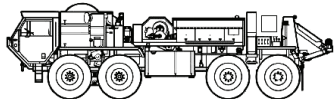
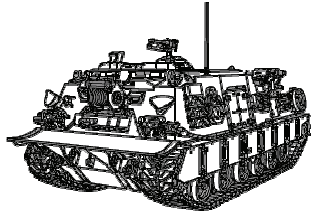
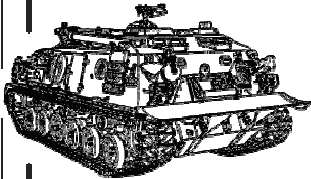


GTA 09-14-002

**U S ARMY ORDNANCE
CENTER & SCHOOL
ABERDEEN PROVING GROUND
MARYLAND**



**RIGGING CARD
FOR
VEHICLE RECOVERY**

01 MAY 2006

RECOVERY PROCEDURES

RECONNOITER AREA	ESTABLISH AREA SECURITY, THEN CHECK TERRAIN FOR BEST APPROACH ROUTE AND NATURAL ANCHORS
ESTIMATE SITUATION	DETERMINE RESISTANCE AND CAPABILITIES AVAILABLE
CALCULATE	DETERMINE MECHANICAL ADVANTAGE REQUIRED
OBTAIN RESISTANCE	COMPUTE TOTAL RESISTANCE
VERIFY SOLUTION	DETERMINE LINE FORCES AND COMPARE WITH LINE CAPABILITES
ERECT RIGGING	ERECT RIGGING FOR DESIRED MECHANICAL ADVANTAGE
RECHECK RIGGING	ENSURE RIGGING IS READY FOR PROPER AND SAFE OPERATION
YOU ARE READY	MOVE TO A SAFE LOCATON: SIGNAL OPERATOR TO PAY IN WINCH CABLE AND RECOVER LOAD

RECOVERY PRECAUTIONS

- 1. WEAR GLOVES WHILE HANDLING CABLES**
- 2. STEP ON - NOT OVER - SLACK CABLES**
- 3. STAND CLEAR OF CABLES UNDER LOAD BY LENGTH OF PAID OUT CABLE AND OPPOSITE ANGLE OF PULL**
- 4. BUTTON UP ALL HATCHES DURING WINCH PULLS**
- 5. KEEP RECOVERY VEHICLE EXHAUST DIRECTED AWAY FROM FUEL SPILLAGE**
- 6. GROUND GUIDE MUST BE LOCATED WHERE ALL VEHICLE OPERATORS CAN OBSERVE SIGNALS**
- 7. INSPECT RIGGINGS FOR SAFE AND PROPER ATTACHMENTS**
- 8. APPLY POWER TO WINCH CABLE GRADUALLY TO REMOVE SLACK IN RIGGING**
- 9. PERFORM FINAL RIGGING CHECK PRIOR TO PAYING IN THE LOAD**
- 10. KEEP ALL PERSONNEL OUT OF UNSAFE AREA**
- 11. REPORT AND CLEAN UP ALL POL SPILLS**

RIGGING FORMULA (long)

LOAD RESISTANCE (LR) = Vehicle weight, plus the cargo weight, times the mire factor, minus reduction factor.

MECHANICAL ADVANTAGE (MA) = Load resistance divided by the winch capacity. If you have a remainder, always round up to the next whole number.

TACKLE RESISTANCE (TR) = Ten percent of the load resistance times the number of sheaves in the tackle system. The number of sheaves is one less than the mechanical advantage.

TOTAL LOAD RESISTANCE (TLR) = Load resistance plus the tackle resistance.

FALL LINE FORCE (FLF) = Total load resistance divided by the mechanical advantage. The fall line force must be less than the winch capacity in order to have a safe working capacity.

DEAD LINE FORCE = Fall line force times the mechanical advantage.

WINCH CAPACITY (WC) = Winch capacity or Available Effort will be given.

MIRE FACTORS

Track

Wheel

WHEEL DEPTH MIRE

**Up to the top of
the road wheel
but not over**

**Up to the center
of the hub but
not over**



FENDER DEPTH MIRE

**Over the top of the
road wheel to the
fender but not over**

**Over the center of
the hub to the top
of the fender but
not over**



TURRET OR CAB DEPTH MIRE

**Over the fender
to the turret**

**Over the fender
to the cab**



TRACK VEHICLE LOAD RESISTANCE REDUCTION FACTORS

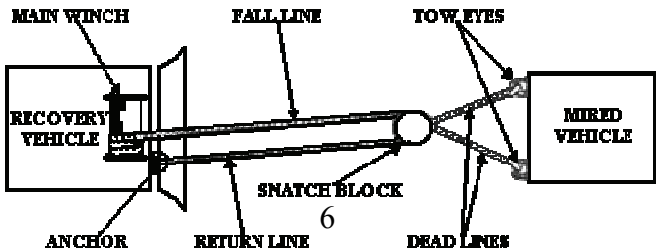
- 10 Percent---Recovery in the opposite direction from which the mired vehicle was traveling
- 40 Percent---Applying power to the tracks of the mired vehicle
- 50 Percent---Combination of recovery in the opposite direction and applying power to the tracks of the mired vehicle

DETERMINING MECHANICAL ADVANTAGE

$$\frac{\text{TOTAL LOAD RESISTANCE (Lbs)}}{\text{WINCH CAPACITY (Lbs)}} = \text{REQUIRED MECHANICAL ADVANTAGE}$$

RIGGING EXAMPLE

2 : 1



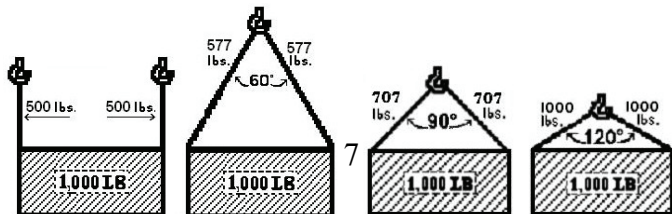
ROPE AND CHAIN CAPACITIES

DIAMETER (inches)	FIBER ROPE (sisal) $T = D^2$ (tons)	WIRE ROPE (IPS) AND CHAIN $T = 8D^2$ (tons)
3/8	0.140625	1.125
7/16	0.19140625	1.53125
1/2	0.25	2.0
5/8	0.390625	3.125
3/4	0.5625	4.5
7/8	0.765625	6.125
1	1.0	8.0
1-1/8	1.265625	10.125
1-1/4	1.5625	12.5
1-1/2	2.25	18.0

SLING LEG FORCES

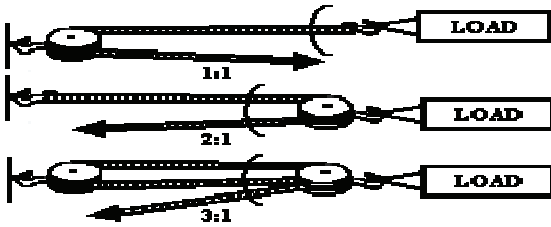
Force per sling leg (2-leg slings) per 1,000 lb. of total resistance

INCLUDED SLING LEG ANGLE (degrees)	SLING LEG FORCE (pounds)	INCLUDED ANGLE (degrees)	FORCE (pounds)
0	500	90	707
10	502	100	778
20	508	110	872
30	518	120	1,000
40	532	130	1,183
50	552	140	1,462



RIGGING FOR SAFETY

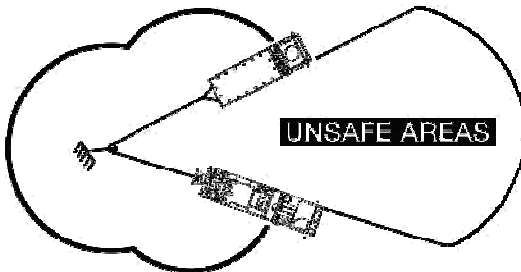
VARIOUS TACKLE MECHANICAL ADVANTAGES



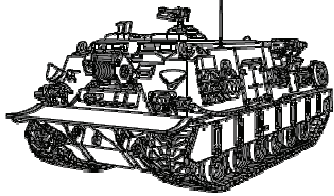
HOOK POSITIONS

INCORRECT

CORRECT



RECOVERY TRACKED VEHICLE CAPABILITIES (LBS)

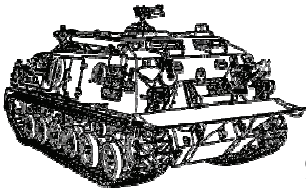


	<u>HOIST CAPACITY</u>	<u>MAIN WINCH</u>	<u>AUX WINCH</u>	<u>TOW PINTLE</u>
M88A2	12,000 ¹			
RECOVERY	50,000 ²	140,000	6,000	107,000
VEHICLE	70,000 ³			

CABLE SIZE	3/4"	1-3/8"	3/8"	
------------	------	--------	------	--

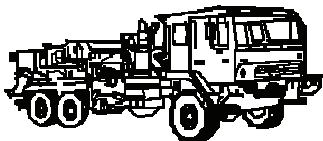
M88A1	12,000 ¹			
RECOVERY	40,000 ²	51,400 ⁴		90,000
VEHICLE	50,000 ³	90,000		

CABLE SIZE	5/8"	1-1/4"		
------------	------	--------	--	--



- 1 Spade Up
- 2 Spade Up W/Lockout
- 3 Spade Down 4 Part Line
- 4 Full Drum Capacity

RECOVERY WHEELED VEHICLE CAPABILITIES (LBS)



	<u>CRANE WINCH</u>	<u>MAIN WINCH</u>	<u>SELF RECOVERY WINCH</u>	<u>TOW PINTLE</u>	<u>LIFT TOW</u>
M1089 FMTV WRECKER	11,000	30,000	15,500	21,000	20,000
CABLE SIZE	3/8"	3/4"	1/2"		
M984A1/A2 HEMTT WRECKER	14,000	60,000	20,000	100,000	25,000
CABLE SIZE	7/16"	1"	9/16"		

