

June 6, 2006

SFAE-CSS-LT (Ms. N. Voss)  
U.S. Army Tank-automotive and Armaments COMmand (TACOM)  
Warren, Michigan 48397-5000

Subject: Hydraulic Winch Compatibility with the M1151/M1152

Reference: Contract No. DAAE07-99-C-S027, WD 0222 (Phase 2)

Dear Ms. Voss:

### **Introduction**

TACOM issued Work Directive 0222 to STS Engineering to conduct a review of hydraulic winch kits and to determine which kit is suitable to be installed on the M1151/M1152 (with or without armor) HMMWVs. This report covers Phase 2 of this work directive.

### **Objective**

The objectives of this work directive are outlined below:

### **Phase II (Funded)**

- Verify the winch kit application for the M1151, M1151P1, M1152, and M1152P1.
- Complete a trial installation of the winch on a GFE M1151P1.
- Conduct an engineering design study on the remaining M1151 and M1152 configurations for winch installation.
- Document all necessary changes to the winch installation instructions, for Phase 3 ECP action.
- Document all necessary changes to the HMMWV TDP, for Phase 3 ECP action.
- Conduct winch operation tests IAW AM General's "Mile Marker Two Speed Hydraulic Winch Test" procedure, dated 7 April 1997.
- Record test hydraulic pressure and temperature readings.
- Provide a written test report, IAW CDRL A002, to PM-LTV Engineering POC, COTR, and APM.

## **Conclusion**

1. Installation of the front mounted hydraulic winch kit (57K3562) on M1151A1 + B1 Armor Kit (formerly known as M1151P1) HMMWV was successful with only minor changes to the kit instructions. These changes were recorded and will be used for the revision of the TDP.
2. The M1151A1 + B1 Armor Kit HMMWV was selected for the build up (worst case scenario) to determine how the armor will affect the installation. Based on the successful installation of the front mounted hydraulic winch on the M1151A1 + B1 Armor Kit, it is determined that the 57K3562 winch kit can be installed on all M1151/M1152 HMMWV configurations (with or without armor).
3. The 60% slope vehicle recovery tests performed at Milford Proving Grounds (MPG) were completed. The M1151A1 + B1 Armor Kit HMMWV using the Mile Marker (MM) front mounted hydraulic winch was deemed to have passed the 60% slope vehicle recovery tests.

## **Recommendations**

Based on the successful installation of the front mounted hydraulic winch kit and the completion of the 60% slope vehicle recovery tests at MPG, AM General STS Engineering recommends proceeding to Phase 3 of this work directive to provide technical support for winch testing at a Government test site (possibly Aberdeen Proving Grounds) and to prepare/process an ECP for revisions to the winch kit TDPs.

## **Discussion**

An engineering trial installation was conducted using the front mounted hydraulic winch kit (57K3562) on the M1151A1 + B1 Armor Kit HMMWV with a 4-man air conditioning system. The trial installation was successful with minor changes to the kit instructions. One minor change is the relocation of the circuit breaker on top of the left cowl (see Appendix A and B). This is due to the fact that there is armor plating on the left cowl area as shown in Appendix B. The circuit breaker bolt-hole locations were measured and recorded and will be used for the revision to the kit instruction. Another change to the kit instruction is to make use of the 458C lead (from engine harness 12469287) that supplies 28VDC and is dedicated for the winch valve circuit. This change will eliminate the need for the "Y" adapter and jumper harness included in the kit for vehicles with 12469287 engine harness installed. Revision to the kit instruction involves adding procedures for the two changes previously mentioned above for only the HMMWV variants with armor and engine harness (12469287) installed. Otherwise, the kit instruction as originally released is applicable for all other variants.

After the engineering trial installation, AMG STS Engineering performed an engineering design study on the remaining M1151/M1152 configurations. Based on the successful installation of the front mounted hydraulic winch on the M1151A1 + B1 Armor Kit HMMWV and review of the kit instructions, AM General STS Engineering deemed that the 57K3562 kit can be installed on all M1151/M1152 HMMWV variants listed below (see Table 1).



Model	Description	Reference
M1151	Armament Carrier without Armor	--
M1151A1	Armament Carrier with IAP Armor	--
M1151A1 + B1 Armor Kit	Armament Carrier with IAP + B-Kit Armor	Formerly known as M1151P1 but hereafter referred to as M1151A1/B1
M1152	2-man without Armor	--
M1152A1	2-man with IAP Armor	--
M1151A1 + B2 Armor Kit	2-man with IAP + B-Kit Armor	Formerly known as M1152P1 but hereafter referred to as M1152A1/B2
M1165	M1152 (4-man) without Armor	--
M1165A1	M1152 (4-man) with IAP Armor	--
M1165A1 + B3 Armor Kit	M1152 (4-man) with IAP + B-Kit Armor	Formerly known as 4-man M1152P1 but hereafter referred to as M1165A1/B3

**Table 1 M1151/M1152 HMMWV Variants**

After the installation of the hydraulic winch kit, AM General STS Engineering scheduled a 60% slope vehicle recovery test at Milford Proving Grounds (Milford, MI). There were two 60% slope tests performed on the M1151A1/B1 HMMWV at Milford Proving Grounds (MPG). The first test was performed on December 14, 2005. Jim Alvarez (TACOM), Drew Aho (Mile Marker), Tom Simo (Mile Marker), Srikanth Kanchibhotla (Mile Marker), Ron Panganiban (AMG), Scott Wright (AMG), John Randolph (AMG), and Greg Patyk (MPG) were present during the test. Per TACOM direction, the vehicle was loaded to GVW before the test. The M1151A1/B1 was weighed before the 60% slope test in order to document the weight values of the vehicle. Weight distribution of the truck (at GVW) is depicted in Table 2 below. The hydraulic pressure and temperature readings for the December 14, 2005 test are shown in Appendix C and D for the two attempts of vehicle recovery. It was revealed that the hydraulic winch performed, as anticipated, to its capability up to the second layer load limit under the adverse conditions of severe snow weather and the vehicle being loaded to GVW. In order to exercise more operational time and retrieval, TACOM directed STS Engineering to perform another 60% slope test with the vehicle at vehicle curb weight.

Right Front	2,563 lbs
Left Front	2,667 lbs
Right Rear	3,497 lbs
Left Rear	3,375 lbs
<b>TOTAL</b>	
Front Axle	5,230 lbs
Rear Axle	6,872 lbs
Right Side	6,060 lbs
Left Side	6,042 lbs
<b>Total Weight</b>	<b>12,102 lbs</b>

**Table 2 Weight Distribution at GVW for December 14, 2005 Test**



After the approval of the Work Directive 0222 supplement, the second test was scheduled for May 10, 2006. As in the previous instance, Milford Proving Grounds was used for the 60% slope vehicle recovery test. Jim Alvarez (TACOM), Steve Davenport (TACOM), Jim Armour (Mile Marker), JR (Mile Marker), Ron Panganiban (AMG), Dave Johnson (AMG), and Greg Patyk (MPG) were present during the test. Once again, the M1151A1/B1 was weighed before the 60% slope test in order to document the weight values of the vehicle. Weight distribution of the truck (at CVW) is depicted in Table 3 below. The hydraulic pressure and temperature readings for the May 10, 2006 test are shown in Appendix E and F for the two attempts of vehicle recovery. This time, the test was deemed successful and TACOM directed STS Engineering to write a closeout report for Phase 2.

Right Front	2,694 lbs
Left Front	2,501.5 lbs
Right Rear	2,686.5 lbs
Left Rear	2,703.5 lbs
<b>TOTAL</b>	
Front Axle	5,195.5 lbs
Rear Axle	5,390 lbs
Left Side	5,205 lbs
Right Side	5,380.5 lbs
<b>Total Weight</b>	<b>10,585.5 lbs</b>

**Table 3 Weight Distribution at CVW for May 10, 2006 Test**

Overall, the successful engineering trial installation of the 57K3562 hydraulic winch on the M1151A1/B1 and the completion of the vehicle recovery tests at MPG proved that the front mounted hydraulic winch is suitable for all M1151/M1152 HMMWV variants depicted in Table 1 above. AM General recommends closure of Phase 2 and to proceed to Phase 3 of this work directive. Upon approval of recommendation to proceed to Phase 3, AM General will submit a supplement to Work Directive 0222 to cover ECP action and test support.

There is no logistical impact at this moment and therefore it is not provided with this report.

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# APPENDIX A

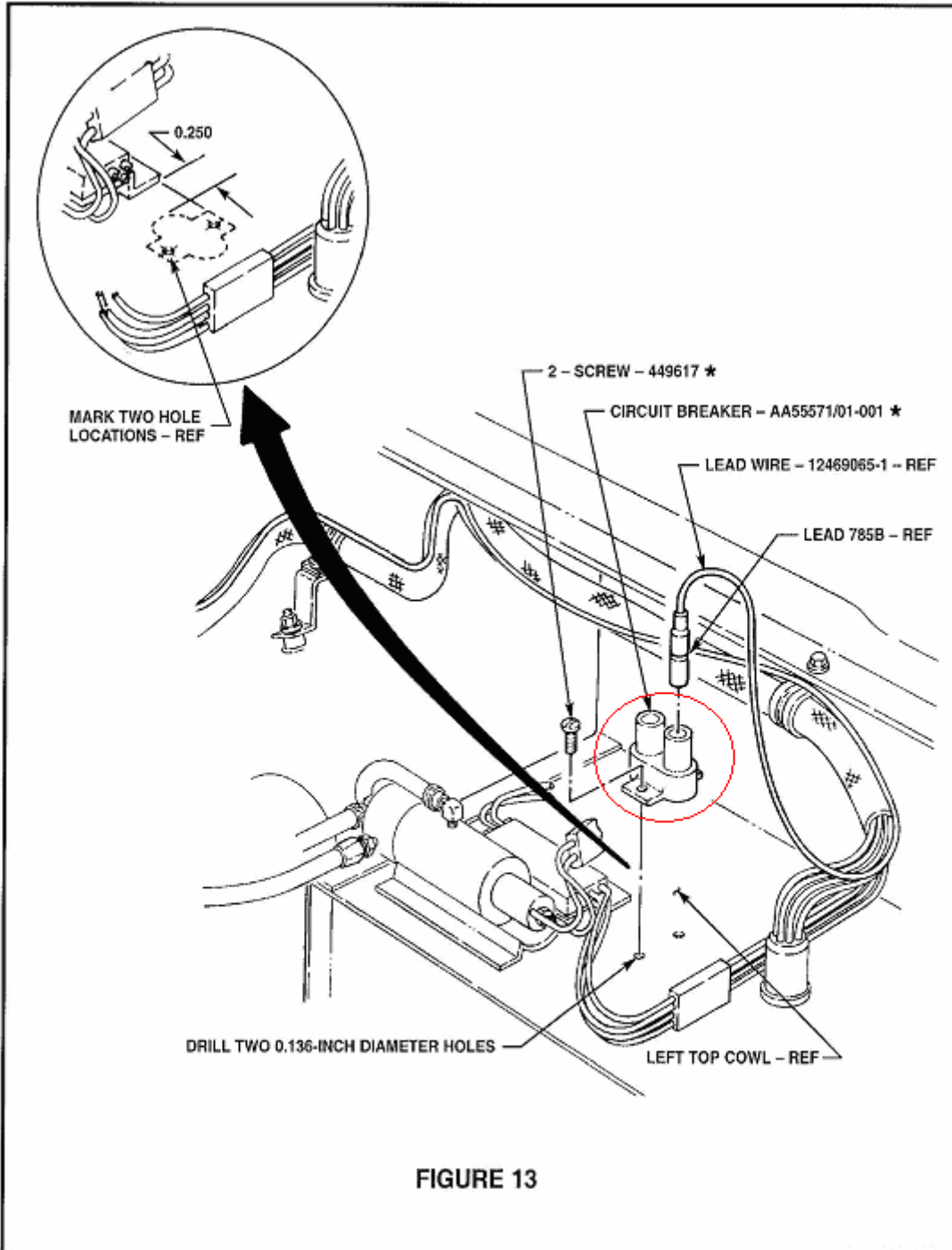
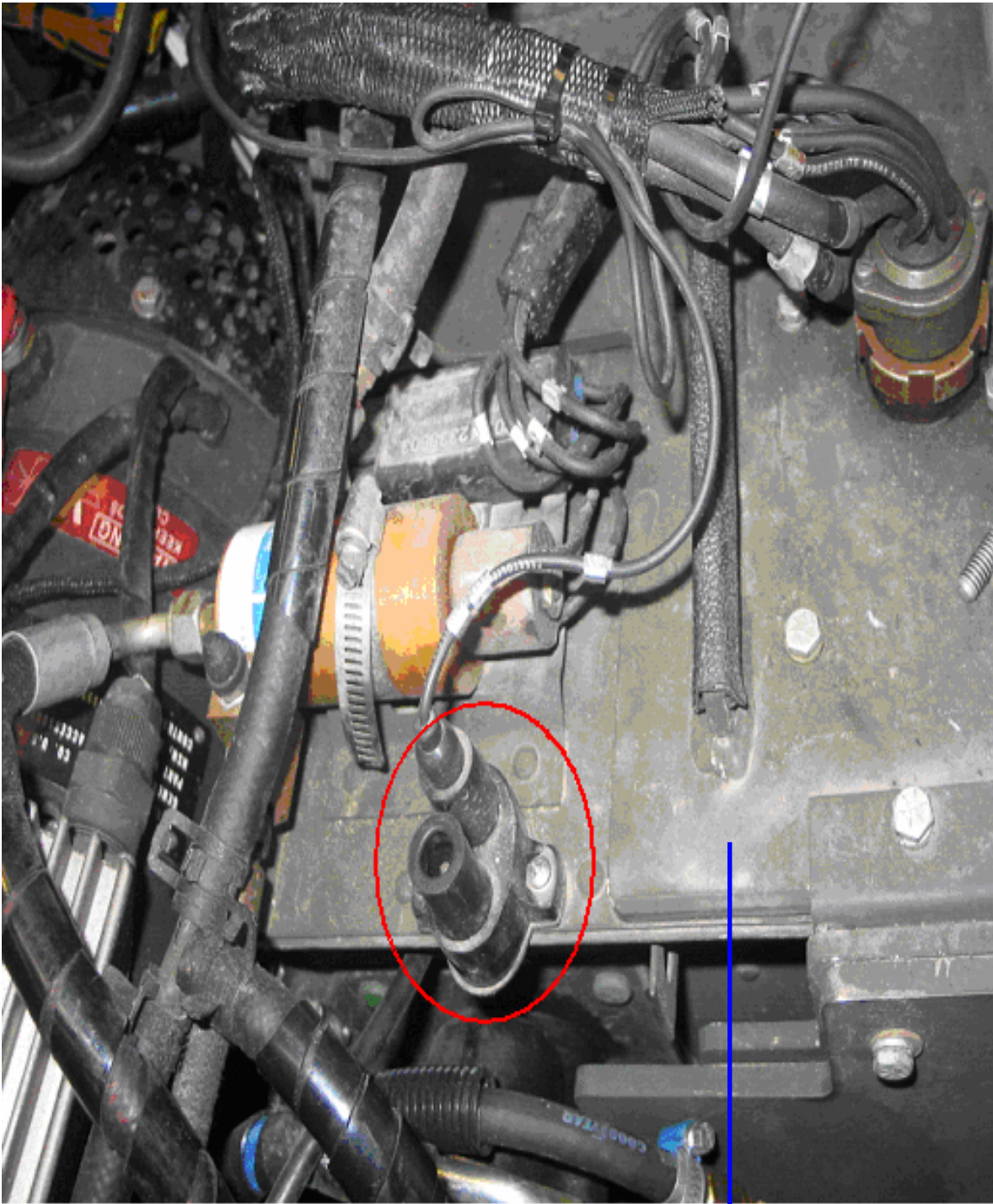


FIGURE 13

INSTALLATION INSTRUCTIONS, M1113 10,500 LB HYDRAULIC WINCH ACCESSORY KIT 57K3562	SIZE <b>A</b>	CAGE CODE <b>19207</b>	<b>12469354</b>	
	ERR AMG U1805	02-10-09	REVISION LEVEL	SHEET 21

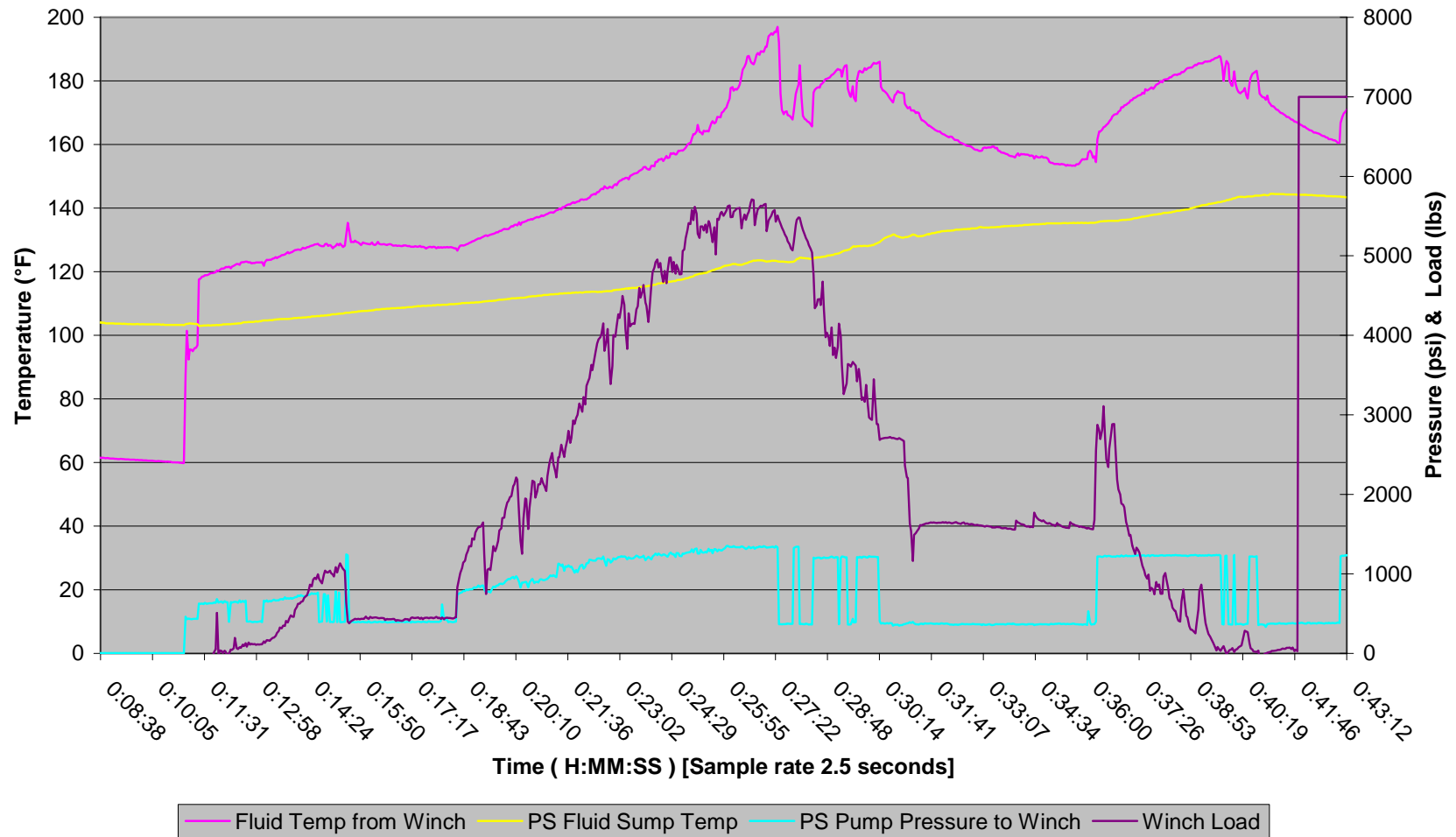
**APPENDIX B**



**Armor Plating**

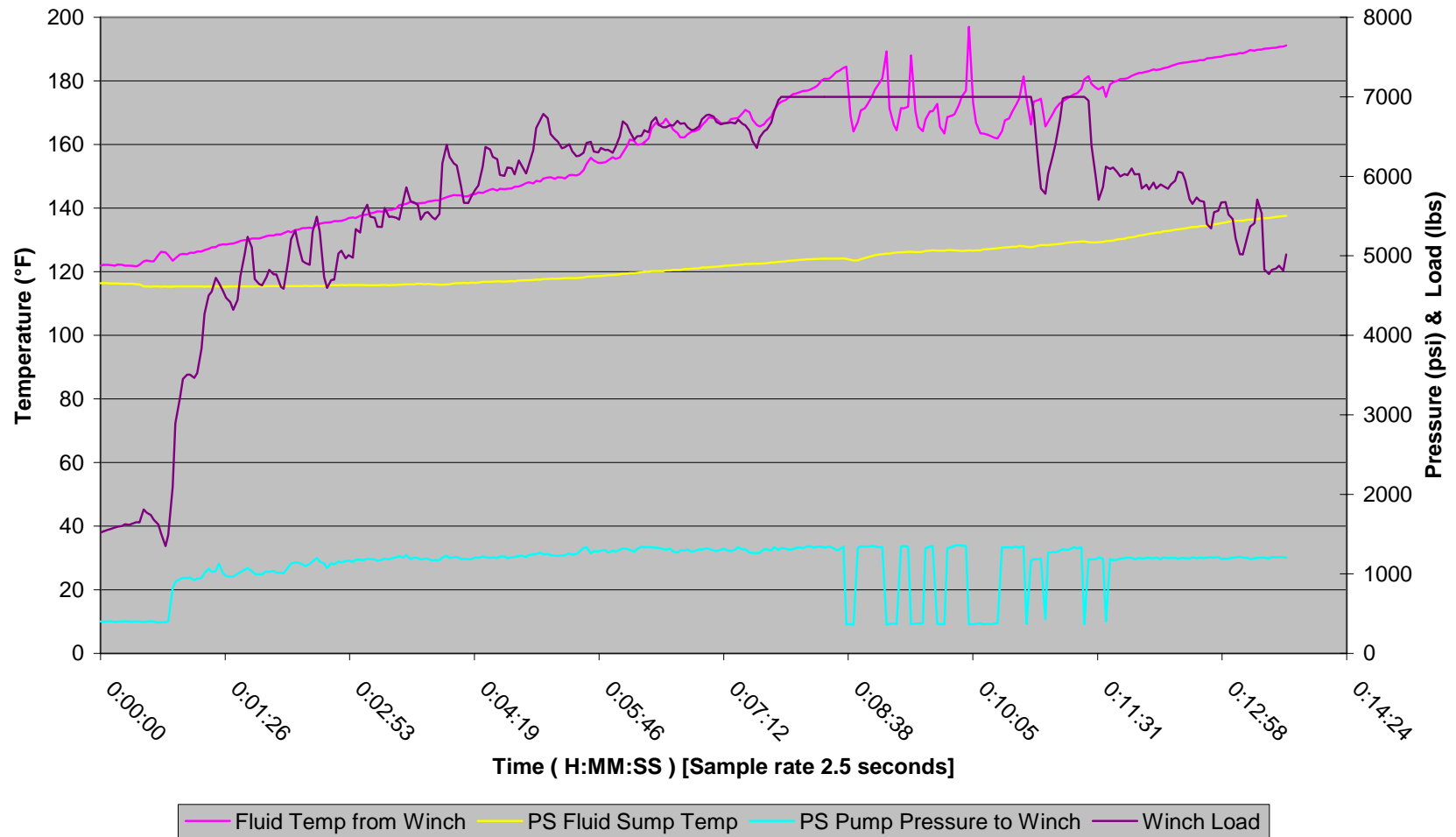
# APPENDIX C

Hydraulic Winch on M1151P1 GVW:12,100 lbs  
60% Slope Vehicle Recovery Test  
1st attempt on December 14, 2005



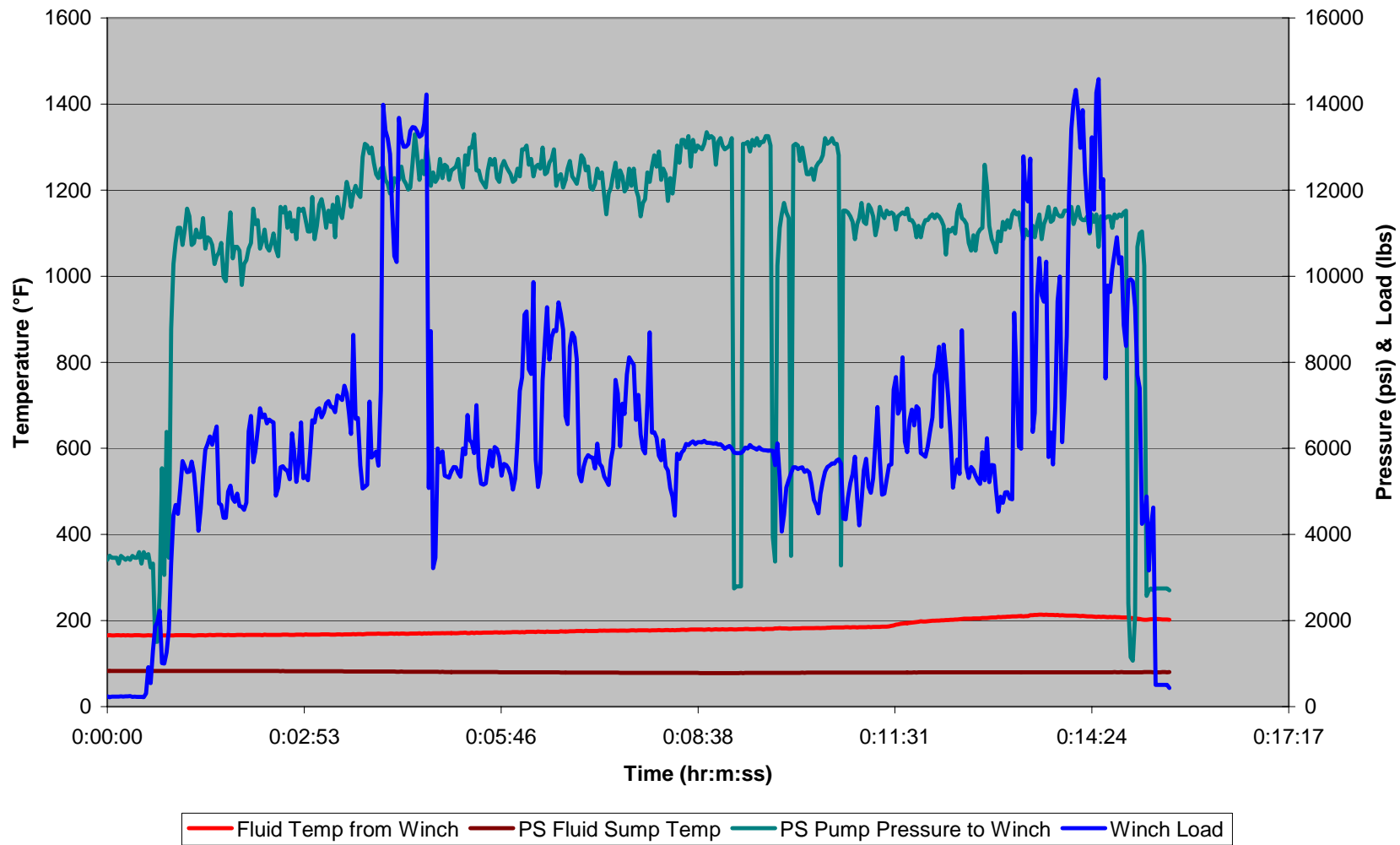
# APPENDIX D

## Hydraulic Winch on M1151P1 GVW:12,100 lbs 60% Slope Vehicle Recovery Test 2nd attempt on December 14, 2005



# APPENDIX E

Hydraulic Winch on M1151P1 CVW:10,500 lbs  
60% Slope Vehicle Recovery Test  
1st attempt on May 10, 2006



# APPENDIX F

Hydraulic Winch on M1151P1 CVW:10,500 lbs  
60% Slope Vehicle Recovery Test  
2nd attempt on May 10, 2006

