Construction of a Custom Built Front-End Loader

Bill of Materials

Frame

Quantity	Description
25'	3"x5"x 1/4" tube
6 sq ft	1/4" plate
3/4 sq ft	3/8" plate
4"	Pipe for bushings
4	3/4"x 6" bolts w/nuts & lockwashers
2'	1" round stock
21"	5/8" round stock
4	l/4"x 2" bolts w/nuts & lockwashers
2	l/2"x 2" bolts w/nuts & lockwashers
10"	l/4"x 1" strap
30"	l"x 1-1/2" bar stock
4	3/8" grease fittings

Arms

30'	3"x 5"x 1/4" tube
5-1/2 sq ft	1/4" plate
2-1/2'	Pipe for bushings
8"	1/2"x 4" steel plate
6	l/4"x 2" bolts w/nuts & lockwashers
3'	1" round stock
10"	l/4"xl" strap
6	3/8" grease fittings
8	3/8"x 2" bolts w/nuts & lockwashers
2'	l/8"x 1" strap

Bucket

1	5'x 10'x 1/4" plate
1'	1" round stock
2	1/4"x 2" bolts w/nuts & lockwashers
2	3/8" grease fittings
1	5/8"x 3" bolt w/nut & lockwasher
10'	l/2"x4"plate
6"	2"x2"x 1/4" angle iron
1-1/2'	Pipe for bushings

Steel

55'	3"x5"x 1/4" tube
1'	5'x 10'x 1/4" plate
3'	l"x 1-1/2" bar stock
7'	1" round stock
1	l'x l'x 3/8" plate
12'	l/2"x4"plate
5'	Pipe for bushings
2'	l/4"x 1" strap
2'	l/8"x 1" strap

Hydraulics

2	2-1/2" bore x 30" stroke cylinders
2	2-1/2" bore x 24" stroke cylinders
44'	5/8" steel hydraulic tubing
39.5'	1/2" two wire rubber hose
1	Double spool valve w/float
10	1/2"-90° swivel fittings
4	1/2" - 90° rigid fittings w/flare & pipe thread

Quantity	Description
4	Tees w/flare & pipe thread
4	Quick disconnect couplers
2	3/4" to 1/2" pipe reducers
4	1/2" to 2" nipples
28	1/2" rubber hose end fittings
16	5/8" flare nuts
16	5/8" flare collars

Hardware

12	3/8"x 2" bolts w/nuts & lockwashers
1	5/8"x 3" bolt w/nut & lockwasher
12	1/4"x 2" bolts w/nuts & lockwashers
1	Chain hook
12	3/8" grease fittings
3	3/8"x 3" bolts w/nuts & lockwashers
2	l/2"x 6-1/2" bolts w/nuts & lockwashers
4	5/8" nuts & lockwashers
4	3/4"x 6" bolts w/nuts & lockwashers
2	l/2"x 2" bolts w/nuts & lockwashers
1-1/4	Gallons of paint

Construction Procedures

1.) The frame is constructed of 3"x 5" rectangular tubing with 1/4" walls. The frame consists of two halves. The procedure for one-half, is described, the other half is identical to the first. The first piece to make is the front support bracket. It bolts solid on the side, near the front of the tractor. The front end of the frame bolts to this piece. It is made of 3-1/2"x 5"x 3/8" angle iron with triangles, made of 3/8" plate, placed in the corners on each end for strength. Read step 4 before drilling any holes.

2.) The next step is to make the U-bolts which attach the rear end of the frame to the rear axle of the tractor. They are made of 5/8" rod, and they are threaded with a 5/8" - 12 die.

3.) Next, make spacers out of the 3"x 5" tubing. They will be used later in another step. Cap off both ends of the spacers with 3/16" plate.

4.) Cut the tubing into the lengths needed for the frame. The lengths are:

Part A — 4'6"
Part B — 27"
PartC — 3'1"

At one end of Part A, drill two 3/4" holes on 2-1/2" centers, 1-1/2" in from the end of the tube. These holes should also be centered width-wise on the tube. Drill into the 3" wide, side of the tube and go all the way through both sides. These holes are used to bolt the front end of the frame to the front support bracket. The front support bracket and Part A should be drilled at the same time to ensure proper alignment of the holes.

5.) Parts B and C should now be welded together at a 90 degree angle. Make two plates to reinforce this weld. Place one on each side of this joint that you have just made.

6.) The next step is to make plates for the U-bolts to attach to. These plates are welded to Part C, opposite the end that Part B is welded to.

7.) Mark off a square line, 1 *'2"* on Part B, from the top of Part C. The bottom of the spacers that you made earlier should line up with that line. Tack weld the spacer to Part B. Part A is now welded to the outside of the spacer. IMPORTANT! Be sure all joints are square. Go back and finish the welds that are not fully completed.

8.) To reinforce the previous joint, a plate must be cut and welded to the frame. The dimensions for this plate are 8-1/2"x 5"x 1/4" thick.

9.) The next pieces to make are two lift cylinder plates. They need to be cut and drilled. Later you will fit bushings into these holes. On Part B mark a square line 8" from the top of Part C. The bottom edge of these plates should line up with this line. Each plate must be welded on opposite sides of Part B, 1-1 */2"* back from the front of Part B.

10.) A stabilizer bar connects each half of the frame together. It bolts to each side of the frame at the corner of Parts B and C. It is made of l"x 1-1/2" solid stock. (Only one of these is required for the entire frame.)

11.) Two - 2"x 2"x 1/4" plates with 1/2" holes drilled in the center of them are welded to the frame at the corner of Parts B and C. These are used to bolt the stabilizer bar to the frame. Each end of the stabilizer bar should fit between two of these plates.

12.) The next pieces to make are the arm pivot plates. They must be bent and drilled. Bushings will be welded into these holes later. They are welded to the top of Part B. Mark a square line, 1" down on both sides from the top of Part B. The bottom edge of these plates should align with this line. A bead should also be run on the backside of the plates where they meet, and on the inside of the same joint.

13.) Cut and drill plates for a step. They are welded together, and then welded to the frame at the corner of Parts B and C. The step makes mounting the tractor much easier. The step should be welded to the left-hand frame.

14.) The final step in the construction of the frame is to cap off all open ends of the tubing with 1/4" plate.

The construction of the arms is as follows:

1.) There are two halves to the arms, as with the frame. The following describes the construction of one half. The arms are made of 3" x 5" x 1/4" rectangular tubing. The lengths that need to be cut are listed below:

Part A — 4'6"
Part B — 4'8"

2.) On one end of Part A, cut a 57.5 degree angle. Then on the end opposite this angle, drill a 1-9/64" hole (this may vary depending on the size of bushings you use. This hole should be centered width-wise and 1-1/2" in from the end of the tubing.

Perform this same procedure on Part B.

3.) On the topside of Part A, drill a 3/4" hole 1-1/2" in from the end of the tubing so that it is directly in line with the hole that you have drilled previously. Do this on Part B also, except drill in from the bottomside. These are access holes to grease the bushings that you will weld in later.

4.) Weld the arms together by abutting Parts A and B at the angle that you cut on the ends of each. Be sure that the arms are straight from end to end. Also, be sure to lay strong beads on this joint, since it is a critical stress area.

5.) Make bushings that weld into the holes in the arms that you drilled in Step 2. A steel tube with 3/16" walls was used. The inside diameter was 29/32". Cut two - 3" long pieces, and then drill and tap for a grease fitting on each one. Harden by quenching in oil. Weld these bushings into the holes in the arms that you drilled in Step 2.

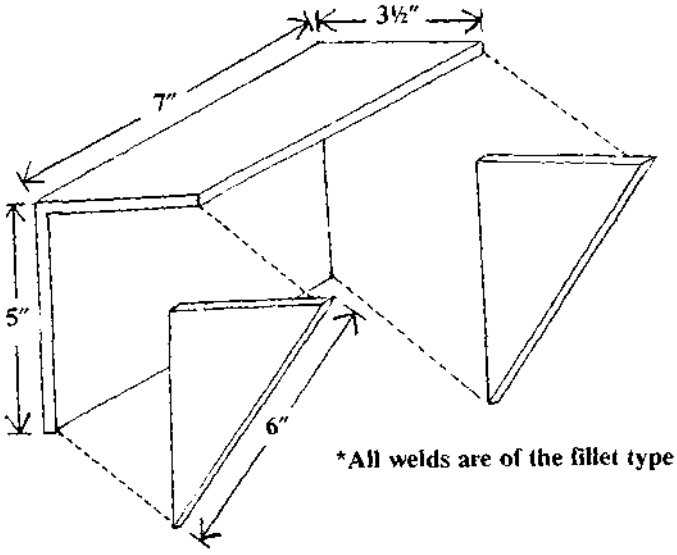
6.) Turn down pins from 1" stock to fit these bushings. Weld handles onto the ends of these pins. (Handles only need to be welded onto the arm pivot pins.)

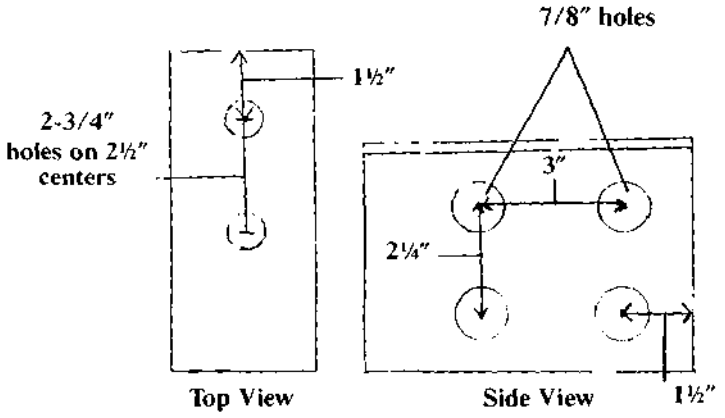
7.) These pins must not turn while the loader is in operation. To secure the pins, drill 1/4" holes through the bushings that are welded to the arm pivot plates and the bucket mount plates. Drill these holes on the inside bushings, (the bushings closest to the tractor). Drill the pins and the bushing at the same time so that the holes line up. Then use 1/4"x *2"* bolts in these holes.

8.) Once both arms are made, cut a piece of 3"x 5" tubing, 31" long, to use as a crossbrace, connecting the arms. Weld this piece to the arms. The bottom of this brace should be 19-1/2" from the end, with the bushing, of Part B on each arm. Before this crossbrace is welded to the arms, mount the frame to the tractor, and then mount the arms to the frame. This will ensure proper alignment of the arms to the frame. Make sure that the arms are parallel and level to each other, and then weld the crossbrace to the arms.

9.) Cut a piece of 1/2" thick plate, 3" wide x 4" long and weld it on the backside of Part B, 2" in from the end with the bushing. This is used as a knock plate. When the bucket is dumped, part of the bucket mounting plates hit these plates instead of the arm.

10.) Make the arm corner plates. They are made of 1/4" thick plate. Cut and drill. The holes will be used to weld bushings in later. Weld these to the arms. Leave about 1/2" of each plate sticking out above the top of the arm. This will allow enough surface area to weld to.





*Left hand side front support bracket

11.) Cut and bend two plates 3" wide x 6" long to fit over the corners of the arm, on the topside and the underside. They should fit in between the arm corner plates. Weld these into place. These plates provide added structural support for this joint.

The contruction of the bucket is as follows:

1.) Start with a 5'x 10' piece of 1/4" plate. The plate that was left over from this piece was used for other parts of the loader. Lines were drawn on the sheet of metal. Partial cuts were made along these lines, leaving the other areas uncut. A torch was used to heat the areas left uncut, and the sides and the back of the bucket were bent so that they were at a 90 degree angle. Then the remaining portion of the back of the bucket, that protruded above the sides of the bucket, was bent over to meet the top edge of the sides, thus forming the roof of the bucket. All the joints were then welded.

2.) To provide support for the top, front edge, cut a 5' long piece of l/4"x 2" angle iron to fit inside the bucket along the top edge. Then weld in so the outside corner of the angle iron is facing down.

3.) Cut a piece of 1 /2"x 4" wide plate, 5'8" long. Using a torch, cut a 45 degree angle along one edge of this piece, then smooth with a hand grinder. This piece is used as a cutting edge for the bucket. When this piece is welded to the bottom of the bucket, the cutting edge should protrude about 1-1 *IT* from the front edge of the bucket. On each end, 4" should be left sticking out past the side of the bucket. This extra amount on each end is bent up at a 90 degree angle to meet the sides of the bucket and then welded into place.

4.) Cut 3 pieces of 1 /2"x 4" plate, 21" long. These are welded to the bottom of the bucket, running from front to back. Place one on each end of the bucket and one in the middle. These are used as wear plates.

5.) Make the bucket mounting plates. When you weld these on, leave a 1/8" gap between the arm and the mounting plate on each side to allow free swiveling action. Also, make sure that the bucket is centered when it is mounted to the arms.

6.) The last step in the construction of the bucket is to make the chain hook plates. This is an optional but handy feature to have. The mounting plates are made of 1 /4"x 2" angle iron.

The attachment of hydraulic cylinders is as follows:

1.) Cut and drill the bushings and pins listed below. Remember to drill only the inside bushings and drill the pins and bushings at the same time.

Plates	No. of Bushings	Pin Size	No. of Bushing to be Drilled
Arm Pivot	4	29/32"	2
Lift Cylinder	4	1"	2
Arm Corner	8	1"	4
Bucket Mount	4 - for cylinders	1"	2
	4 - for arms	29/32"	2

Note: All pins must be cut six inches long. A total of 12 pins are needed

2.) With the frame bolted to the tractor and the arms and bucket attached, line up the cylinders, by inserting the bushings in the plate holes and the pins through the bushings and the cylinder ends. Then weld the bushings onto the plates. This process ensures proper alignment of the cylinder ends and the bushings so that the pins fit through easily.

3.) Make the control valve mounting plate. It bolts to the right hand side of the frame.

4.) For the hydraulic lines use 1 /2" I.D. steel line and 1 /2" double wire rubber hose where flexing occurs. Quick-disconnect connectors were used at the control valve so that the arms and bucket can be easily disconnected. They also prevent the loss of oil from the lines when the loader is disconnected.

5.) To attach the steel line to the arms, weld a 3/8"x 1-1/2" long stud to the arm on each side of the set of four lines in four places as shown. Then bolt on brackets. You will need four brackets placed in the locations shown.

6.) The clevis end type of hydraulic cylinders were used. As they were, there was no way to grease these ends. Bushings were cut with a 1" inside diameter, so that they fit in between the clevis on each end of each cylinder. They were drilled and tapped for a grease fitting. These bushings were then welded to the clevis.

7.) The final step in this project is to give the entire loader two coats of paint with the color of your choice.

Note: Be sure to grease all pivot points before operating.