-style-type: none"> - positive and non-positive displacement pumps - gear pumps - external - internal - piston - radial - axial - fixed displacement - variable displacement

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- pressure compensated
- flow compensated
- vane pumps
- balanced
- unbalanced
- fixed displacement
- variable displacement
- pressure compensated
- flow compensated

2.5.3 Describe the principles of operation of hydraulic pumps.
[4/0]

- gear pumps
- external
- internal
- piston
- radial
- axial
- fixed displacement
- variable displacement
- pressure compensated
- flow compensated
- vane pumps
- balanced
- unbalanced
- fixed displacement
- variable displacement
- pressure compensated
- flow compensated

2.5.4 Demonstrate inspection, testing, and diagnostic procedures following manufacturers recommendations for fixed displacement hydraulic pumps.
[1/3]

- relationship between flow and pressure
- inspect gear, vane, and piston pumps
- pump failures and relate to damaged components
- outline the recommended disassembly and reassembly procedures
- disassembly and reconditioning procedures for a hydraulic pump assembly

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Assignments/Theory	20%
Shop/Assigned/Tasks	30%
Tests/Theory	50%

Date:

July 30, 2021

Addendum:

Please refer to the course outline addendum on the Learning Management System for further information.

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