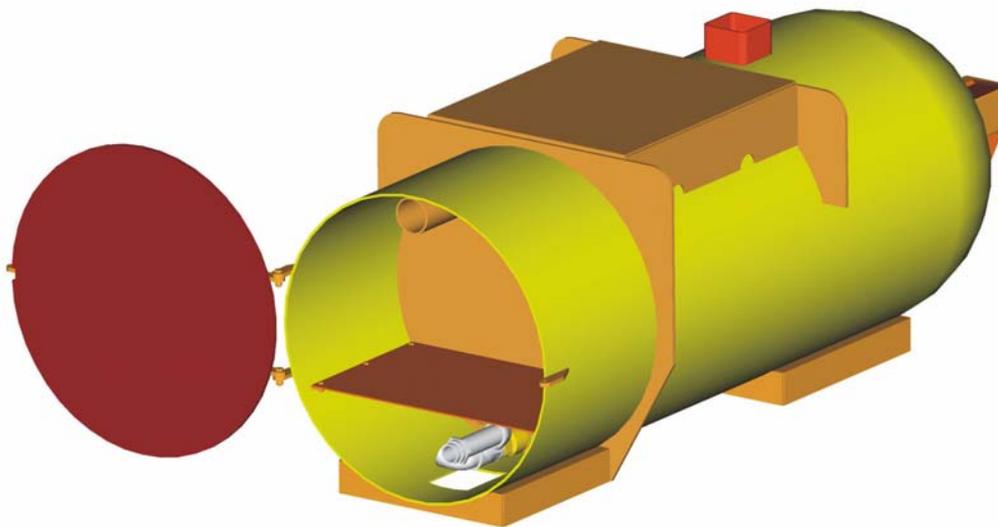


ROSCOMMON EQUIPMENT CENTER

Project Number 67

November 2002



Portable Fire Fighting Unit for Grapple Skidders

National Association of State Foresters
in Cooperation with
Michigan's Forest Fire Experiment Station

REC Project No. 67

Portable Fire Fighting Unit for Grapple Skidders

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Disclaimer

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Introduction

Earlier, REC reviewed the potential of using forestry skidders as wildfire fighting units. It was found that skidders, as a dedicated fire fighting unit, were very useful and effective (refer to REC Equipment Evaluation Report, "Skidders in Fire Control"). More recently, working with the State of Maine, REC documented a water handling system that could be picked up and hauled using the main winch of a cable type skidder

(REC Project No. 26). This allowed the skidders to be available for fire fighting duties without being a dedicated unit. Since that time the trend of logging operations has been directed toward grapple type skidders. With grapple skidders now predominant in the eastern states, REC again teamed with the State of Maine to document a water handling concept specifically for grapple skidders.

Tank and Water Handling System

The concept for this design is based on the modification of a 500 gallon liquefied petroleum (LPG or propane) container. The containers are pressure vessels and thus have substantial wall thickness and are quite durable. The round shape also lends itself well to be picked up using the grapple.

Propane tanks have a limited life as a pressure vessel and it appears that they are available for alternate uses. Once properly purged and vented they can be modified to suit the needs of a secondary user.

WARNING: Do not attempt to modify a propane tank unless it has been properly purged by the propane company.

Two propane companies have indicated they would support conversion of the used tanks to water tanks for wildfire use. They are Irving Oil Ltd. in eastern Canada and the northeast United States, and Amerigas in most of the United

States. Contact your local propane company as there may be other companies willing to support this use.

This report includes drawings that depict how to convert these tanks into a 325 gallon capacity water handling package. A lockable area for the pump and storage for draft and discharge hoses is included.

This tank is not designed for a specific pump. The pump compartment is sized large enough to handle a Wildfire Mark 3 pump or any pump of similar or smaller size.

The discharge (1" NPT) and suction (2" NPT) are sized to accommodate pumps that might be used with this design. In addition to draft from the tank, the system has the capability of overboard draft to fill the tank or for overboard discharge. Storage tubes for the draft hose are included in the design.

Grapple Skidder Characteristics

There are many differences from one skidder to another. As this tank system is only affected by some, this report will only cover those aspects. They are grapple configuration, arch configuration, and lifting capacity.

Grapple configuration varies between manufacturers and grapple function. The individual variations between grapples is an area

that can only be addressed on a case-by-case basis. However, the round cross section of this tank seems to adapt to many of these variations.

There are two main arch configurations, single and dual function, used on grapple skidders. Although, this tank system can be used with either, it will work best with a dual function arch. Dual function arches usually have both a higher

lifting capacity and height. They also have fore and aft positioning capability that allows the operator to bring the tank forward to keep the nose of the tank in contact with the bunk for better tank stability.

The lifting capacity of the skidder increases with the size of the skidder and varies depending on arch configuration. Appendix B lists basic lifting capacities of common skidders. Make sure to verify the capacity of the skidder to be used with the manufacturer or dealer.

Loading and Transport

The unit is designed to be set on the ground at a logging site when not in use. When the unit is to be moved by the skidder, back the skidder up to the nose end (opposite the pump end). Lower the grapple so that the tongs wrap around the entire tank. The longitudinal position of the grapple should be such that when the unit is raised, the nose of the tank should tilt up slightly (Figure 1). This will allow the nose guide to contact the bunk of the skidder. After contact is made, raise the grapple slightly to help the stability of the tank during transport. The unit should be carried as low as practical to minimize its effect on the side stability of the skidder.

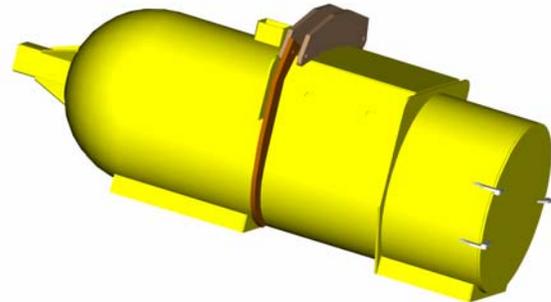


Figure 1

Although not included in this design package, a chain tether system is recommended. Tether lines extending forward and outward from the

midpoint of the tank and connecting to the skidder, should help in stabilizing the tank during transport.

Design Considerations and Alternatives

The concept of a water package for a grapple skidder is not unique or difficult. There are, however, some points about the function of the grapple that need to be considered.

1. The grapple is designed to pick up round objects, therefore, a round section tank is probably the best choice. A square or rectangular x-section can be used, but the grapple to tank contact points will be on the corners only.
2. The grapple is designed to have a very high constant holding force when closed. Therefore, the tank must be substantial enough to withstand this force.
3. In order to keep the unit in a vertical position, the top of the tank should be flat and allowed to bump up against the grapple cylinder frame. This top should be narrow

enough to keep the tongs from hitting its side before closing on the tank body (Figure 2).

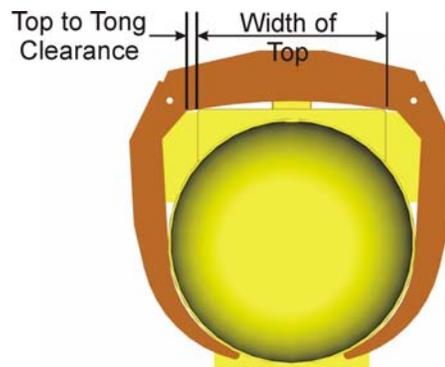


Figure 2

4. The top plate must extend forward of the center of gravity of the unit including water. This will allow the tank to be carried more level or with slight upward pressure of the nose against the bunk (Figure 1).
5. After the modification of a few 500 gallon propane tanks, it has been noticed that they vary in diameter. The radii cut on some parts will therefore vary. To calculate the outside diameter or radius prior to cutting the tank, measure the circumference of the tank and use the equations below.

$$\text{Diameter} = \frac{\text{Circumference}}{3.14}$$

$$\text{Radius} = \frac{\text{Circumference}}{6.28}$$

6. A lockable cover for the fill port guard is an option if vandalism is a concern.

7. As stated earlier a tether stabilization system is recommended. Lines running forward from the tank to the skidder at outward angles will increase the stability of the tank during transport.

REC has located one commercially available unit. REC has not evaluated this product and has added the following company information only as a starting point for those who may wish to pursue purchasing a unit.

George Zacharias Logging, Ltd.
 RR#1, Site 17B, Comp. 4
 Burns Lake, B.C. Canada V0J1E0
 Telephone: (250) 698-7451
 Fax: (250) 698-7421

Construction Notes

1. **WARNING: Make sure tank has been purged and all ports on the tank are open prior to cutting or welding on the tank.**

2. The tank is cut into three pieces with two being reused (Drawing 90-6724C). The largest piece (tank, cut), along with the bulkhead S/W, will form the water compartment. All welds in this area must be water tight.
3. The cylindrical section of the tank (tank, pump mount) is welded to the bulkhead S/W concentric with the rest of the tank with the rectangular cutout on the bottom.
4. Use the pump deck to position the pump deck mounts.

5. Attach the hinge/latch halves to the door as dimensioned first (Drawing 90-6701C). Use the door to position the hinges/latch halves on the tank. The latch half on the door should be above the latch half on the tank.
6. The fill port guard should not be welded on the sides to allow water drainage.
7. Fill cap must be vented or removed when pumping out of or into the tank. Use of a purchased vented cap is recommended.
8. Plug all ports in the tank when welding and cutting is complete.

Grapple Skidder Tank Data

Construction: Mild steel and modified propane tank.

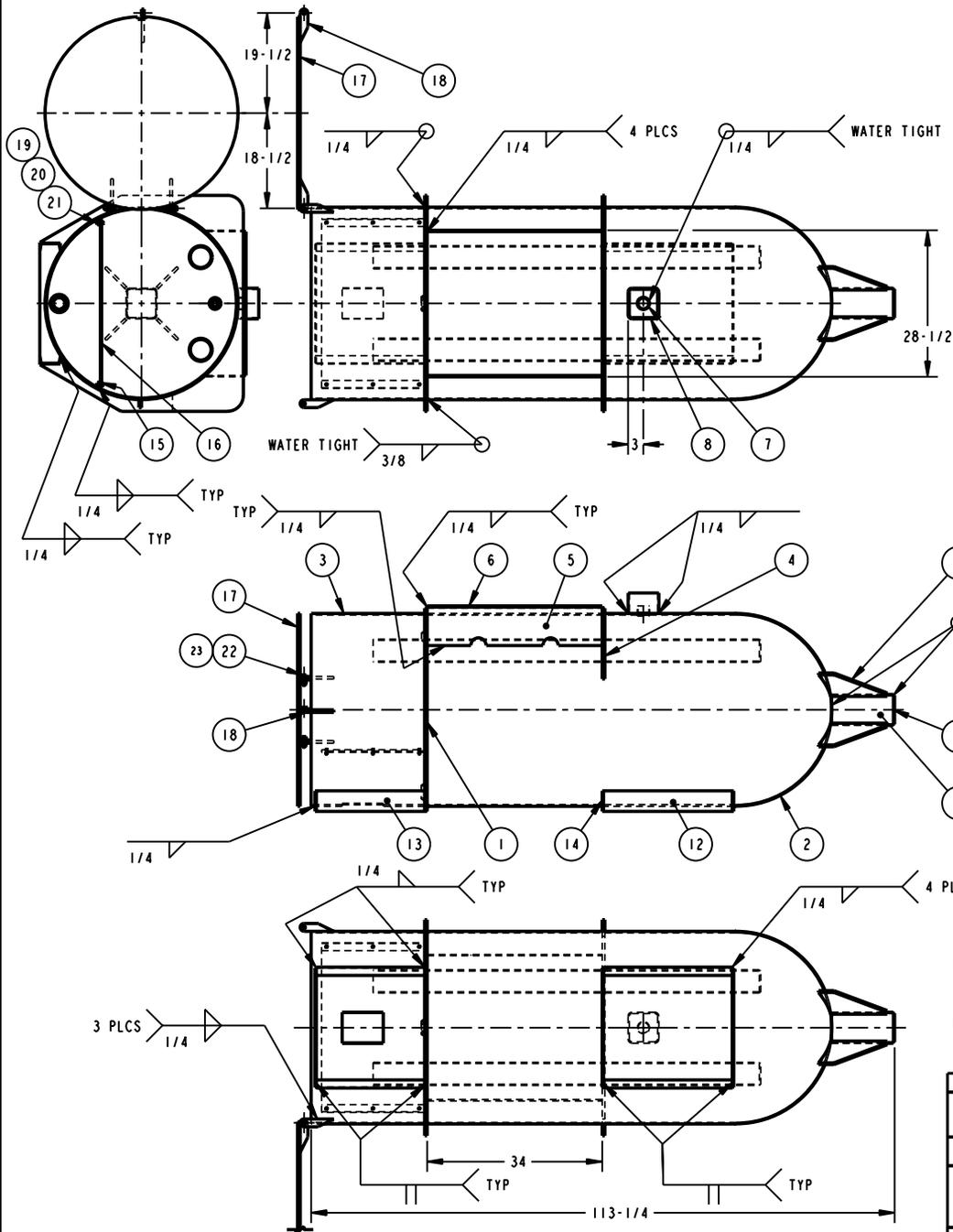
Water Capacity: 325 Gallons

Overall Dimension: Length: 115-1/2 Inches
Width: 42 Inches
Height: 43 Inches

Weight of Unit: Empty w/o Pump: 1,935 Pounds
Empty w/Mark III Pump: 1,980 Pounds
Full w/Mark III Pump: 4,600 Pounds

Drawing List

Drawing Number	Drawing Name
90-6700C	Tank A/C
90-6701C	Tank W/C
90-6723C	Bulkhead Details
90-6724C	Tank Details 1
90-6725C	Tank Details 2
90-6726C	Tank Details 3



ITEM	PART NO.	DWG	DESCRIPTION	QTY
1	90-6702	90-6723C	BULKHEAD S/W	1
2	90-6706	90-6724C	TANK, CUT	1
3	90-6707	90-6724C	TANK, PUMP MOUNT	1
4	90-6708	90-6724C	GRAPPLE GUIDE	1
5	90-6709	90-6724C	SIDE BAR	2
6	90-6710	90-6724C	GRAPPLE BUMP TOP	1
7	90-6711	90-6724C	FILL NECK	1
8	90-6712	90-6724C	FILL PORT GUARD	1
9	90-6713	90-6725C	GUIDE	1
10	90-6714	90-6725C	GUIDE CAP	1
11	90-6715	90-6725C	GUSSET, GUIDE	4
12	90-6716	90-6725C	BASE CHANNEL, LONG	2
13	90-6717	90-6725C	BASE CHANNEL, SHORT	2
14	90-6718	90-6725C	BASE END	3
15	90-6719	90-6726C	MOUNT, PUMP DECK	2
16	90-6720	90-6726C	PLATE, PUMP DECK	1
17	90-6721	90-6726C	DOOR	1
18	90-6722	90-6726C	HINGE/LATCH HALF	6
19	TS-06GG08		SCREW, HEX HEAD CAP 3/8-16UN X 1 GR 5 PLTD	6
20	WS06-BC		WASHER, LOCK 3/8, SPRING TYPE, REG PLTD	6
21	TS-06GP		NUT, HEX 3/8-16UN GRADE 5 PLATED	6
22	TS-08GG14		SCREW, HEX HEAD CAP 1/2-13UN X 1 3/4 GR 5 PLTD	2
23	TS-08GPL		NUT, HEX LOCK 1/2-13UN	2

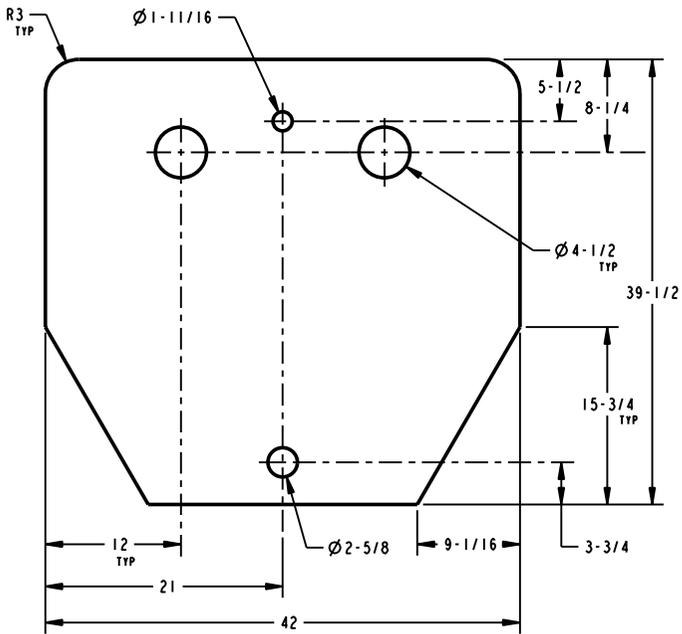
NOTE: CENTER ITEM 17 ON ITEM 3
 ASSEMBLE ITEMS 18, 22 AND 23
 THEN POSITION IN PLACE FOR WELDING

NOTE: LEAVE SIDES OF ITEM 8
 OPEN FOR DRAINAGE

PART NO: 90-6701
 EST WT: 1903 LBS

STD. TOL.		DRAWN: MSP	
FRACTIONAL:		DESIGNED: MSB	
6 TO 4 IN ± .005		APPROVED: MSB	
6 IN AND UP ± .010		DATE: 28-Sep-79	
ANGULAR:		SCALE: 1/16	
± .1 DEG.		PROJECT NO: REC 61	
DECIMAL:		TITLE: TANK W/C	
1 PLACE ± .005		FOREST FIRE EXPERIMENT STATION	
2 PLACE ± .001		P.O. BOX 68 ROSCOMMON, MICHIGAN 48633	
3 PLACE ± .0005		ROSCOMMON EQUIPMENT CENTER	
PROJECT NO: REC 61		DWG. NO: 90-6701	

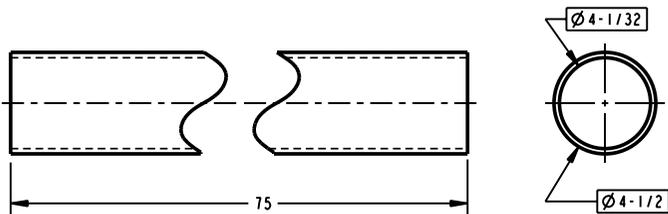
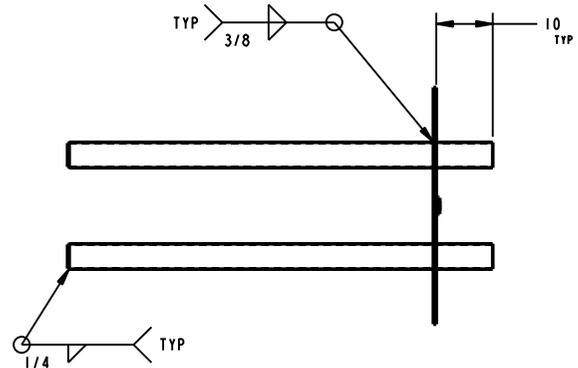




BULKHEAD
SCALE 1/8

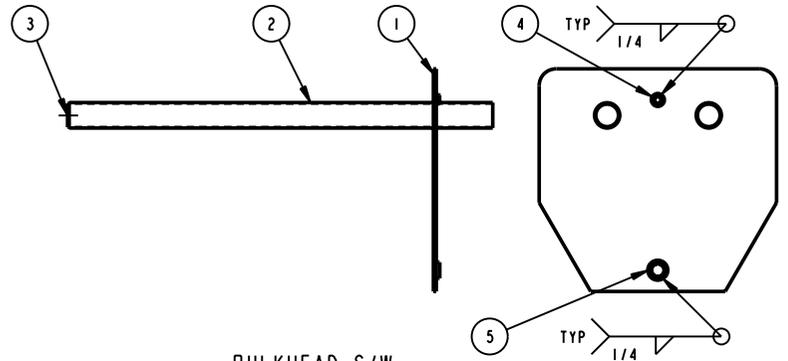
PART NO: 90-6703
MAT'L: PLATE 1/2 4X8 HR
G10150
FFES SPEC NO: AA-008488C
EST WT: 208 LBS

ITEM	PART NO.	DWG	DESCRIPTION	QTY
1	90-6703	90-6723C	BULKHEAD	1
2	90-6704	90-6723C	HOSE STORAGE TUBE	2
3	90-6705	90-6723C	CAP, HOSE TUBE	2
4	P16-MAF		FLANGE, TANK 1" STD HVY FLAT W/PILOT	1
5	P32-MAF		FLANGE, TANK 2" STD HVY FLAT W/PILOT	1



HOSE STORAGE TUBE
SCALE 1/4

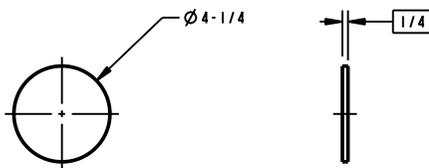
PART NO: 90-6704
MAT'L: PIPE 4" NOM SCH 40 BLACK
K02504
FFES SPEC NO: AF-04064AD
EST WT: 67.4 LBS



BULKHEAD S/W
SCALE 1/16

PART NO: 90-6702
EST WT: 346 LBS

NOTE: ALL WELDS TO BE WATER TIGHT

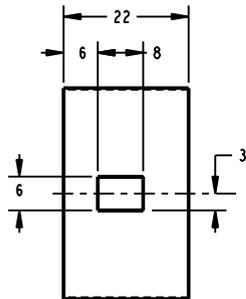
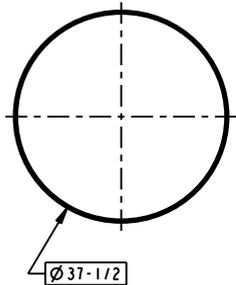


CAP, HOSE TUBE
SCALE 1/4

PART NO: 90-6705
MAT'L: BAR, FLAT 1/4 X 4-1/2 HR
G10200
FFES SPEC NO: AB-00418AA
EST WT: 1.00 LBS

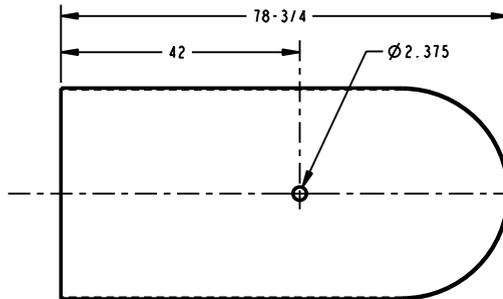
STD. TOL.		DRAWN: MSP	
FRACTIONAL:		DESIGNED:	MSP
6 TO 6 IN ± .010		APPROVED:	MSP
6 IN AND UP ± .015		DATE:	24-Sep-2002
ANGULAR:		SCALE:	N/A
± .1 DEG.		PROJECT NO.:	REC 61
DECIMAL:		TITLE:	BULKHEAD DETAILS
1 PLACE ± .005			
2 PLACE ± .001			
3 PLACE ± .0005			
PROJECT NO.:	REC 61	DWG. NO.:	90-6723





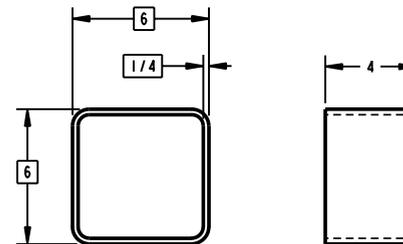
TANK, PUMP MOUNT

PART NO: 90-6707
 MAT'L: CUT FROM 500 GAL PROPANE TANK
 EST WT: 223 LBS



TANK, CUT

PART NO: 90-6706
 MAT'L: CUT FROM 500 GAL PROPANE TANK
 EST WT: 812 LBS

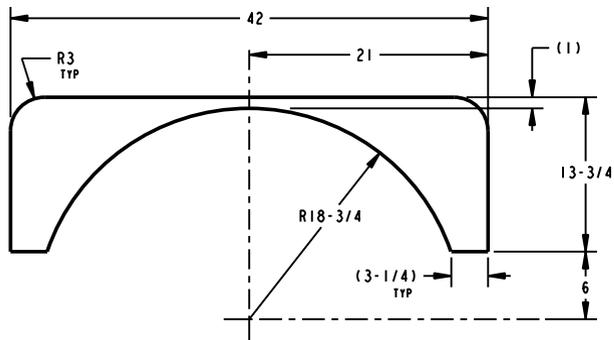


FILL PORT GUARD
 SCALE 1/4

PART NO: 90-6712
 MAT'L: TUBE, SQ 6 X 6 X 1/4 WALL
 K03000
 FFES SPEC NO:
 EST WT: 6.21 LBS

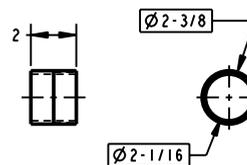
NOTE: REMOVE FEET AND REGULATOR COVER MTS
 PLUG TANK FITTING HOLES AFTER ALL CUTTING IS DONE

SCALE 1/16



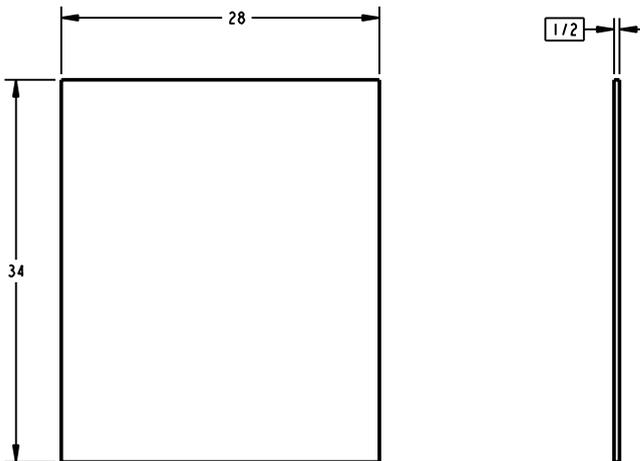
GRAPPLE GUIDE
 SCALE 1/8

PART NO: 90-6708
 MAT'L: PLATE 1/2 4X8 HR
 G10150
 FFES SPEC NO: AA-00848BC
 EST WT: 34.3 LBS



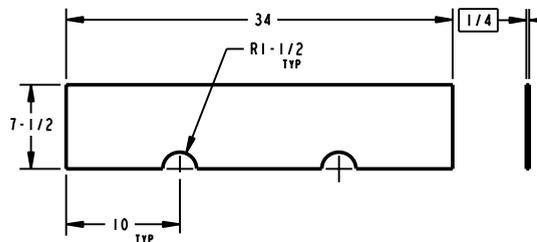
FILL NECK
 SCALE 1/4

PART NO: 90-6711
 MAT'L: CUT FROM NIPPLE 2 X 4 SCH 40 BLACK
 EST WT: 0.61 LBS



GRAPPLE BUMP TOP
 SCALE 1/8

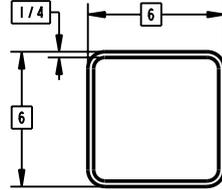
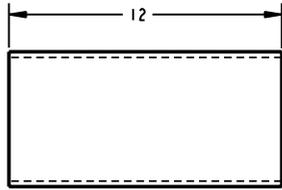
PART NO: 90-6710
 MAT'L: PLATE 1/2 4X8 HR
 G10150
 FFES SPEC NO: AA-00488BC
 EST WT: 135 LBS



SIDE BAR
 SCALE 1/8

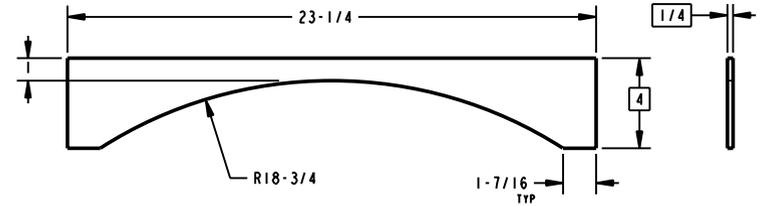
PART NO: 90-6709
 MAT'L: PLATE 1/4 4X8 HR
 G10150
 FFES SPEC NO: AA-00488BC
 EST WT: 17.5 LBS

STD. TOL.						DRAWN: RSP
FRACTIONAL:						DESIGNED: RSP
0 TO 4 IN ± .010						APPROVED: RSP
4 IN AND UP ± .015						DATE: 26-Sep-2002
ANGULAR:						SCALE: N/A
± .1 DEG.						
DECIMAL:	FOREST FIRE EXPERIMENT STATION					
1 PLACE ± .005	P.O. BOX 68 ROSCOMMON, MICHIGAN 48653					
2 PLACE ± .001						
3 PLACE ± .000						
PROJECT NO.: REC 61	TITLE: TANK DETAILS I					
	Dwg. No. 90-6724 C					



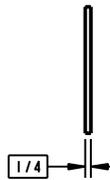
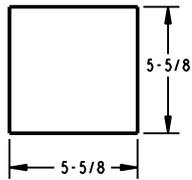
GUIDE

PART NO: 90-6713
 MAT'L: TUBE, SQ 6 X 6 X 1/4 WALL
 K103000
 FFES SPEC NO: AE-60012AY
 EST WT: 18.6 LBS



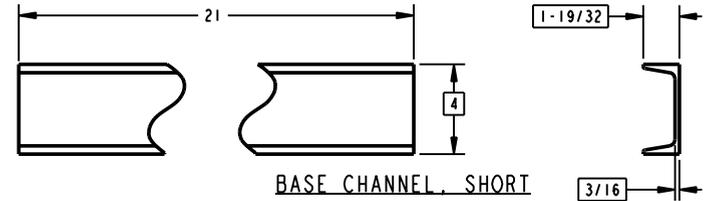
BASE END

PART NO: 90-6718
 MAT'L: BAR, FLAT 1/4 X 4 HR
 G10200
 FFES SPEC NO: AB-00416AA
 EST WT: 3.65 LBS



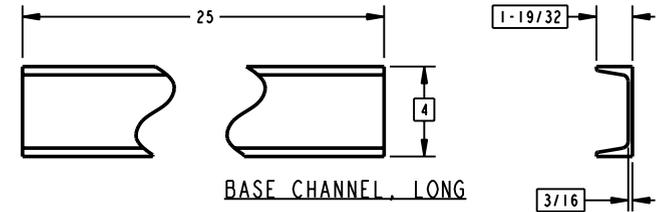
GUIDE CAP

PART NO: 90-6714
 MAT'L: BAR, FLAT 1/4 X 6 HR
 G10200
 FFES SPEC NO: AB-00424AA
 EST WT: 2.24 LBS



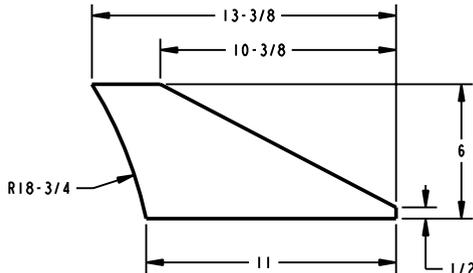
BASE CHANNEL, SHORT

PART NO: 90-6717
 MAT'L: CHANNEL 4 x 5.4 #/FT
 K02603
 FFES SPEC NO: AH-04054AG
 EST WT: 9.40 LBS



BASE CHANNEL, LONG

PART NO: 90-6716
 MAT'L: CHANNEL 4 x 5.4 #/FT
 K02603
 FFES SPEC NO: AH-04054AG
 EST WT: 11.2 LBS

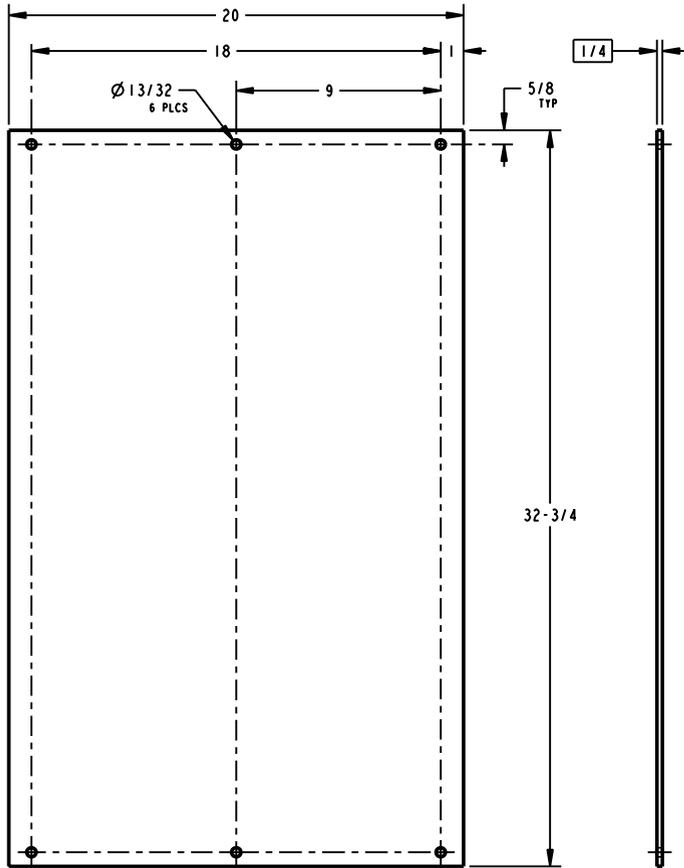


GUSSET, GUIDE

PART NO: 90-6715
 MAT'L: BAR, FLAT 1/2 X 6 HR
 G10200
 FFES SPEC NO: AB-00824AA
 EST WT: 6.12 LBS

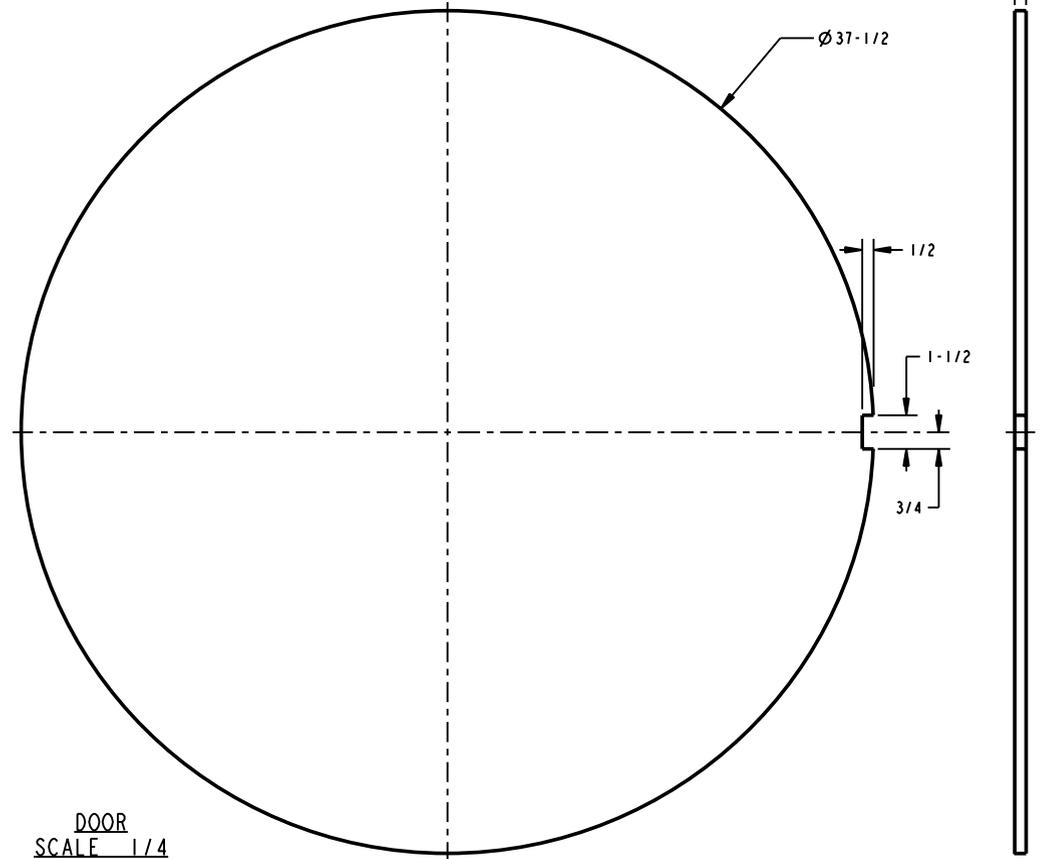
STD. TOL.						DRAWN: BSP
FRACTIONAL: 0 TO 4 IN ± .1/32 4 IN AND UP ± .1/16						DESIGNED: BSP
ANGULAR: ± .1 DEG.						APPROVED: BSP
DECIMAL: 1 PLACE ± .005 2 PLACE ± .002 3 PLACE ± .001						DATE: 21-Sep-2002
PROJECT NO.: REC 61	FOREST FIRE EXPERIMENT STATION P.O. BOX 68 ROSCOMMON, MICHIGAN 48653				SCALE: 1:1	ROSCOMMON EQUIPMENT CENTER
TITLE: TANK DETAILS 2						90-6725





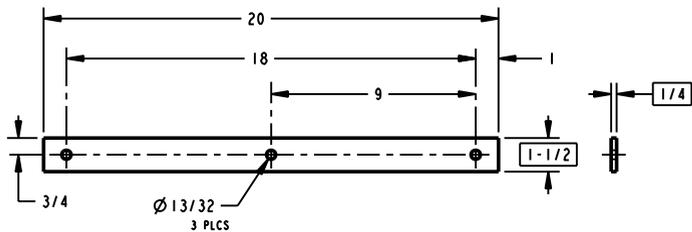
PLATE, PUMP DECK
SCALE 1/4

PART NO: 90-6720
MAT'L: PLATE 1/4 4X8 HR
G10150
FFES SPEC NO: AA-00448BC
EST WT: 46.3 LBS



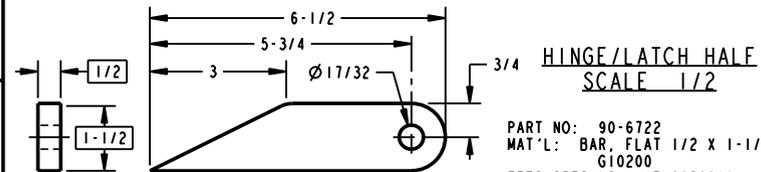
DOOR
SCALE 1/4

PART NO: 90-6721
MAT'L: PLATE 1/2 4X8 HR
G10150
FFES SPEC NO: AA-00848BC
EST WT: 156 LBS



MOUNT, PUMP DECK
SCALE 1/4

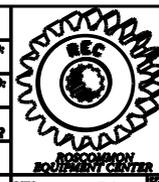
PART NO: 90-6719
MAT'L: BAR, FLAT 1/4 X 1-1/2 HR
G10200
FFES SPEC NO: AB-00406AA
EST WT: 2.10 LBS



HINGE/LATCH HALF
SCALE 1/2

PART NO: 90-6722
MAT'L: BAR, FLAT 1/2 X 1-1/2 HR
G10200
FFES SPEC NO: AB-00806AA
EST WT: 1.00 LBS

STD. TOL.				DRAWN: RSP	
FRACTIONAL:				DESIGNED: RSP	
0 TO 4 IN ± .005				APPROVED: RSP	
4 IN AND UP ± .010				DATE: 21-Sep-2002	
ANGULAR:				SCALE: N/A	
± .1 DEG.				PROJECT NO.: REC 61	
DECIMAL:		FOREST FIRE EXPERIMENT STATION P.O. BOX 68 ROSCOMMON, MICHIGAN 48653			
1 PLACE ± .005					
2 PLACE ± .002					
3 PLACE ± .001		TITLE: TANK DETAILS 3		REV. NO.: 90-6726	



Appendix A – Skidder Lifting Capacities¹

Manufacturer	Model	Arch Configuration	Capacity in Lbs.²
John Deere	548	Single Function	7,000
	648	Single Function	9,000
	648	Dual Function	12,000
	748	Dual Function	16,000
Caterpillar	515	Single Function	N/A
	525B	Single Function	12,000
	525B	Dual Function	12,000
	535B	Dual Function	15,100
	545B	Dual Function	17,500

¹ Lifting capacity is rated for the arch less the grapple. This capacity must be reduced by the weight of the grapple used.

² Contact the manufacturer or dealer of the particular skidder to be used to verify the lifting capacity of the unit.