TRAINING SUPPORT PACKAGE (TSP)

<table>
<thead>
<tr>
<th>TSP Number</th>
<th>H8C11A04</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSP Title</td>
<td>Basic Recovery Methods and Rigging Techniques</td>
</tr>
<tr>
<td>Task Number(s) / Title(s)</td>
<td>091-179-0130, Determine Recovery Method</td>
</tr>
<tr>
<td>Effective Date</td>
<td>01 Oct 1999</td>
</tr>
<tr>
<td>Supersedes TSP(s)</td>
<td></td>
</tr>
<tr>
<td>TSP Users</td>
<td></td>
</tr>
<tr>
<td>Proponent</td>
<td>The proponent for this document is Ordnance Center and School.</td>
</tr>
<tr>
<td>Comments / Recommendations</td>
<td>Send comments and recommendations directly to:</td>
</tr>
<tr>
<td></td>
<td>401 1st St</td>
</tr>
<tr>
<td></td>
<td>Suite 227</td>
</tr>
<tr>
<td></td>
<td>Ft Lee, VA 23801-1511</td>
</tr>
<tr>
<td></td>
<td>Or e-mail: <a href="mailto:townslen@lee-dns1.army.mil">townslen@lee-dns1.army.mil</a></td>
</tr>
<tr>
<td>Foreign Disclosure Restrictions</td>
<td>This product has been reviewed by the product developers in coordination with the Ft. Lee foreign disclosure authority. This product is releasable to military students from all requesting foreign countries without restrictions.</td>
</tr>
</tbody>
</table>
Purpose

This Training Support Package provides the instructor with a standardized lesson plan for presenting instruction for:

<table>
<thead>
<tr>
<th>Task Number: 091-179-0130</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title: Determine Recovery Method</td>
</tr>
<tr>
<td>Conditions: In a field or garrison given required materials, general mechanic tool kit and applicable technical manual(s).</td>
</tr>
<tr>
<td>Standards: The vehicle must be recovered IAW applicable technical publications, procedures and specifications.</td>
</tr>
</tbody>
</table>
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</tr>
</tbody>
</table>
## SECTION I. ADMINISTRATIVE DATA

### All Courses Including This Lesson

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>091-ASIH8-63B,S,W</td>
<td>Wheel Vehicle Recovery Specialist</td>
</tr>
<tr>
<td>091-ASIH8-63D,E,H,T,Y</td>
<td>Track Vehicle Recovery Specialist</td>
</tr>
<tr>
<td>610-ASIH8-63B,S</td>
<td>Wheel Vehicle Recovery Specialist</td>
</tr>
<tr>
<td>610-ASIH8-63W</td>
<td>Wheel Vehicle Recovery Specialist</td>
</tr>
<tr>
<td>611-ASIH8-63D,H,Y</td>
<td>Track Vehicle Recovery Specialist</td>
</tr>
<tr>
<td>611-ASIH8-63E,T</td>
<td>Track Vehicle Recovery Specialist</td>
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</tbody>
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### Task(s) Taught(*) or Supported

<table>
<thead>
<tr>
<th>Task Number</th>
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</thead>
<tbody>
<tr>
<td>091-179-0130 (*)</td>
<td>Determine Recovery Method</td>
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</table>

### Reinforced Task(s)

<table>
<thead>
<tr>
<th>Task Number</th>
<th>Task Title</th>
</tr>
</thead>
</table>

### Academic Hours

The academic hours required to teach this TSP are as follows:

<table>
<thead>
<tr>
<th>Resident Hours/Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 / Conference / Discussion</td>
</tr>
<tr>
<td>3.0 / Practical Exercise (Performance)</td>
</tr>
</tbody>
</table>

| Test | .0 |
| Test Review | .0 |

Total Hours: **5.0**

### Prerequisite Lesson(s)

<table>
<thead>
<tr>
<th>Lesson Number</th>
<th>Lesson Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>H8C11A01</td>
<td>Locate a Recovery Site</td>
</tr>
<tr>
<td>H8C11A02</td>
<td>Operate Tactical Communication Equipment</td>
</tr>
<tr>
<td>H8C11A03</td>
<td>Cut Metal Using Oxyacetylene Equipment</td>
</tr>
</tbody>
</table>

### Clearance Access

Security Level: Unclassified

Requirements: There are no clearance or access requirements for the lesson.

### References

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Date</th>
<th>Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARM IC-17</td>
<td>RIGGING CARD FOR VEHICLE RECOVERY</td>
<td>01 Jan 1900</td>
<td></td>
</tr>
<tr>
<td>FM 9-43-2</td>
<td>Recovery and Battlefield Damage Assessment and Repair</td>
<td>15 Oct 1995</td>
<td>Oct 95</td>
</tr>
</tbody>
</table>

### Student Study Assignments

One primary instructor is required for conference and PE001. One assistant instructor is required for each group in PE002.
### Additional Support Personnel Requirements

None

### Equipment Required for Instruction

<table>
<thead>
<tr>
<th>Name</th>
<th>Quantity</th>
<th>Expendable</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Materials Required

**INSTRUCTOR MATERIALS:**
- Chalk board
- H8C11AO4 PE Sheet 1
- H8C11AO4 PE Sheet 2
- H8C11A04 Viewgraph 001-037
- Overhead Projector
- Light Pro

**STUDENT MATERIALS:**
- FM 9-43-2
- H8C11AO4 PE Sheet 1
- Calculator
- Hard hat
- Gloves
- Rigging Card
- Block and tackle
- Fiber ropes (6 ft.)
- Rigging Card
- Conventional Block 1 ea. per group
- Snatch blocks 1 ea. per group
- Chains 2 ea. per group
- Wire Rope
- Hemp rope

### Classroom, Training Area, and Range Requirements

**GENERAL INSTRUCTION CLASSROOM**

### Ammunition Requirements

<table>
<thead>
<tr>
<th>Name</th>
<th>Student Qty</th>
<th>Misc Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Instructional

**NOTE:** Before presenting this lesson, instructors must thoroughly prepare by studying this
<table>
<thead>
<tr>
<th>Guidance</th>
<th>lesson and identified reference material.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Proponent Lesson Plan Approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>--------</td>
</tr>
</tbody>
</table>


SECTION II.  INTRODUCTION

Motivator

Suppose you are called in the middle of the night to recover a disabled vehicle? What resistance factors must be considered during recovery operations as result of the force of gravity? What method of recovery would you use to recover the vehicle?

Resistance is the gross vehicle weight that must be taken into consideration when estimating the recovery of a vehicle. You as a member of a recovery team, must be capable of estimating the situation before you start performing the actual recovery operation. Methods of recovery and calculating resistance and mechanical advantage must be learned before performing the recovery operations. You may be assigned to a field unit and have to perform various types of recovery operations. These operations can take place as far forward as the front line or all the way to the rear support area.

You will be given a rigging card and references, you are required to calculate resistance and compute mechanical advantage and total resistance IAW references.

Terminal Learning Objective

NOTE: Inform the students of the following Terminal Learning Objective requirements.

At the completion of this lesson, you [the student] will:

<table>
<thead>
<tr>
<th>Action</th>
<th>Determine recovery methods and procedures.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conditions:</td>
<td>In a classroom and field environment, given FM 9-43-2, FM 5-125, Rigging Card, pencil and paper, snatch blocks, wire ropes and cables.</td>
</tr>
<tr>
<td>Standards:</td>
<td>Students will compute the basic methods of recovery, determine types of resistance factors, source of effort and mechanical advantage needed IAW references.</td>
</tr>
</tbody>
</table>

Safety Requirements

Incidental to Army operations and activities, all operations must provide for public safety, safe and healthful work places, procedures and equipment. Observe all safety precautions when using lifting devices and handling heavy parts. Observe all safety and/or environmental precautions regarding electricity, radiation, radio frequency (RF), fuel lubricants, high pressures, and refrigerants. Provide ventilation for exhaust fumes during equipment operation and use hearing protection when required IAW AR 385-10, The Clean Air Act (CAA), CAA amendments, National Ambient Air-Quality Standards (NAAQS), and the OSHA Hazard Communication standard.

Risk Assessment Level

Low
Environmental Considerations

All operations will/must conform to the Army Environmental Program, TC 5-400 (Unit Leader’s Handbook for Environmental Stewardship), local, state, and federal environmental policies, the Clean Air Act (CAA), CAA amendments, National Ambient Air-Quality Standards (NAAQS), as well as OSHA Hazard Communication Standard for Industry, 29 CFR, part 1910.

All operations will conform to the Army Environmental Policy, local, state and federal environmental regulations, AR 385-10, the Clean Air Act (CAA) and CAA amendments.

Evaluation

In lesson H8C11A05 you (the student) will have two hours to take a written test on the material covered in this lesson.

Instructional Lead-In

We are ready to begin the first learning step activity, Principles of Recovery.
SECTION III. PRESENTATION

1. Learning Step / Activity 1. Principles of Recovery

   Method of Instruction: Conference / Discussion
   Time of Instruction: 30 mins
   Media: Training Device

   NOTE: Show VGT 001

1. Always use the eight steps of recovery procedures (R-E-C-O-V-E-R-Y) to recover a vehicle.

   NOTE: Show VGT 002

   A. Reconnoiter the area.

      (a) Check for area of approach.

      (b) Check the terrain, survey the entire area.

      (c) Method of rigging (manpower).

      (d) Natural anchorage (trees-stumps-rocks).

      (e) Check your evacuation route.

   NOTE: Show VGT 003

   B. Estimate the situation.

      (a) Estimate the resistance created by the load.

      (b) Determine the capacity of the available effort. This would be the maximum capacity of the winch.

      (c) When the distance between the load and recovery vehicle is restricted, the maximum available effort may be as little as half of its rated capacity.

   NOTE: Show VGT 004

   C. Calculate ratio: Estimate the mechanical advantage needed to recover the load.

   NOTE: Show VGT 005

   D. Obtain resistance: Determine the tackle resistance and then the total resistance.

   NOTE: Show VGT 006

   E. Verify the solution:
(a) Compute the fall line force. This can not be greater than the available effort. If it is greater than the AE, the mechanical advantage must be increased.

(b) Compute the dead line force.

(c) No physical work has been done to this point and no time lost erecting rigging the wrong way.

NOTE: Show VGT 007

F. Erect rigging.

(a) Orient the crew and assign them specific duties.

(b) Work as a team.

NOTE: Show VGT 008

G. Recheck the rigging.

(a) Safety.

(b) Personnel at a safe location.

NOTE: Show VGT 009

H. You are ready to recover the disabled vehicle.

2. Mechanical advantage.

a. Mechanical advantage comes in many forces such as gears, levers and block/tackle systems.

b. Mechanical advantage is the ability to apply a small amount of effort over a long distance to move a large load over a short distance.

(1) Class 1.

(2) Class 2.

3. Components of a tackle system (simple and compound).

NOTE: Display fiber rope.

a. Fiber rope.

(1) Used for light loads.

(2) Computation for breaking strength of fiber rope.

NOTE: Use chalkboard and rigging card to explain breaking strength.
(a) SWC = Diameter of the rope squared
(b) T = strength in tons.
(c) D = diameter of rope.

NOTE: Display wire rope.

b. Wire rope (cable).
   (1) Used for heavy loads.
   (2) Computation for breaking strength of wire rope is SWC =.

NOTE: Use chalkboard and rigging card to explain breaking strength.

(a) SWC = 8 multiplied by the diameter squared
(b) T = strength in tons.
(c) D = Diameter of the rope.

NOTE: Display chain.

c. Chains.
   (1) Used for slings and as dead lines.
   (2) Computation for breaking strength of chain same as wire rope.
   (3) Inspect chain for cracks.
   (4) Never paint chains, paint cover cracks.

d. Types of blocks.

NOTE: Display conventional block.

   (1) Conventional block.

NOTE: Display snatch block.
(2) Snatch block.

4. Uses of block in a tackle system.

NOTE: Draw simple tackle system on chalkboard to explain components.

a. Fixed or leading blocks have no mechanical advantage except in self-recovery. May be used to gain mechanical advantage.

b. Traveling or running blocks are used to gain mechanical advantage.

5. Tackle system.

NOTE: Use chalkboard to explain mechanical advantage of simple and compound system.

a. Simple system.
   
   (1) One rope and one or more blocks.
   
   (2) Determine mechanical advantage by counting the number of lines supporting the load.

b. Compound system.
   
   (1) Two or more ropes and two or more blocks.
   
   (2) Determine mechanical advantage by multiplying the simple system together.

6. Types of load resistance.

NOTE: Display VGT 010

a. Overturned resistance - half the vehicle weight.

NOTE: Display VGT 011

b. Grade resistance - equal to vehicle weight plus the cargo.

NOTE: Display VGT 012

c. Mire resistance – vehicle weight plus the cargo.
   
   (1) Wheel depth - vehicle weight.
   
   (2) Fender depth - twice the vehicle weight.
(3) Turret/cab depth - three times the vehicle weight.

NOTE: Display VGT 013

d. Water resistance- estimated the same as land resistance.

NOTE: Display VGT 014

7. Reduction factors.

a. Power to the tracks.

b. Recover vehicle in opposite direction of travel - 10 percent reduction.

c. Both factors applied - 50 percent reduction.

d. Reduction factors do not apply to wheel vehicles.

NOTE: Conduct a check on learning and summarize the learning activity.

2. Learning Step / Activity 2. Rigging

Method of Instruction: Conference / Discussion
Time of Instruction: 1 hrs
Media: Training Device

NOTE: Display VGT 015

1. Lines.

a. Fall lines come from the source of effort.

b. Return line returns to source of effort or anchor.

c. Deadline attaches tackle system to the load or anchor.

2. Recovery fundamentals.

NOTE: Display VGT 016

a. Available effort- AE (winch capacity)

NOTE: Display VGT 017

b. Load resistance. – LR

   (1) Estimated weight of the load.
   (2) Computed by adding the weight of vehicle plus the cargo.

NOTE: Display VGT 018

c. Tackle resistance – TR
(1) The resistance created by friction in the tackle system.
(2) Computed by multiplying the number of sheaves in the system by 10% and the multiplying that number by the load resistance.

NOTE: Display VGT 019

d. Total load resistance - TLR.
   (1) Computed by adding the load resistance and tackle resistance.
   (2) The total amount of resistance of the load.

NOTE: Display VGT 020

e. Mechanical advantage. – MA
   (1) A small amount of force applied over a long distance to move a heavy load a short distance.
   (2) Computed by dividing the total load resistance by the available effort.

NOTE: Display VGT 021

f. Fall line force - FLF.
   (1) The amount of force on the return and support lines
   (2) Computed by dividing the total load resistance by the mechanical.
   (3) The FLF can not exceed the capacity of the AE.

NOTE: Display VGT 022

g. Dead line force - DLF.
   (1) The amount of force on the lines that anchor the tackle system.
   (2) Computed by multiplying the supported winch lines and the fall line force.

NOTE: Display VGT 023 and review the procedure for computing line forces, resistance and mechanical advantage.


NOTE: Display VGT 024

   a. Backup method.

NOTE: Display VGT 025

   b. Lead method.

NOTE: Display VGT 026

   c. Manpower method.
4. Methods to determine sling leg force.
   a. Abbreviations for sling leg force.

   NOTE: Display VGT 027

   (1) \( T \) = tension on sling.
   (2) \( WL \) = weight of load.
   (3) \( N \) = number of slings.
   (4) \( L \) = length of sling legs.
   (5) \( V \) = vertical distance from hook to top of load.

   b. Formula for determining the sling leg force. FM 5-125

   NOTE: Display VGT 028, explain the procedure on the VGT.

   (1) \( WL \) divided by \( N \)
   (2) \( L \) divided by \( V \)
   (3) Multiply the two sums together are the tension on the sling.

   NOTE: Display VGT 029, compute the sling leg force with the students.

5. Anchors.
   a. Natural.

   (1) Trees.
   (2) Rocks.

   b. Manmade anchors.

   NOTE: Display VGT 030

   (1) Picket hold fast.

   E: NOTE: Display VGT 031

   (2) Log dead man

   NOTE: Display VGT 032

   (3) Scotch anchor.

   NOTE: Display VGT 033

   (4) Sand parachute.
NOTE: Conduct a check on learning and summarize the learning activity.

3. Learning Step / Activity 3. Methods of Recovery

   Method of Instruction: Conference / Discussion
   Time of Instruction: 10 mins
   Media: -None-

10. Methods of recovery.

   NOTE: Display VGT 034

   a. Winching.

   b. Towing.

   NOTE: Display VGT 035

       (1) Highway towing.

   NOTE: Display VGT 036

       (2) Cross-country towing.

   NOTE: Display VGT 037

       (3) Combat towing.

   c. Lifting operation.

   d. Expedients.

NOTE: Conduct a check on learning and summarize the learning activity.

4. Learning Step / Activity 4. Determine Mechanical Advantage

   Method of Instruction: Practical Exercise (Performance)
   Time of Instruction: 2 hrs
   Media: Individualized, self-paced Instruction

   NOTE: Issue the students H8C11A05 Practical Exercise Sheet 001. Read the instructions to the students.

NOTE: Conduct a check on learning and summarize the learning activity.

5. Learning Step / Activity 5. Erect Rigging

   Method of Instruction: Practical Exercise (Performance)
   Time of Instruction: 1 hrs
   Media: Group-paced Instruction
NOTE: Prior to committing soldiers to the practical exercise, the instructor will conduct a review of training objective and safety elements involved in this task.

Briefly summarize main learning points.

Assign soldiers to groups with an instructor prior to leaving the classroom. Move soldiers to the rigging range. The instructor will have the required stations set up in a field location. The soldier will rig a simple and a compound tackle system.

Throughout the exercise use H8C11A04 PE SHEET 2, Practical Exercise Checklist to check the soldiers performance. Conduct an on-the-spot review to emphasize a point or to get soldiers back on track when they are not working towards the objective.

NOTE: Conduct a check on learning and summarize the learning activity.
SECTION IV. SUMMARY

| Method of Instruction: Conference / Discussion |
| Instructor to Student Ratio is:               |
| Time of Instruction: 0 hrs 5 mins             |
| Media: None                                    |

NOTE: The instructor will review the training objective and safety precautions by asking questions to insure the students understand the training objective.

Determine if the students have learned the material presented by soliciting student questions and explanations. Ask the students questions and correct misunderstandings. These are examples.

QUESTION: What are three types of load resistance?
ANSWER: Overturned, grade and mire.

QUESTION: What are three types of mire resistance?
ANSWER: Wheel depth, fender depth and turret/cab depth.

QUESTION: What are three methods of rigging?
ANSWER: Backup, lead and manpower.

QUESTION: What are three methods of recovery?
ANSWER: Winching, towing and lifting.
SECTION V. STUDENT EVALUATION

NOTE: Describe how the student must demonstrate accomplishment of the TLO standard. Refer student to the Student Evaluation Plan.

Testing Requirements

In lesson H8C11A05 you (the student) will have two hours to take a written test that will cover material in this lesson.

NOTE: Rapid, immediate feedback is essential to effective learning. Schedule and provide feedback on the evaluation and any information to help answer students’ questions about the test. Provide remedial training as needed.

Feedback Requirement
Learning Step 1

VGT H8C11A04, VGT
Determine Mechanical Advantage

H8C11A04 version TATS / Basic Recovery Methods and Rigging Techniques

During this lesson, the method to determine mechanical advantage and sling leg force has been discussed. This practical exercise will give you a chance to practice your ability to compute mechanical advantage and sling leg force. Remember that without the proper use of mechanical advantage and sling leg force, it would be impossible to perform the recovery operations.

Suppose you are called in the middle of the night to recover a disabled vehicle? What resistance factors must be considered during recovery operations as result of the force of gravity? What method of recovery would you use to recover the vehicle?

Resistance is the gross vehicle weight that must be taken into consideration when estimating the recovery of a vehicle. You as a member of a recovery team, must be capable of estimating the situation before you start performing the actual recovery operation. Methods of recovery and calculating resistance and mechanical advantage must be learned before performing the recovery operations. You may be assigned to a field unit and have to perform various types of recovery operations. These operations can take place as far forward as the front line or all the way to the rear support area.

You will be given a rigging card and references, you are required to calculate resistance and compute mechanical advantage and total resistance IAW references.

NOTE: Inform the students of the following Terminal Learning Objective requirements.

At the completion of this lesson, you [the student] will:

<table>
<thead>
<tr>
<th>Action:</th>
<th>Determine recovery methods and procedures.</th>
</tr>
</thead>
<tbody>
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<td>Conditions:</td>
<td>In a classroom and field environment, given FM 9-43-2, FM 5-125, Rigging Card, pencil and paper, snatch blocks, wire ropes and cables.</td>
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and the OSHA Hazard Communication standard.

**Risk Assessment Level**

Low

**Environmental Considerations**

**Evaluation**

In lesson H8C11A05 you (the student) will have two hours to take a written test that will be covered in this lesson.

**Instructional Lead-In**

Given references, pencil and paper, the student will compute the basic methods of recovery which include winching, lifting and recovery expedients. Students will determine types of resistance factors, source of effort and mechanical advantage used IAW references.

**Resource Requirements**

**INSTRUCTOR MATERIALS:**

H8C11A05 PE 001 Solution Sheet.

**STUDENT MATERIALS:**

FM 9-43-2
FM 5-125
Rigging Card
H8C11A04 PE 001
Pencil and Paper
Calculator (optional)

**Special Instructions Procedures**

NOTE: Complete problems 1 through 11 IAW FM 9-43-2, FM 5-125 and Rigging Card. Students will work independently and may use a calculator to solve the problems.

**SIMPLE/COMPOUND TACKLE SYSTEMS**

1. ____________Estimated load resistance

2. ____________Reduction factor of 50 percent

3. ____________Load resistance

4. ____________Tackle resistance
2. ___________ Estimated load resistance
   ___________ Reduction factor of 10 percent
   ___________ Load resistance
   ___________ Tackle resistance
   ___________ Total resistance
   ___________ Mechanical advantage
   ___________ Fall line force
   ___________ Dead line force

3. ___________ Estimated load resistance
   ___________ Reduction factor of 0 percent
   ___________ Load resistance
   ___________ Tackle resistance
   ___________ Total resistance
   ___________ Mechanical advantage
   ___________ Fall line force
   ___________ Dead line force
16,000 lb load, AE is 15,000 lbs. Mired Turret Depth

Question 3

32,000 lb load, AE is 10,000 lbs. Mired Wheel Depth

Question 4

4. _____________Estimated load resistance
   _____________Reduction factor of 50 percent
   _____________Load resistance
   _____________Tackle resistance
   _____________Total resistance
   _____________Mechanical advantage
   _____________Fall line force
   _____________Dead line force

5. _____________Estimated load resistance
   _____________Reduction factor of 50 percent
   _____________Load resistance
   _____________Tackle resistance
   _____________Total resistance
   _____________Mechanical advantage
   _____________Fall line force
   _____________Dead line force
6. Determine the sling leg force using the following formula:

\[ T = \frac{W}{N} \times \frac{L}{V} \]

7. A vehicle that weighs 100,000 pounds is mired at top of its road wheels. You have an M88A1 with a main winch capacity of 90,000 pounds. Estimate the load resistance:

- [ ] Estimated load resistance
- [ ] Reduction factor
- [ ] Load resistance
8. A 25,000 pound vehicle is mired over the top of its road wheels. You have a recovery vehicle with a main winch capacity of 60,000 pounds. You have power to the tracks and capability of recovery in the opposite direction, estimate the load resistance:

<table>
<thead>
<tr>
<th>Estimated load resistance</th>
<th>Tackle resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction factor</td>
<td>Total resistance</td>
</tr>
<tr>
<td>Load resistance</td>
<td>Fall line force</td>
</tr>
<tr>
<td>Mechanical advantage</td>
<td>Dead line force</td>
</tr>
</tbody>
</table>

9. You are required to lift a load of 15,000 pounds with a four-legged sling. The vertical height of the sling is 10 feet and the sling legs are 15 feet long. Calculate the sling leg force.

|                                      |

10. You have a power pack to lift, which weighs 1,650 pounds with a three-legged sling. The legs of the sling are 8 feet long and are 6 feet from the hook to the load. Calculate the sling leg force.

|                                      |

11. A 35,000 pound vehicle is mired over its fenders. You have another vehicle with a front winch capacity of 65,000 pounds, calculate the following:

<table>
<thead>
<tr>
<th>Estimated load resistance</th>
<th>Reduction factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load resistance</td>
<td>Tackle resistance</td>
</tr>
<tr>
<td>Total resistance</td>
<td>Mechanical advantage</td>
</tr>
</tbody>
</table>
Fall line force

Dead line force

Feedback
Requirements
SOLUTION FOR
PRACTICAL EXERCISE H8C11A04 PE 001

SIMPLE/COMPOUND TACKLE SYSTEMS

1. 56,000 Estimated load resistance
    28,000 Reduction factor of 50 percent
    28,000 Load resistance
    2,800 Tackle resistance
    30,800 Total resistance
    2:1 Mechanical advantage
    15,400 Fall line force
    30,800 Dead line force

Question 1
28,000 lb. Load, AE is 20,000 lbs.

Question 2
40,000 lb. Load, AE is 50,000 lbs.

2. 120,000 Estimated load resistance
    12,000 Reduction factor of 10 percent
    108,000 Load resistance
    21,600 Tackle resistance
    132,600 Total resistance
    3:1 Mechanical advantage
    44,000 Fall line force
    132,000 Dead line force

Mired Fender Depth

Mired Turret Depth
3.  

Estimated load resistance

Reduction factor, power can be applied to the tracks.

Load resistance

Mechanical advantage

Tackle resistance

Total resistance

Fall line force

Dead line force

4.  

Estimated load resistance

Reduction factor, power to the tracks and will be recovered in the opposite direction of travel.

Load resistance

Tackle resistance

Total resistance

Mechanical advantage

Fall line force

Dead line force
5. 30,000 Estimated load resistance

15,000 Reduction factor of 50 percent

15,000 Load resistance

6:1 Mechanical advantage

4,500 Tackle resistance

19,500 Total resistance

3,250 Fall line force

16,250 Dead line force

Question 5
6. Determine the sling leg force using the following formula:

\[ T = \frac{W}{N} \times \frac{L}{V} \]

\[ T = \frac{3,600}{8} \times \frac{6}{2,340} = \frac{100,000}{2,340} \]

\[ T = 42.24 \text{ pounds} \]

7. A vehicle that weighs 100,000 pounds is mired at the top of its road wheels. You have an M88A1 with a main winch capacity of 90,000 pounds. Estimate the load resistance:

\[ \frac{100,000}{100,000} \text{ Estimated load resistance} \]

\[ 0 \text{ Reduction factor} \]

\[ \frac{100,000}{10,000} \text{ Load resistance} \]

\[ \frac{100,000}{110,000} \text{ Tackle resistance} \]

\[ \frac{100,000}{110,000} \text{ Total resistance} \]

\[ 2:1 \text{ Mechanical advantage} \]

\[ \frac{55,000}{55,000} \text{ Fall line force} \]

\[ \frac{110,000}{110,000} \text{ Dead line force} \]

8. A 25,000 pound vehicle is mired over the top of its road wheels. You have a recovery vehicle with a main winch capacity of 60,000 pounds. You have power to the tracks and capability of recovery in the opposite direction, estimate the load resistance:

\[ \frac{50,000}{50,000} \text{ Estimated load resistance} \]

\[ 0 \text{ Tackle resistance} \]

\[ \frac{25,000}{25,000} \text{ Reduction factor} \]

\[ \frac{25,000}{25,000} \text{ Total resistance} \]

\[ \frac{25,000}{25,000} \text{ Fall line force} \]

\[ \frac{1:1}{1:1} \text{ Mechanical advantage} \]

\[ \frac{25,000}{25,000} \text{ Dead line force} \]
9. You are required to lift a load of 15,000 pounds with a four-legged sling. The vertical height of the sling is 10 feet and the sling legs are 15 feet long. Calculate the sling leg force.

5,625

10. You have a power pack to lift, which weighs 1,650 pounds with a three-legged sling. The legs of the sling are 8 feet long and are 6 feet from the hook to the load. Calculate the sling leg force.

732

11. A 35,000 pound vehicle is mired over its fenders. You have another vehicle with a front winch capacity of 65,000 pounds, calculate the following:

105,000 Estimated load resistance
0 Reduction factor
105,000 Load resistance
31,500 Tackle resistance
136,500 Total resistance
3:1 Mechanical advantage
45,500 Fall line force
136,500 Dead line force
Title

Errect Rigging

Lesson Number/Title

H8C11A04 version TATS / Basic Recovery Methods and Rigging Techniques

Introduction

A salvaged wheeled vehicle weighing 10,000 pounds is mired to wheel depth, and positioned near several natural anchors.

Motivator

Suppose you are called in the middle of the night to recover a disabled vehicle? What resistance factors must be considered during recovery operations as result of the force of gravity? What method of recovery would you use to recover the vehicle?

Resistance is the gross vehicle weight that must be taken into consideration when estimating the recovery of a vehicle. You as a member of a recovery team, must be capable of estimating the situation before you start performing the actual recovery operation. Methods of recovery and calculating resistance and mechanical advantage must be learned before performing the recovery operations. You may be assigned to a field unit and have to perform various types of recovery operations. These operations can take place as far forward as the front line or all the way to the rear support area.

You will be given a rigging card and references, you are required to calculate resistance and compute mechanical advantage and total resistance IAW references.

NOTE: Inform the students of the following Terminal Learning Objective requirements.

At the completion of this lesson, you [the student] will:

<table>
<thead>
<tr>
<th>Action</th>
<th>Determine recovery methods and procedures.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conditions:</td>
<td>In a classroom and field environment, given FM 9-43-2, FM 5-125, Rigging Card, pencil and paper, snatch blocks, wire ropes and cables.</td>
</tr>
<tr>
<td>Standards:</td>
<td>Students will compute the basic methods of recovery, determine types of resistance factors, source of effort and mechanical advantage needed IAW references.</td>
</tr>
</tbody>
</table>

Safety Requirements

Incidental to Army operations and activities, all operations must provide for public safety, safe and healthful work places, procedures and equipment. Observe all safety precautions when using lifting devices and handling heavy parts. Observe all safety and/or environmental precautions regarding electricity, radiation, radio frequency (RF), fuel lubricants, high pressures, and refrigerants. Provide ventilation for exhaust fumes during equipment operation and use hearing protection when required IAW AR 385-10, The Clean Air Act (CAA), CAA amendments, National Ambient Air-Quality Standards (NAAQS), and the OSHA Hazard Communication standard.

CAUTION: Inform soldiers of the following safety precautions.
1. Soldiers will wear hard hats.
2. For safety control of recovery operations, use only one ground guide.
3. Personnel handling wire rope will wear heavy leather palmed gloves. Never allow cable to run through hands.
4. Position hooks on blocks with open side up.
5. All observing personnel should stand at least one cable length away, opposite the angle of pull.
6. Inspect tackle and equipment thoroughly before recovery operations start.
7. Remove all jewelry.
8. Recheck rigging making sure the rigging lines are not crossing each other.
9. Safety keys should be in place on all tow hooks and shackles.
10. Dispose of petroleum products IAW local environmental SOP.
11. The level of risk for this lesson is LOW.

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**Risk Assessment Level**

Low

**Environmental Considerations**

Incidental to Army operations and activities, all operations must provide for public safety, safe and healthful work places, procedures and equipment. Observe all safety precautions when using lifting devices and handling heavy parts. Observe all safety and/or environmental precautions regarding electricity, radiation, radio frequency (RF), fuel lubricants, high pressures, and refrigerants. Provide ventilation for exhaust fumes during equipment operation and use hearing protection when required IAW AR 385-10, The Clean Air Act (CAA), CAA amendments, National Ambient Air-Quality Standards (NAAQS), and the OSHA Hazard Communication standard.

**Evaluation**

In lesson H8C11A05 you (the student) will have two hours to take a written test that will cover material in this lesson.

**Instructional Lead-In**

You will recover a mired wheel vehicle using proper rigging techniques and all safety precautions.

**Resource Requirements**

INSTRUCTOR MATERIALS:
H8C11A04 PE 002

STUDENT MATERIALS:
FM 9-43-2
FM 5-125
Hard hat
Gloves
Rigging Card
Block and tackle
Fiber ropes (6 ft.)
4 ea. 2,450 pound conventional block.
1 ea. 5/8 inch fiber rope.
SITUATION: During this lesson, you will recovery a mired wheel vehicle using proper rigging techniques and all safety precautions.

DIRECTIONS: Accomplish the following before soldiers arrive at problem site.

1. A salvaged wheeled vehicle weighing 10,000 pounds is mired to wheel depth, and positioned near several natural anchors. The student must recover the vehicle using a series of blocks and tackles, rig to 25:1, and determine correct fall line force IAW FM 9-43-2 and FM 5-125.

2. Complete PE Check list as the group performs the task. Once the group has correctly performed a step, place a check in the column. After the tasks have been completed, fill out the Student Data Sheet.

3. Ensure that each soldier participates. Rotate soldiers so that all members of the group use references and tools and perform the hands-on steps of the task. If time permits, repeat the task with different members performing different steps.

4. Ensure that the group completes each performance step IAW applicable references.

5. If a safety violation occurs, stop the group, correct on the spot, and restart the group.

6. If a soldier misses the practical exercise or a team needs remedial training for longer than the PE allows, then conduct this remedial training IAW TRADOC Reg 350-6.

7. Conduct a detailed review to ensure that each soldier can accomplish the following performance measures.

8. Insure that the following equipment is available.
   a. 4 ea. 2,450 pound conventional block.
   b. 1 ea. 5/8 inch fiber rope.
   c. 1 ea. 1 inch fiber rope.
   d. 2 ea. 1/2 inch wire rope dead lines.

PROCEDURE: Using the eight steps of recovery procedures, you must recover the vehicle.

1. Reconnoiter the area.
a. Check for area of approach.

b. Method of rigging (manpower).

c. Natural anchorage (trees-stumps-rocks).

2. Estimate the situation.

a. Load resistance of 10,000 pounds, mired wheel depth equals the vehicle weight of 10,000 pounds.

b. Effort available manpower (60 pound estimated pull each), 12 men equals 750 pounds effort.


4. Obtain resistance: Tackle resistance of 10% of 10,000 pounds, load resistance equals 1,000 pounds times the number of sheaves in rigging, 8 ea. equals 8,000 pounds. 8,000 pounds plus 10,000 pounds equals 18,000 pounds.

5. Verify solution.


7. Recheck the rigging.

a. Safety.

b. Personnel at a safe location.

c. Signal man.

NOTE: Disassemble and store rigging equipment.

Feedback Requirements

1. Soldier questions.

2. Review of recovery procedures and safety precautions.
Directions to the instructor:

1. Complete this PE Check list as the group performs the task. Once the group has correctly performed a step, place a check in the column. After the tasks have been completed, fill out the Student Data Sheet.

GO    NO GO

___    ______- a. Reconnoiter the area.
___    ______- b. Estimate the situation correctly.
___    ______- c. Calculate/verify load resistance.
___    ______- d. Erect rigging properly.
___    ______- e. Recheck the rigging according to references.
___    ______- f. Recover the vehicle safely.
___    ______- g. Accomplish the task without injury or damage.
___    ______- h. Accomplish the task IAW appropriate references.

SOLDIERS NAMES:

_____________________________________________
_____________________________________________
_____________________________________________
_____________________________________________
_____________________________________________

ROSTER NUMBER:______________________ CLASS NUMBER:________________________

START TIME:_____________ STOP TIME: ____________ TOTAL TIME:______________

INSTRUCTOR’S SIGNATURE DATE

_____________________________________________