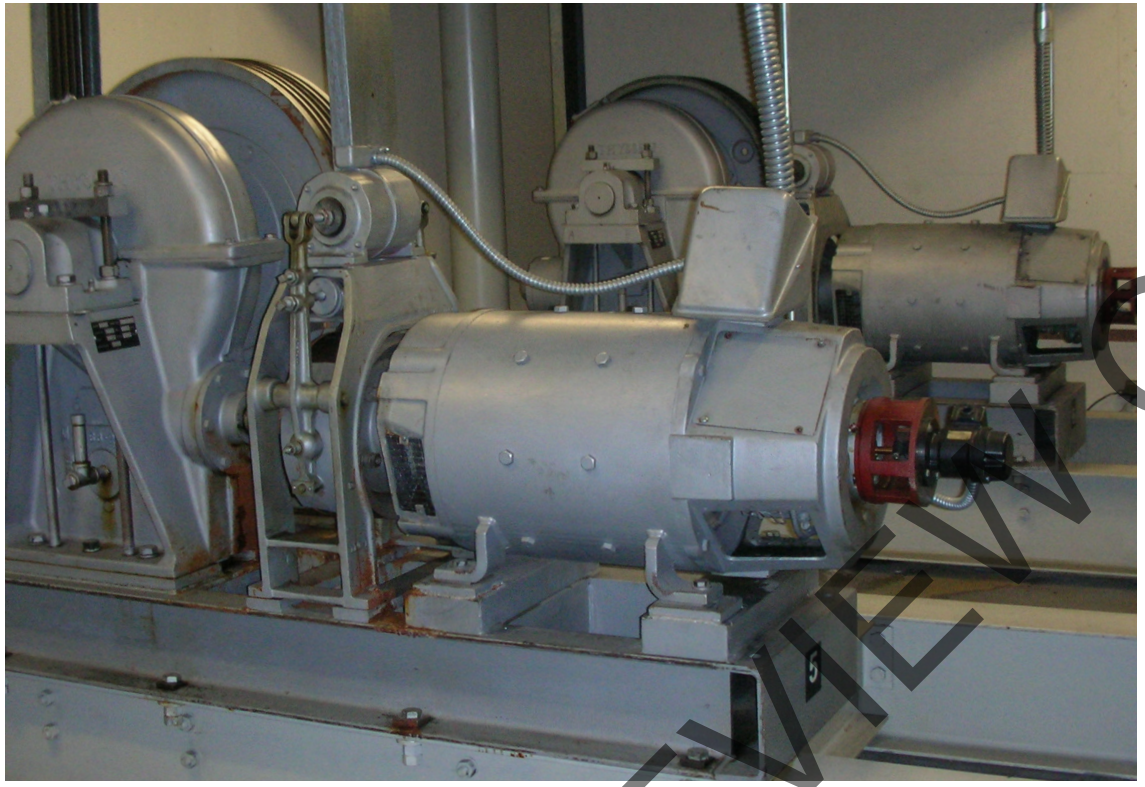
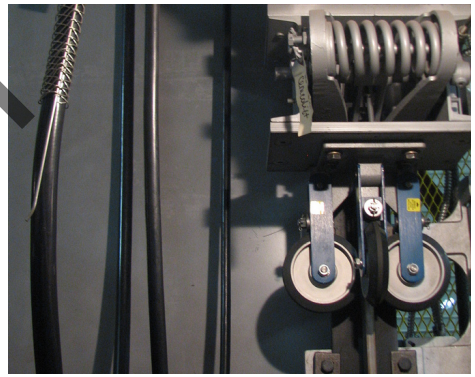
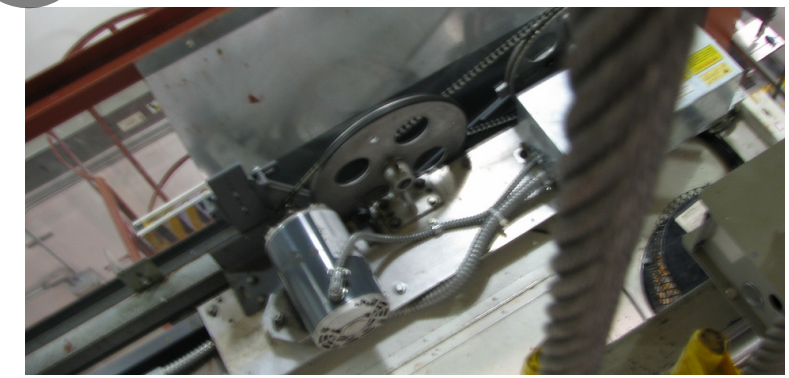
# Instructor Guide









## 215: Elevator: Mechanical Drive Systems
## Module 4: Hydraulic Drive Systems

TRANSIT ELEVATOR/ESCALATOR CONSORTIUM

## Table of Contents

## Icons Used In This Guide

**REVIEW** slides

**INDIVIDUAL ACTIVITY**

**ASK**

**WRITE**

**CLASSROOM ACTIVITY**

Multimedia

**SMALL GROUP ACTIVITY**

**REFER** participants to

## Agenda

| Topic # | Topic Title | Duration |
|---|---|---|
| 1 | Overview | 30 minutes |
| 2 | Hydraulic Drive Components | 60 minutes |
| 3 | Field Trip | 60 minutes |
| 4 | Hydraulic Drive Variations | 50 minutes |
| 4 | Field Trip | 60 minutes |
| 4 | Summary | 40 minutes |
| | **Total Time:** | 300 minutes |

# Overview

**Purpose** The purpose of this module is to:

Provide the participant with an overview on the drive system functions for hydraulic elevators.

**Objectives**

At the end of this lesson, the transit elevator/escalator trainee will be able to:

- Explain how a direct-acting hydraulic cylinder operates
- Identify major components of the hydraulic drive systems
- Identify variations in the direct acting hydraulic drive systems
- Explain the differences between roped and direct acting cylinder systems
- Variation in hydraulic drive systems
- Explain how a roped hydraulic system operates

**Materials**

**Mandatory** Make sure you have the following

- PowerPoint Presentation
- Coursebook
- Quizzes
- Pencils
- Elevators 101 2nd Edition

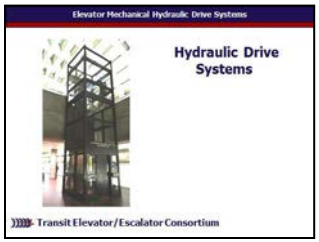
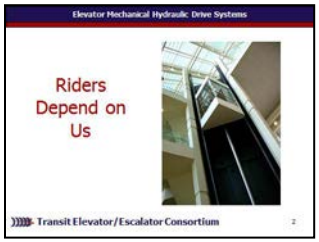
**Optional** You may also want the following for optional activities:

- Chalk board with chalk, large paper with marker, etc.
- Internet connection
- Lab, simulator or out of service elevator

# Elevator – Hydraulic Drive Systems

*Instructor's Guide*

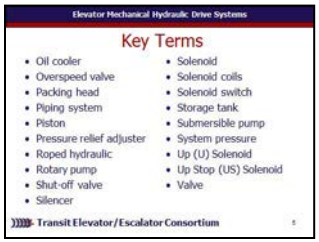
Module Length: 300 min  Time remaining: 300 min  This section: 30 min (7 slides)  *Section start time: _____*  *Section End Time: _____*

| DO | SAY | Materials Needed |
|---|---|---|
| **REVIEW** introduction slides<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br>Welcome to the course on Elevator Mechanical Geared Drive Systems.<br>***Advance***<br><br>This module gives the participant an in-depth look at the major components of hydraulic drive systems. In this module the participant will identify these components as they examine the path of fluid in the hydraulic circuit. Compared to traction elevators, hydraulic elevators are less complex mechanically making them ideal for low-rise installations. The main disadvantage is that they require more power to operate. There are also environmental concerns should either the lifting cylinder leak fluid into the ground.<br>***Advance*** | ✓PPT slides 1, 2<br>  <br>  |

# Elevator – Hydraulic Drive Systems

*Instructor's Guide*

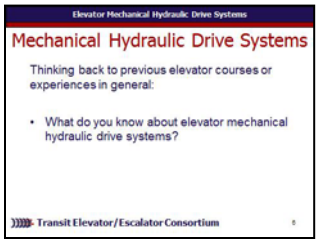
Module Length: 300 min  Time remaining: 300 min  This section: 30 min (7 slides)  *Section start time:* _____  *Section End Time:* _____

| DO | SAY | Materials Needed |
|---|---|---|
| **REVIEW** key terms<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br><br>As well as<br>Oil cooler, Overspeed valve, Packing head, Piping system, Piston, Pressure relief adjuster, Roped hydraulic , Rotary pump, Shut-off valve, Silencer<br>***Advance***<br>Solenoid, Solenoid coils, Solenoid switch Storage tank, Submersible pump, System pressure, Up (U) Solenoid, Up Stop (US) Solenoid, Valve<br>***Advance*** | ✓PPT slide 5<br>  <br> |

# Elevator – Hydraulic Drive Systems

*Instructor's Guide*

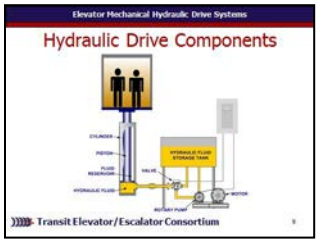
Module Length: 300 min  Time remaining: 300 min  This section: 30 min (7 slides)  *Section start time: _____*  *Section End Time: _____*

| DO | SAY | Materials Needed |
|---|---|---|
| **ASK** participants what they remember about safety and elevators<br><br>**SMALL GROUP ACTIVITY**<br><br>**WRITE**<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br><br>Thinking back to other courses or just in general, What do you know about elevator mechanical hydraulic drive systems?<br><br>***[Allow participants to think for a minute and perhaps discuss with a partner ideas as well as write down any ideas. Discuss participant responses and if possible list them on a chalk board or similar.]***<br><br>***Advance*** | ✓PPT slide 6<br><br>  |

# Elevator – Hydraulic Drive Systems

*Instructor's Guide*

Module Length: 300 min  Time remaining: 270 min  This section: 60 min (36 slides) *Section start time: _____*  *Section End Time: _____*

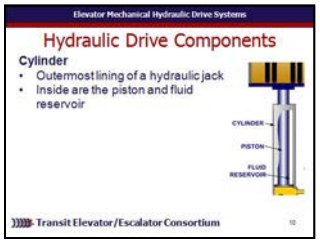
| DO | SAY | Materials Needed |
|---|---|---|
| **REVIEW** slides<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br><br>Lets begin with our first objective: to identify major components of the hydraulic drive systems.<br><br>***[Advance to next slide for larger diagram]***<br><br>***Advance***<br><br>In earlier courses, the participant learned that hydraulic elevators are designed to move the piston up using pressurized suspension means (hydraulic fluid) and using a gravity and control valve to bring the piston down. A hydraulic elevator is one in which liquid under pressure is available at all times for transfer into the hydraulic jack. Here are the major components we will cover.<br><br>***[Direct participants to the components and their locations on the illustration.]***<br><br>***Advance*** | ✓PPT slides 8, 9<br><br>  <br>  |

# Elevator – Hydraulic Drive Systems

*Instructor's Guide*

Module Length: 300 min  Time remaining: 270 min  This section: 60 min (36 slides) *Section start time:* _____ *Section End Time:* _____

| DO | SAY | Materials Needed |
|---|---|---|
| **REVIEW** slide | **In your own words:**<br>The cylinder is the outermost lining of a hydraulic jack. Inside the cylinder are the piston and the fluid reservoir.<br>***[Point out the cylinder, and then point out the piston and fluid reservoir to participants.]***<br>***Advance*** | ✓PPT slide 10 |




## Instructor's Notes

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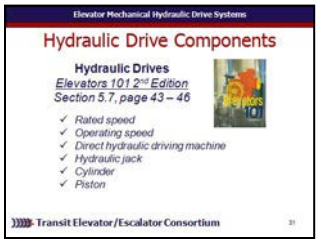
# Elevator – Hydraulic Drive Systems

*Instructor's Guide*

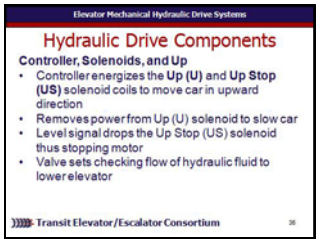
Module Length: 300 min  Time remaining: 270 min  This section: 60 min (36 slides) *Section start time:* _____ *Section End Time:* _____

| DO | SAY | Materials Needed |
|---|---|---|
| **REVIEW** slide<br><br>**REFER** participants to Elevators 101 2nd Edition, Section 5.7, pages 43-46 to review illustration.<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br><br>A detailed discussion on hydraulic drives is found in Elevators 101 2nd Edition, Section 5.7, pages 43-46. Topics covered are: rated speed, operating speed, direct hydraulic driving machine, hydraulic jack, cylinder, and piston.<br><br>***[Refer participants to Elevators 101 2nd Edition Section 5.7 pages 43 - 46 to review the illustration.]***<br><br>***Advance*** | ✓PPT slide 31<br>  <br><br><br>✓ Elevators 101 2nd Edition |

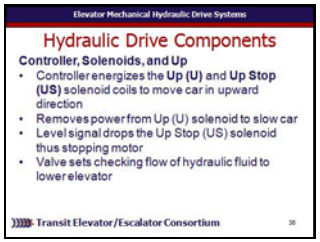
# Elevator – Hydraulic Drive Systems

*Instructor's Guide*

Module Length: 300 min  Time remaining: 270 min  This section: 60 min (36 slides) *Section start time:* _____ *Section End Time:* _____

| DO | SAY | Materials Needed |
|---|---|---|
| **REVIEW** slide<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br>The controller controls the solenoid coils which direct the flow of hydraulic fluid. Flow can be directed back to the tank or it can send the hydraulic fluid out to the piston. If it is directed by the controller to operate the car, the controller can energize the Up (U) and Up Stop (US) solenoid coils which start the operation of the elevator in the up direction. The elevator transitions from fully stopped to contract speed.<br><br>***Advance*** When the car approaches the correct floor, the controller removes power from the Up (U) solenoid which slows the elevator to leveling speed.<br><br>***Continued - Advance*** | ✓PPT slide 36<br>  |

Module Length: 300 min  Time remaining: 270 min  This section: 60 min (36 slides) *Section start time:* _____ *Section End Time:* _____

| DO | SAY | Materials Needed |
|---|---|---|
| **REVIEW** slide<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br>Upon receiving a signal that the elevator is level, it drops the Up Stop (UP) solenoid thereby signaling the pump motor to stop.<br>***Advance***<br><br>The valve then sets checking the flow of hydraulic fluid to lower the elevator.<br>***Advance*** | ✓PPT slide 36<br>  |

# Elevator – Hydraulic Drive Systems

*Instructor's Guide*

Module Length: 300 min  Time remaining: 270 min  This section: 60 min (36 slides) *Section start time: _____*  *Section End Time: _____*

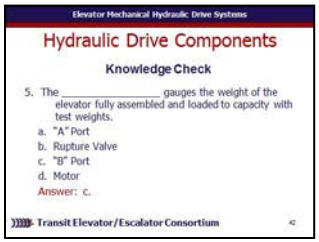
| DO | SAY | Materials Needed |
|---|---|---|
| **REVIEW** slide<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br>To lower the elevator, the controller energizes the Down (D) and Down Stop (DS) solenoid coils which<br>***Advance***<br>opens a path for hydraulic fluid to allow the valve to uncheck the system thereby allowing hydraulic fluid to return to the reservoir at contract speed.<br>***Advance***<br>The controller drops the D solenoid 24 to 30 inches from the landing which transitions the elevator 8 to 10 feet per minute.<br>***Advance***<br>When the controller receives the indication that the elevator is level, the controller de-energizes the DS solenoid thus stopping the hydraulic fluid flow and holding the elevator at the landing. ***Advance*** | ✓PPT slide 37<br>  |

# Elevator – Hydraulic Drive Systems

*Instructor's Guide*

Module Length: 300 min  Time remaining: 270 min  This section: 60 min (36 slides) *Section start time:* _____ *Section End Time:* _____

| DO | SAY | Materials Needed |
|---|---|---|
| **ASK**<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br>Three important paths of hydraulic fluid include<br>(check all that apply)<br>a. Storage tank<br>b. Muffler<br>c. Rotary pump<br>d. Valve<br>***Call on participants for answer***<br>***Advance once given the correct answer***<br>Answer: a., c., d.<br>***Advance*** | ✓PPT slide 39<br>  |

| DO | SAY | Materials Needed |
|---|---|---|
| **ASK** | **In your own words:**<br>The _____ gauges the weight of the elevator fully assembled and loaded to capacity with test weights.<br>a. "A" Port<br>b. Rupture Valve<br>c. "B" Port<br>d. Motor<br><br>***Call on participants for answer***<br>***Advance once given the correct answer***<br>Answer: c.<br>***Advance*** | ✓PPT slide 42<br>  |

## Instructor's Notes

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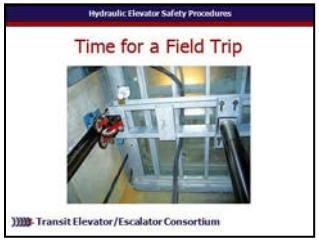
# Elevator – Hydraulic Drive Systems

*Instructor's Guide*

Module Length: 300 min | Time remaining: 210 min | This section: 60 min | *Section start time: _____* | *Section End Time: _____*

| DO | SAY | Materials Needed |
|---|---|---|
| **ASK**<br><br>**CLASSROOM ACTIVITY**<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br><br>***[At instructor's discretion, take time to visit the field and/or lab to look for examples hydraulic drive system components.]***<br>***Advance.*** | ✓PPT slide 44<br>  |

Module Length: 300 min  Time remaining: 150 min  This section: 50 min ( 14 slides) *Section start time:* _____  *Section End Time:* _____

| DO | SAY | Materials Needed |
|---|---|---|
| **ASK**<br><br>**Instructor's Notes**<br>_____<br>_____<br>_____<br>_____<br>_____ | **In your own words:**<br>Maintenance can be difficult in a _____ hydraulic system due to leaks that may occur underground.<br>a. Roped<br>b. Holeless<br>c. Rotary Pump<br>d. Direct Piston<br><br>***Call on participants for answer***<br>***Advance once given the correct answer***<br>Answer: d.<br>***Advance*** | ✓PPT slide 56 |