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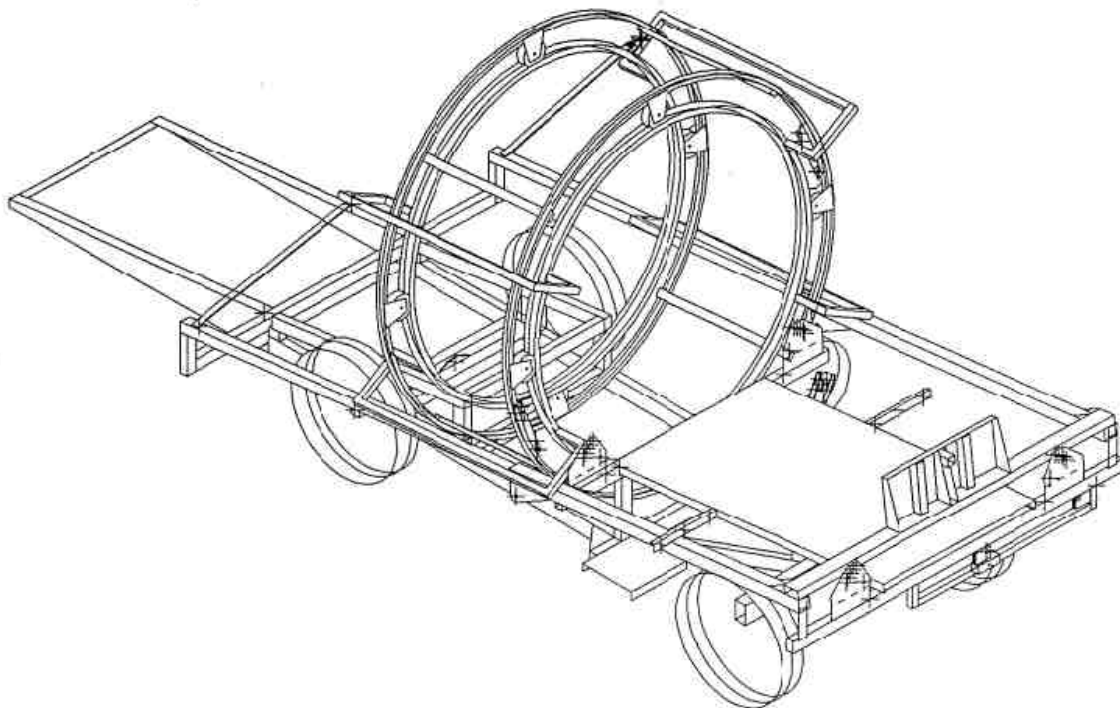
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# Parts Manual

Keep this manual with the machine at all times.

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## Balewrapper TL500



# Parts Manual

Thank you for choosing the Tubeline 500 Balewrapper. We know it will give you many years of productive service. This machine is designed to spread various types of manure evenly over a wide area.

## Warranty and Limitation of Liability

All equipment is sold subject to mutual agreement that it is warranted by the company to be free from defects of materials and workmanship. But the company shall not be liable for special, indirect or consequential, damages of any kind under this contract or otherwise. The company's liability shall be limited exclusively to replacing or repairing without charge, at its factory or elsewhere, at its discretion.

Any material, or workmanship defects which become apparent within one year from the date on which the equipment was purchased, and the company shall have no liability for damages of any kind. The buyer by the acceptance of the equipment will assume all liability for any damages, which may result from the use or misuse by his employees or others.

## Manuals

Parts manuals are printed and shipped with machines as they leave the manufacturer. Your machine may include parts or features not yet included in the initially shipped manual. The latest manual version can be found at [www.tubeline.ca/support](http://www.tubeline.ca/support). Tubeline reserves the right to update and change manuals as seen fit. Dealers are informed of any pressing changes/ modifications. They can help you with any questions regarding replacement parts.

## Serial Number

This number helps us to track changes and improvements and must be mentioned when ordering parts or requesting service. For your convenience, a space has been provided inside the front cover of this manual to record the serial number, model number, purchase date, and dealer name.

Model No: \_\_\_\_\_ TL500 \_\_\_\_\_

Serial No: \_\_\_\_\_

Date Purchased: \_\_\_\_\_

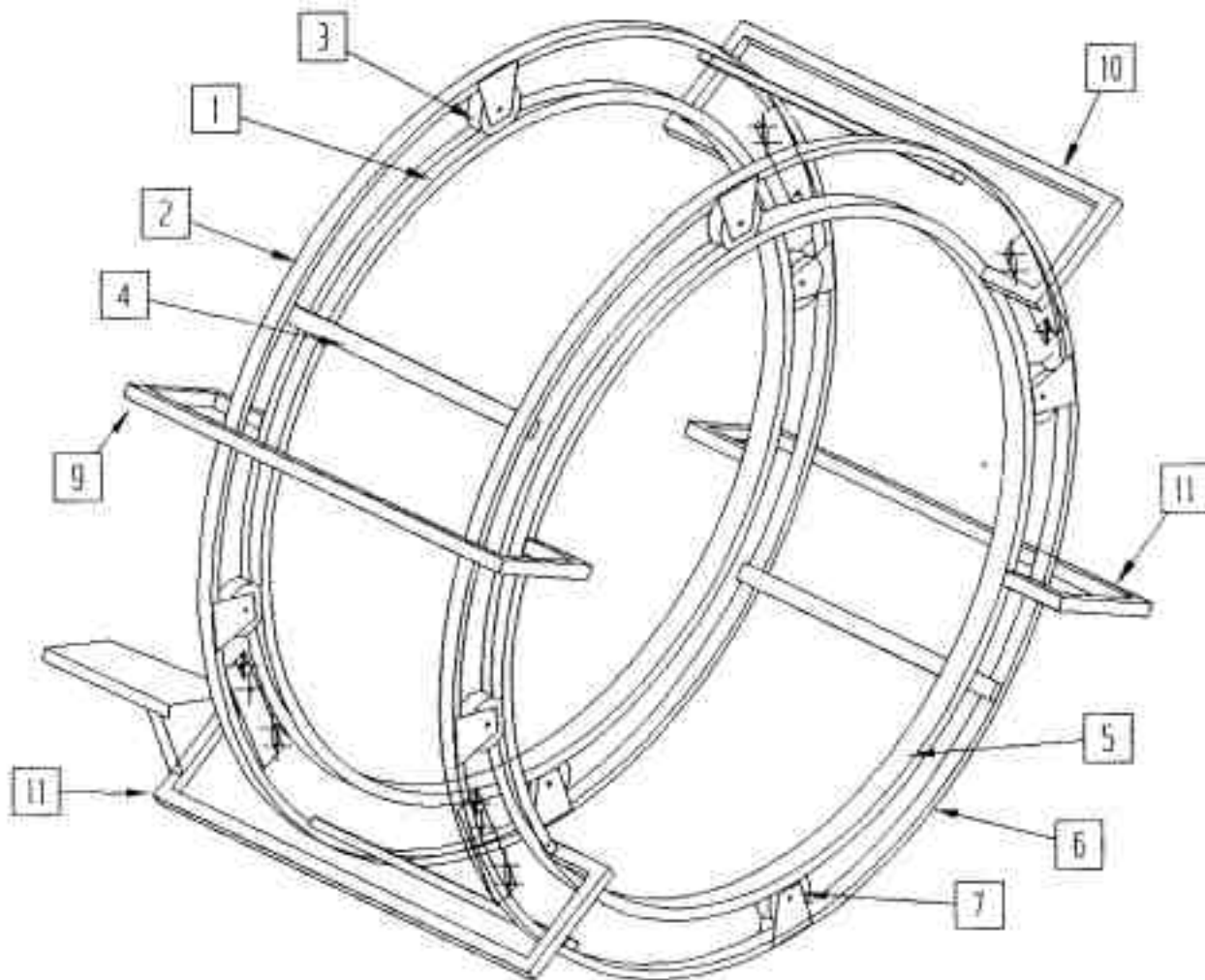
Dealer Name: \_\_\_\_\_

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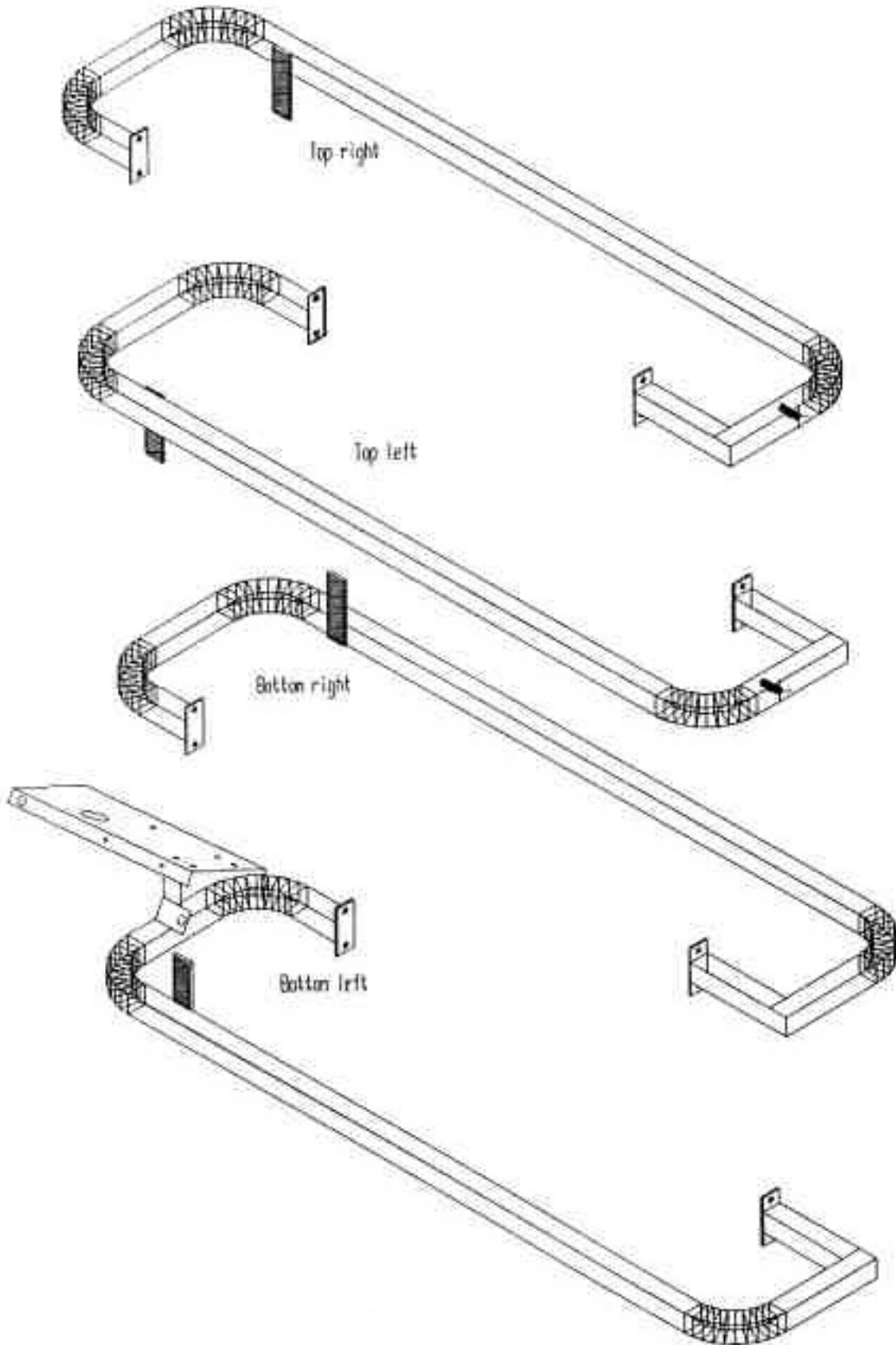
# Section 1 - Parts

## Wrap Chamber

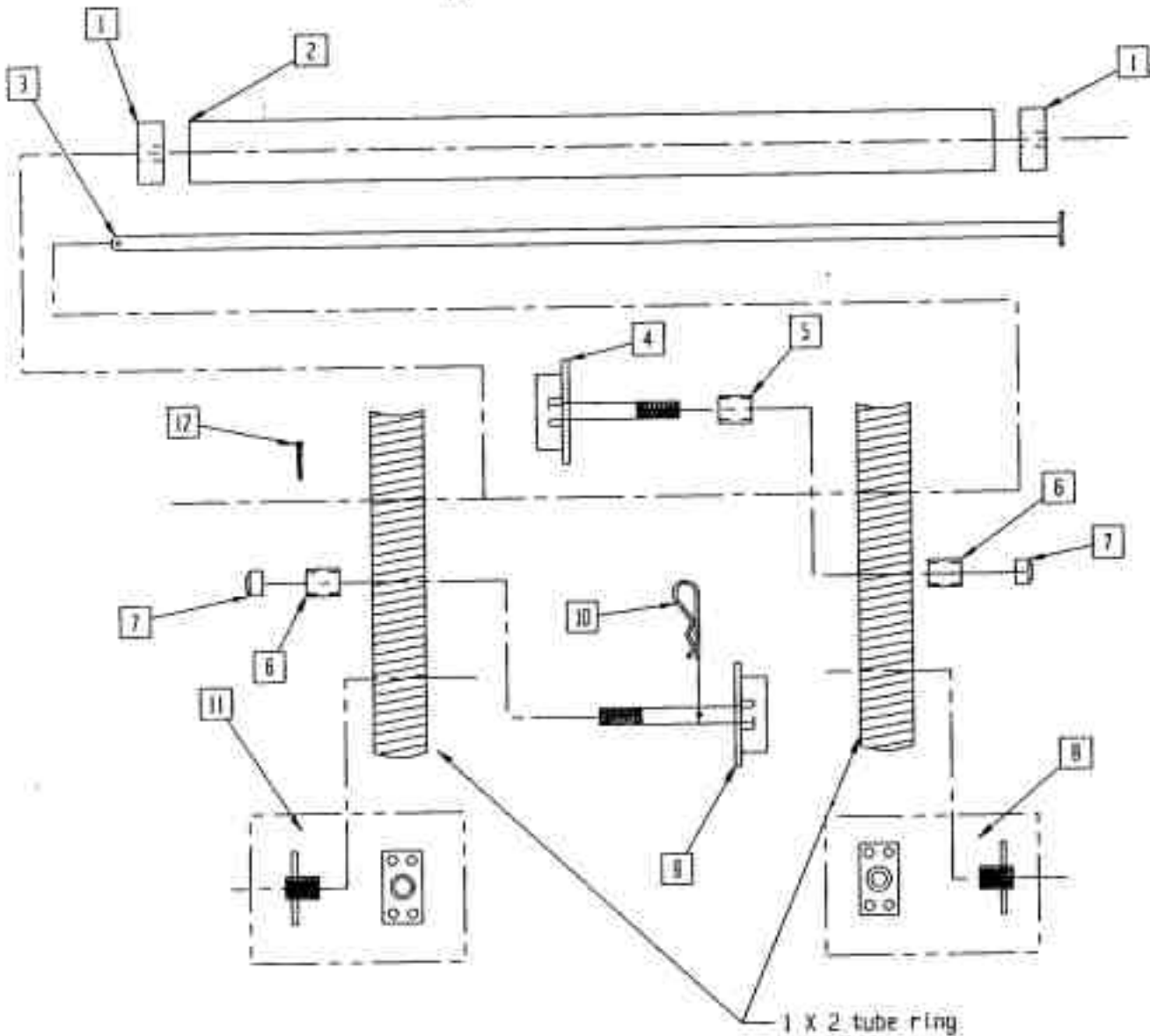


ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-001	Front Channel Ring
2	1	TL500-100-002	Front Tube Ring
3	4	TL500-100-003	Front Wheel - 6"
4	4	TL500-100-004	Ring Tile
5	1	TL500-100-005	Rear Channel Ring
6	1	TL500-100-006	Rear Tube Ring
7	4	TL500-100-007	Rear Wheel - 4"
8	4	TL500-100-008	Mounting Bolt - 1/2" x 2" w/ lockwasher & nut
9	1	TL500-100-009	Top Left Hoop Tie
10	1	TL500-100-010	Top Right Hoop Tie
11	1	TL500-100-011	Bottom Right Hoop Tie
12	1	TL500-100-012	Bottom Left Hoop Tie

# Hoop Ties



## Wrap Carrier(s)

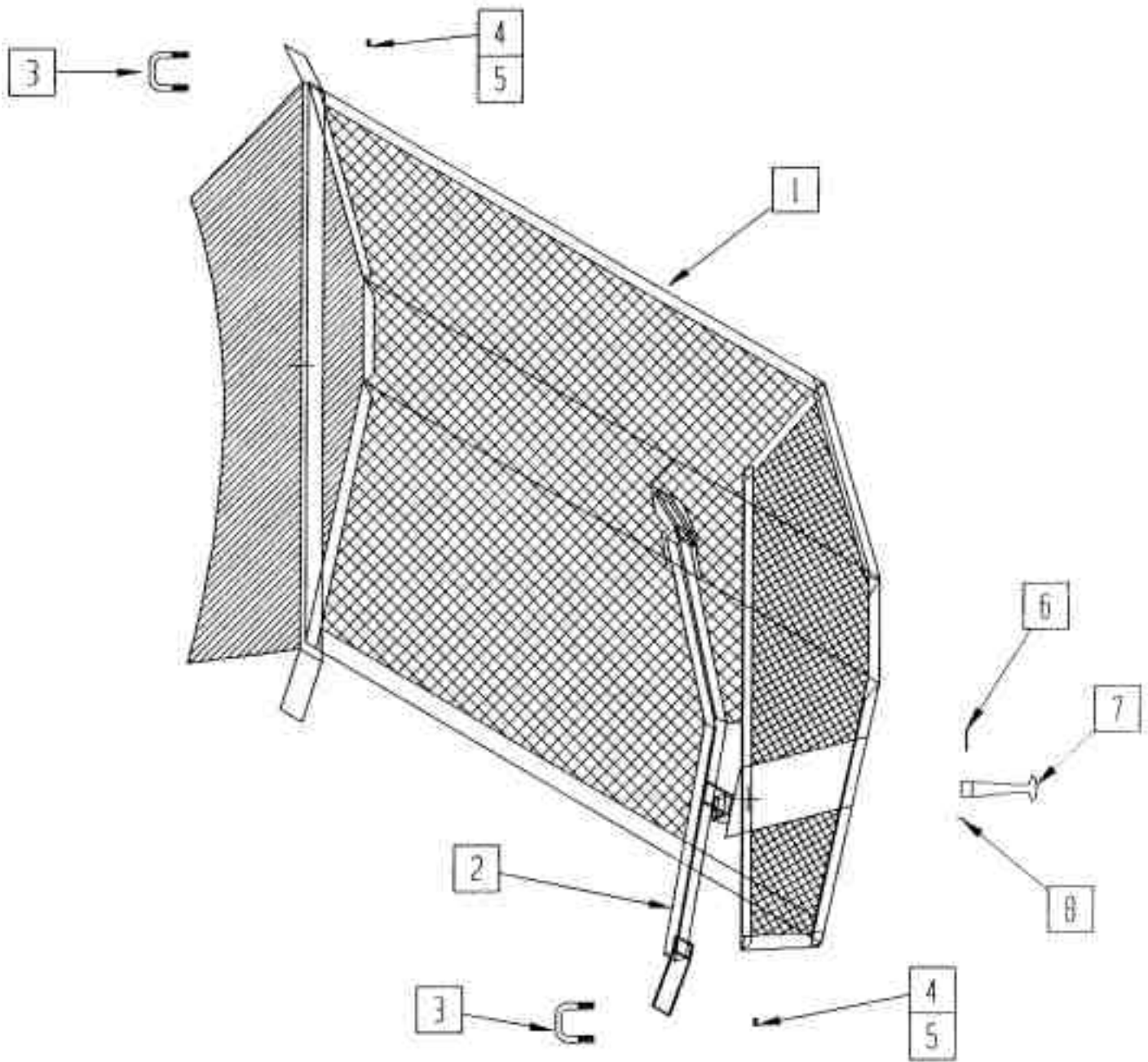


ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	TL500-100-021	HMWPVC Plastic Bearing
2	2	TL500-100-022	2" ABS Plastic Pipe
3	2	TL500-100-023	Plastic Roller Shaft
4	2	TL500-100-024	Plastic Wrap Spool - No Hairpin Hole
5	2	TL500-100-025	Spacer
6	4	TL500-100-026	Oilite Bearing
7	4	TL500-100-027	Nylon Locknut
8	2	TL500-100-028	Stretch Wrap Holder - Small End
9	2	TL500-100-029	Plastic Wrap Spool - With Hairpin Hole
10	2	TL500-100-030	Hair Pin
11	2	TL500-100-031	Stretch Wrap Holder - Large End
12	2	TL500-100-032	Cotter Pin

Use 1/2" and/or 5/8" flat washers as roller spaces as needed.



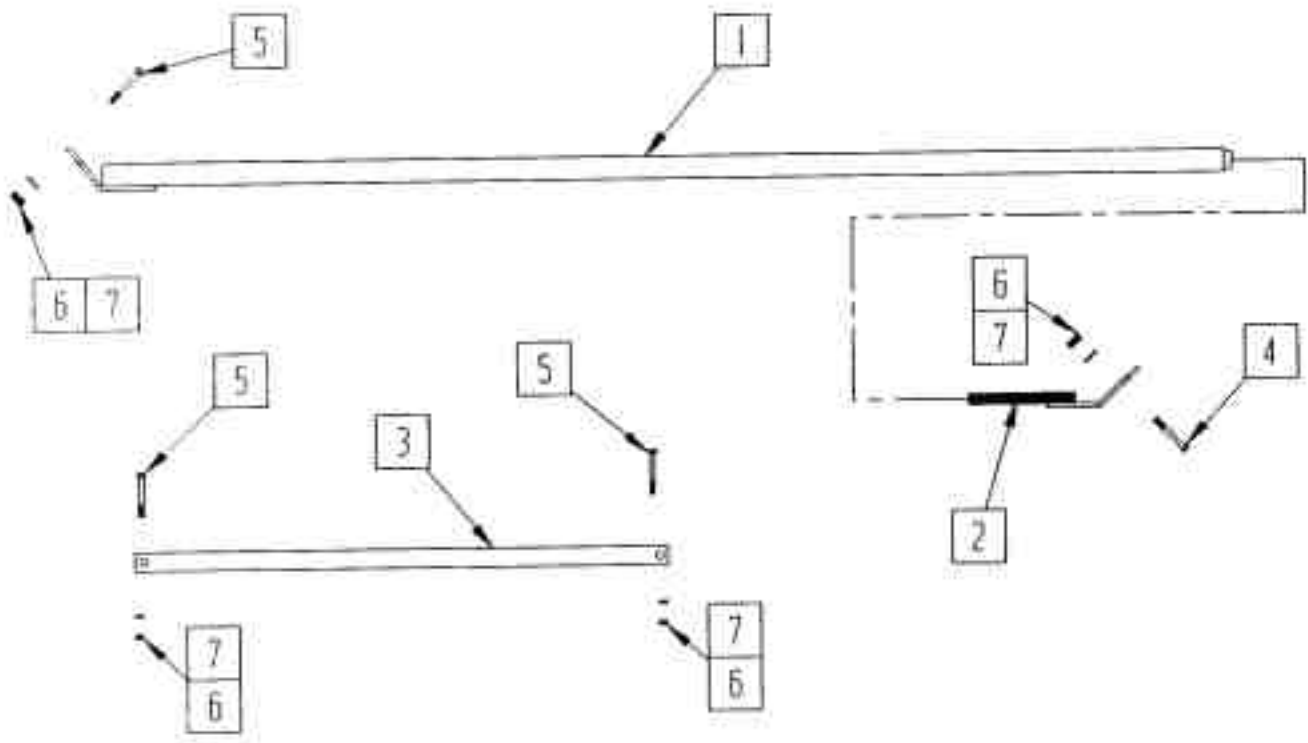
## Safety Mesh



ITEM	QTY	PART NUMBER	DESCRIPTION
1L	1	TL500-100-033	Left Safety Mesh
1R	1	TL500-100-034	Right Safety Mesh
2L	1	TL500-100-035	Left Latch Post
2R	1	TL500-100-036	Right Latch Post
3	8	TL500-100-037	U-bolt
4	16	TL500-100-038	3/8" Lockwasher
5	16	TL500-100-039	3/8" Locknut
6	2	TL500-100-040	Latch Pin
7	2	TL500-100-041	Rubber Latch
8	2	TL500-100-042	Cotter Pin

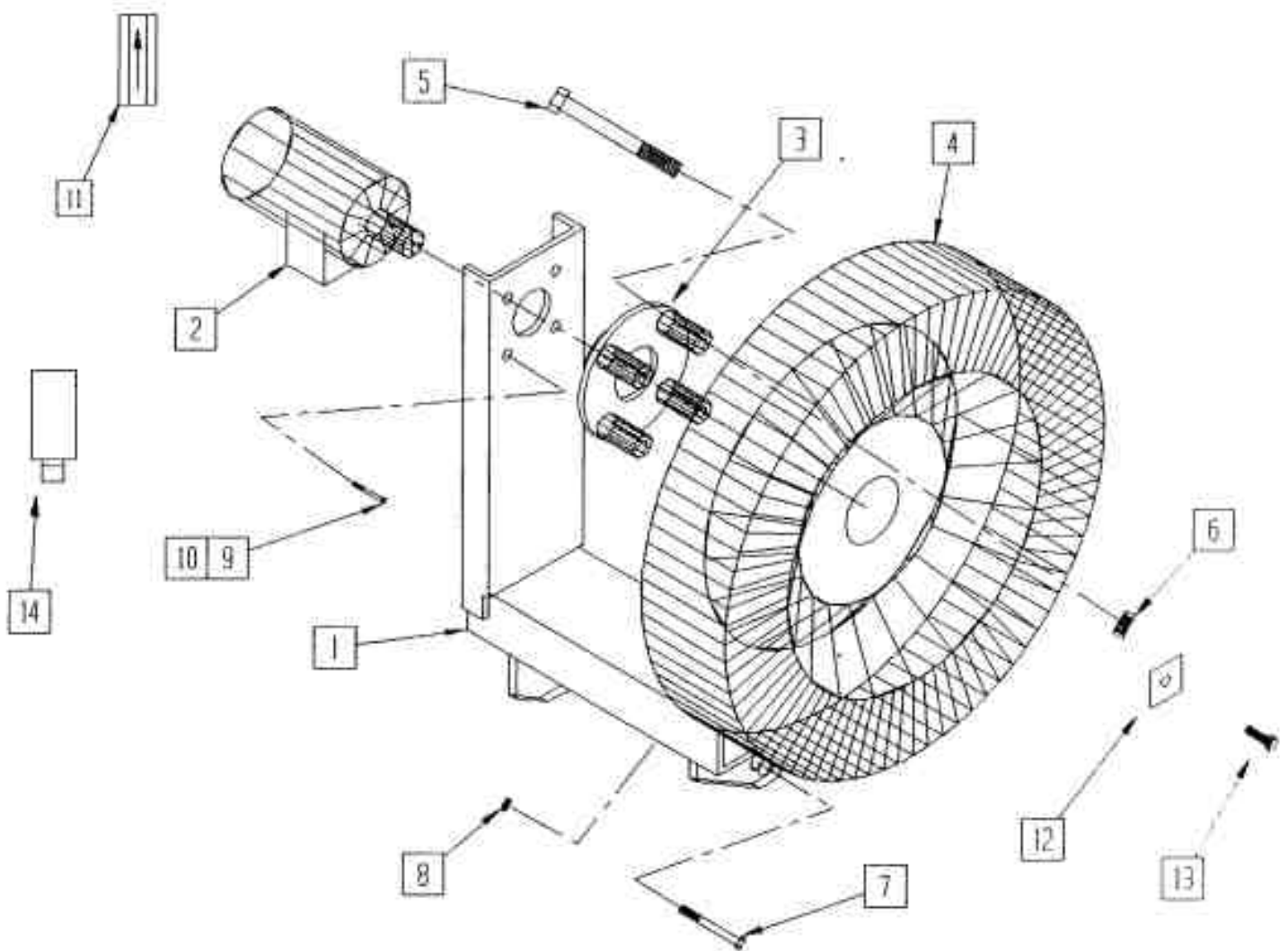


## Wrap & Valve Brace



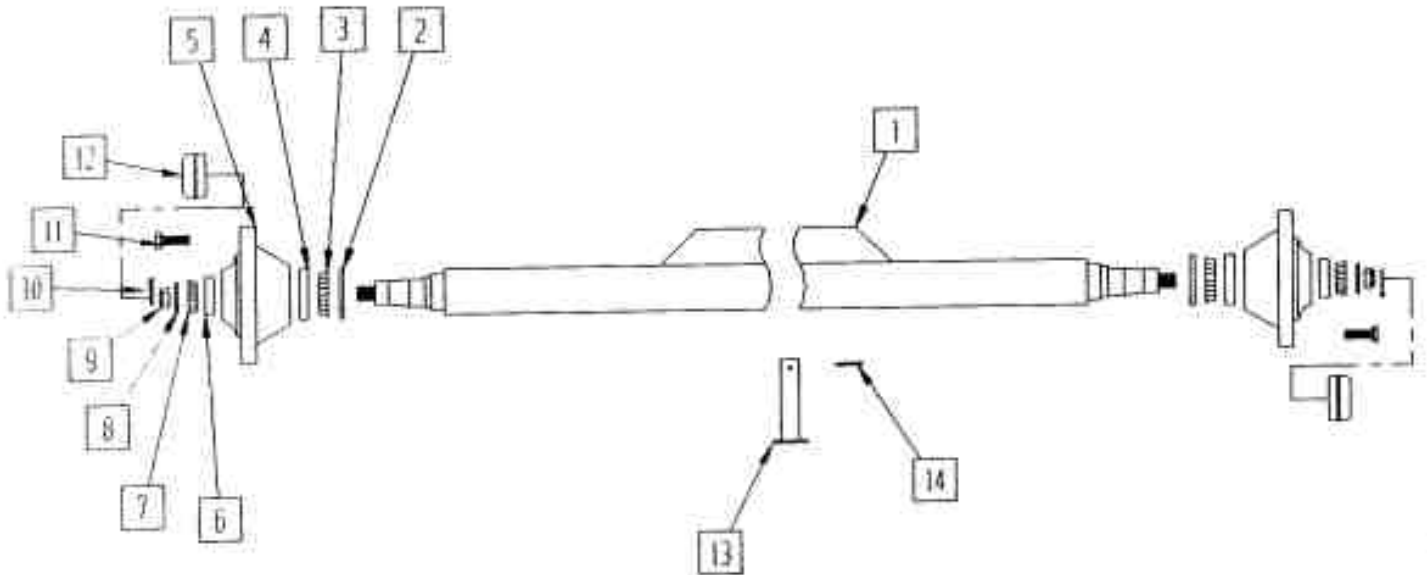
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	TL500-100-043	Bottom Brace
2	2	TL500-100-044	Top Brace
3	1	TL500-100-045	Valve Brace
4	6	TL500-100-046	3/8" x 2" Bolt
5	2	TL500-100-047	3/8" x 1" Bolt
6	6	TL500-100-048	3/8" Locknut
7	6	TL500-100-049	3/8" Lockwasher

## Drive Wheel



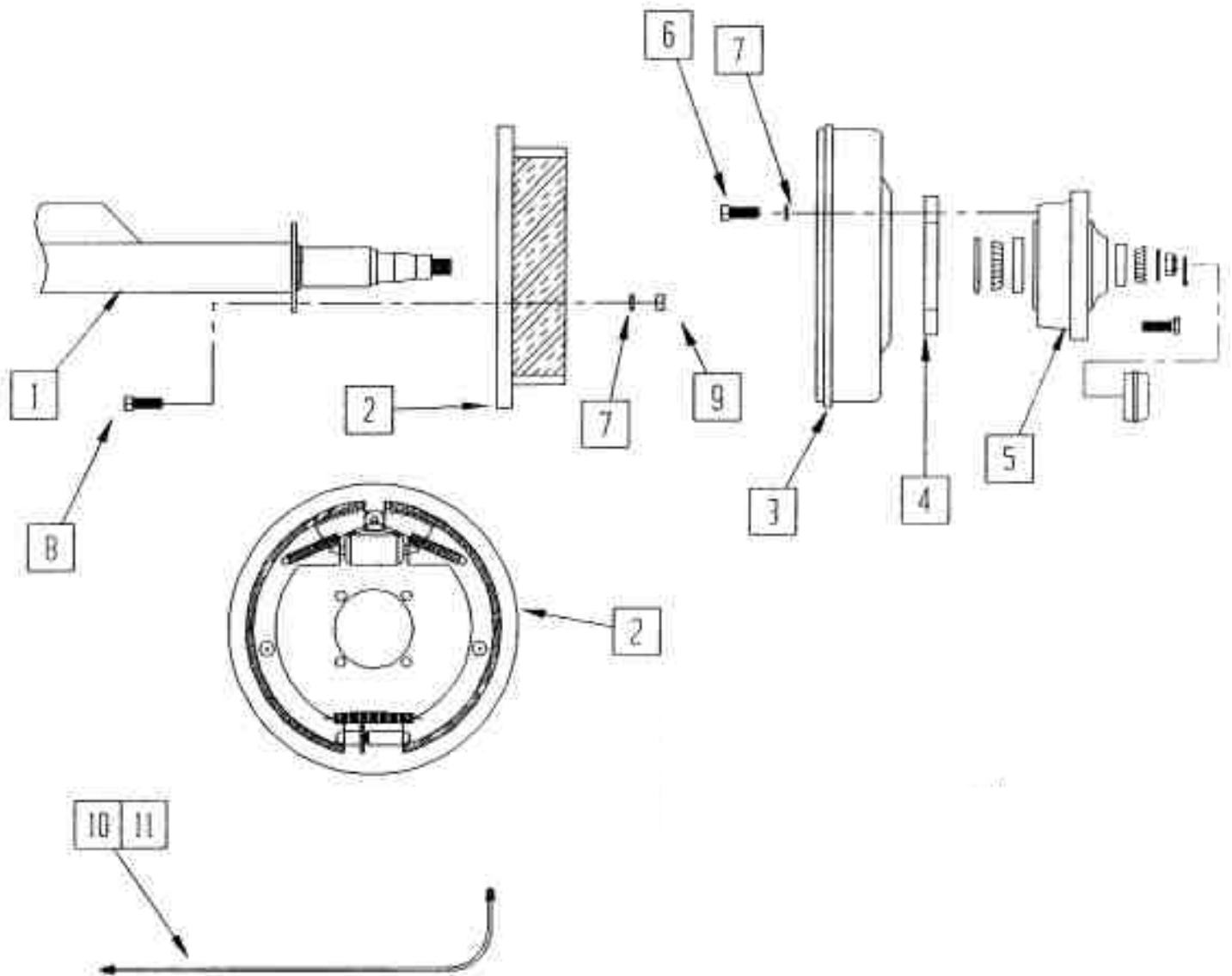
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
1	1	TL500-100-049	Drive Wheel Base	
2	1	TL500-100-050	Hydraulic Motor	
3	1	TL500-100-051	Motor Hub	
4	1	TL500-100-052	Drive Wheel	
5	4	TL500-100-053	1/2" x 3" UNF Bolt	
6	4	TL500-100-054	1/2" Wheel Nut	
7	2	TL500-100-055	5/8" x 1-1/2" Bolt	
8	2	TL500-100-056	5/8" Locknut	
9	4	TL500-100-057	3/8" x 3/4" Bolt	
10	4	TL500-100-058	3/8" Lockwasher	
11	1	TL500-100-059	Check Valve	Manual Only
12	1	TL500-100-060	Washer	
13	1	TL500-100-061	1/4" x 1" Bolt & Lockwasher	
14	1	TL500-101-222	Relief Valve	Manual Only

## Axle-Spindle-Hub



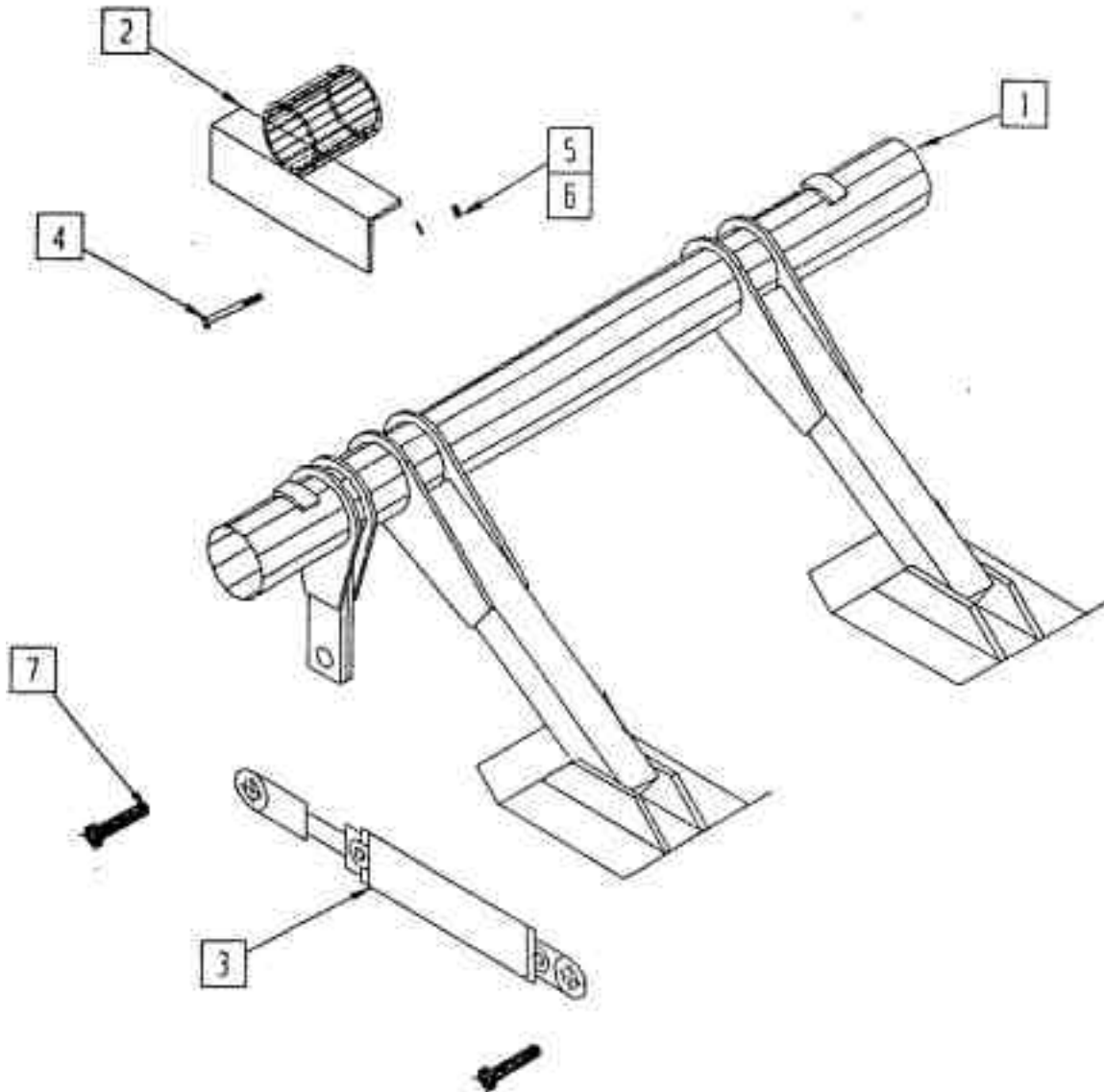
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
1	1	TL500-100-049	Drive Wheel Base	
2	1	TL500-100-050	Hydraulic Motor	
3	1	TL500-100-051	Motor Hub	
4	1	TL500-100-052	Drive Wheel	
5	4	TL500-100-053	1/2" x 3" UNF Bolt	
6	4	TL500-100-054	1/2" Wheel Nut	
7	2	TL500-100-055	5/8" x 1-1/2" Bolt	
8	2	TL500-100-056	5/8" Locknut	
9	4	TL500-100-057	3/8" x 3/4" Bolt	
10	4	TL500-100-058	3/8" Lockwasher	
11	1	TL500-100-059	Check Valve	Manual Only
12	1	TL500-100-060	Washer	
13	1	TL500-100-061	1/4" x 1" Bolt & Lockwasher	
14	1	TL500-101-222	Relief Valve	Manual Only

## Axle-Spindle-Brake - Used from 1997



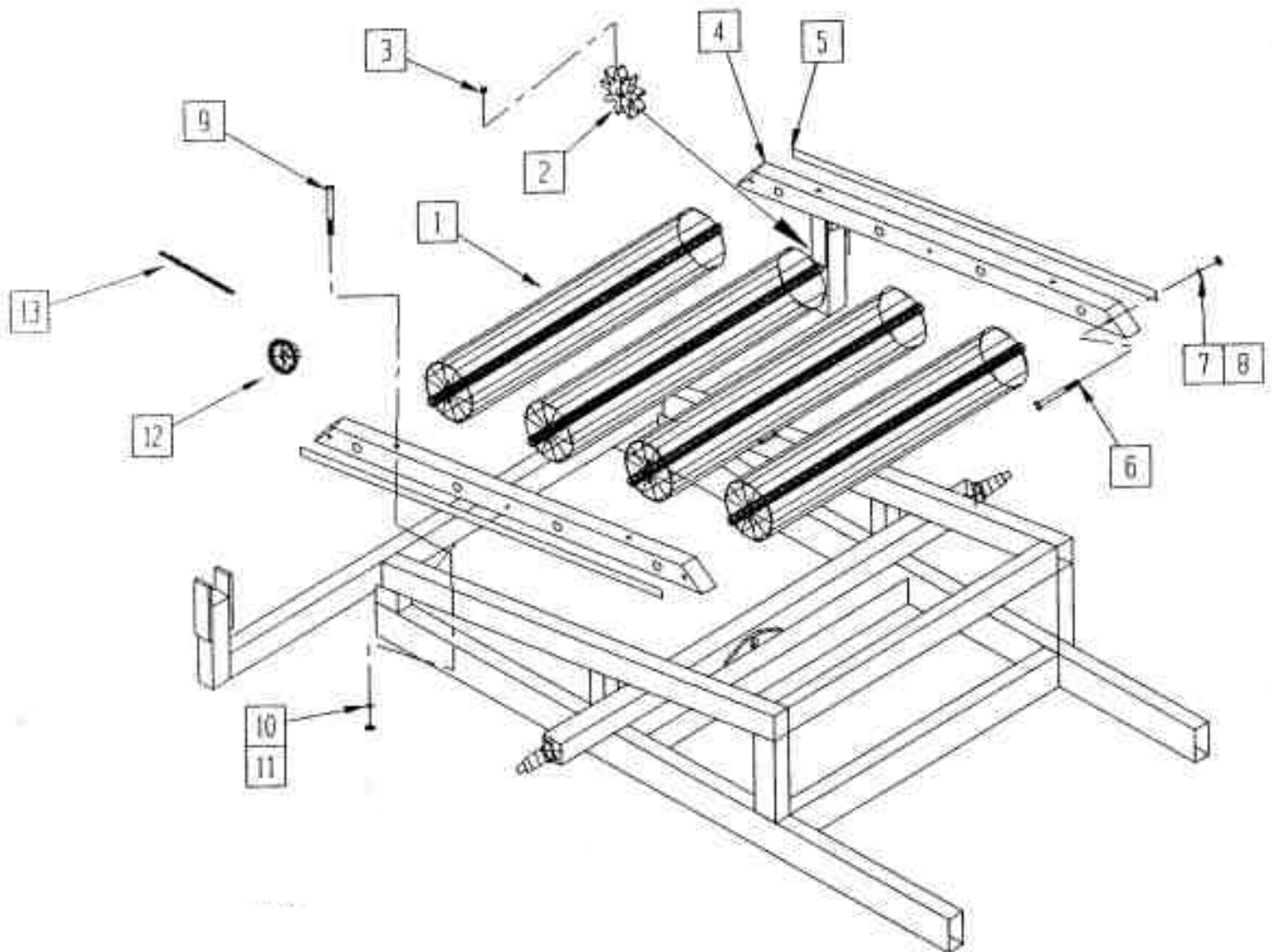
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-062	Axle-Spindle
2	2	TL500-100-080	Backing Plate
3	2	TL500-100-081	Brake Drum
4	2	TL500-100-082	Drum Spacer
5	2	TL500-100-066	Hub
6	12	TL500-100-083	1/2-20" x 1-1/2" Gr.5 Bolt
7	20	TL500-100-075	1/2" Lockwasher
8	8	TL500-100-084	1/2-20" x 1-1/4" Gr.5 Bolt
9	8	TL500-100-085	1/2-20" Nut
10	1	TL500-100-229	3/16" Right Brake Line
11	1	TL500-100-230	3/16" Left Brake Line

## Brake - Used up to 1996



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-080	Brake Rocker
2	2	TL500-100-081	Bearing
3	2	TL500-100-082	2-1/2" x 8" Hydraulic Cylinder
4	4	TL500-100-083	1/2" x 3" Bolt
5	4	TL500-100-076	1/2" Nut
6	4	TL500-100-075	1/2" Lockwasher
7	2	TL500-100-085	Cylinder Pin

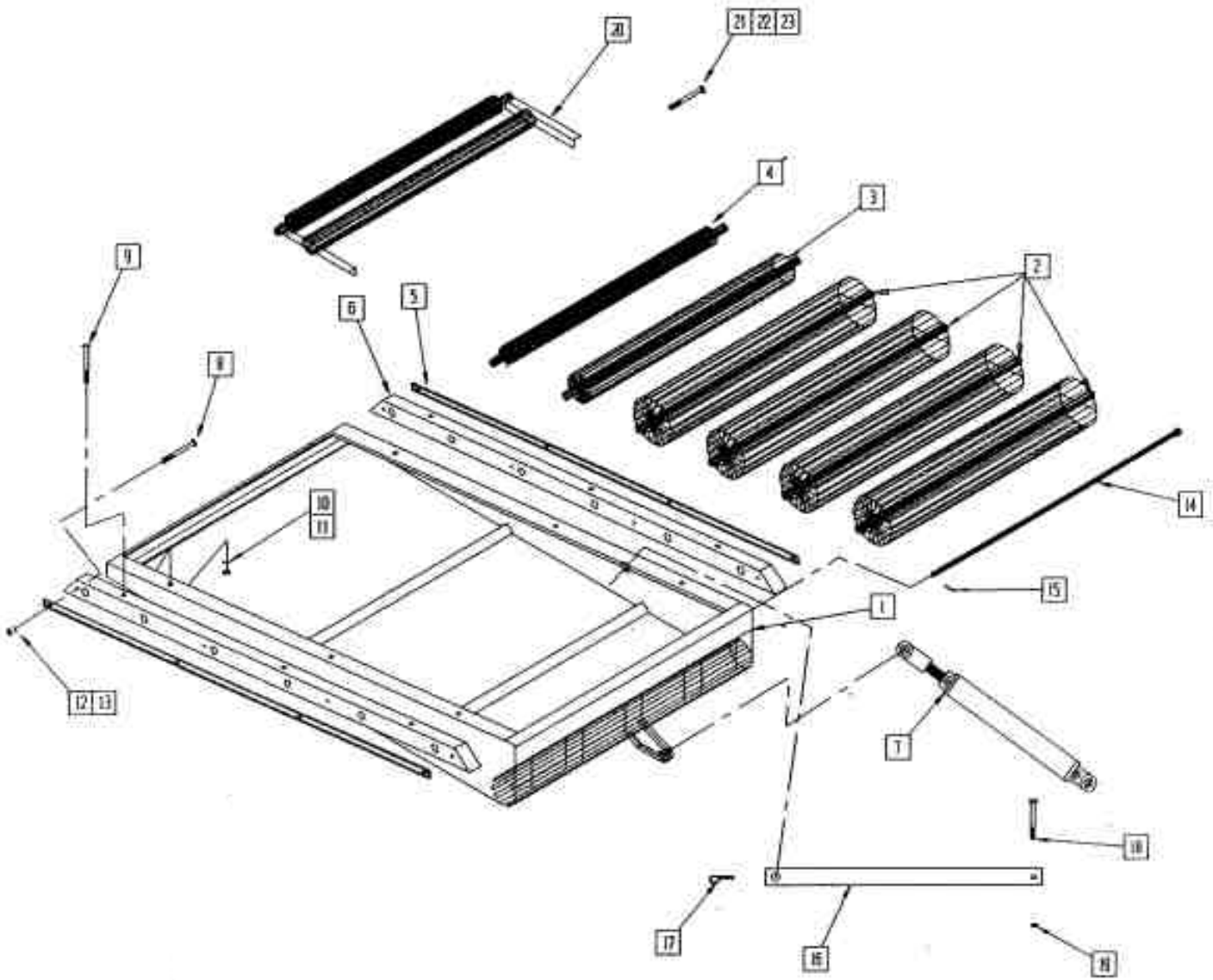
## Rear Roller



ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
1	4	TL500-100-086	Large Roller	
2	1	TL500-100-087	Sprocket Motion Sensor - Electric	
3	2	TL500-100-088	3/8" Set Screw	
4	2	TL500-100-089	Short Wood Strip	
5	2	TL500-100-090	Retainer Bar	
6	6	TL500-100-091	5/16" x 3" Carriage Bolt	
7	6	TL500-100-092	5/16" Lockwasher	
8	6	TL500-100-093	5/16" Nut	
9	4	TL500-100-094	1/2" x 6" Carriage Bolt	
10	4	TL500-100-075	1/2" Lockwasher	
11	4	TL500-100-076	1/2" Nut	
12	2	TL500-100-222	40B20 Sprocket	Auto
13	1	TL500-100-223	#40 Roller Chain	Auto



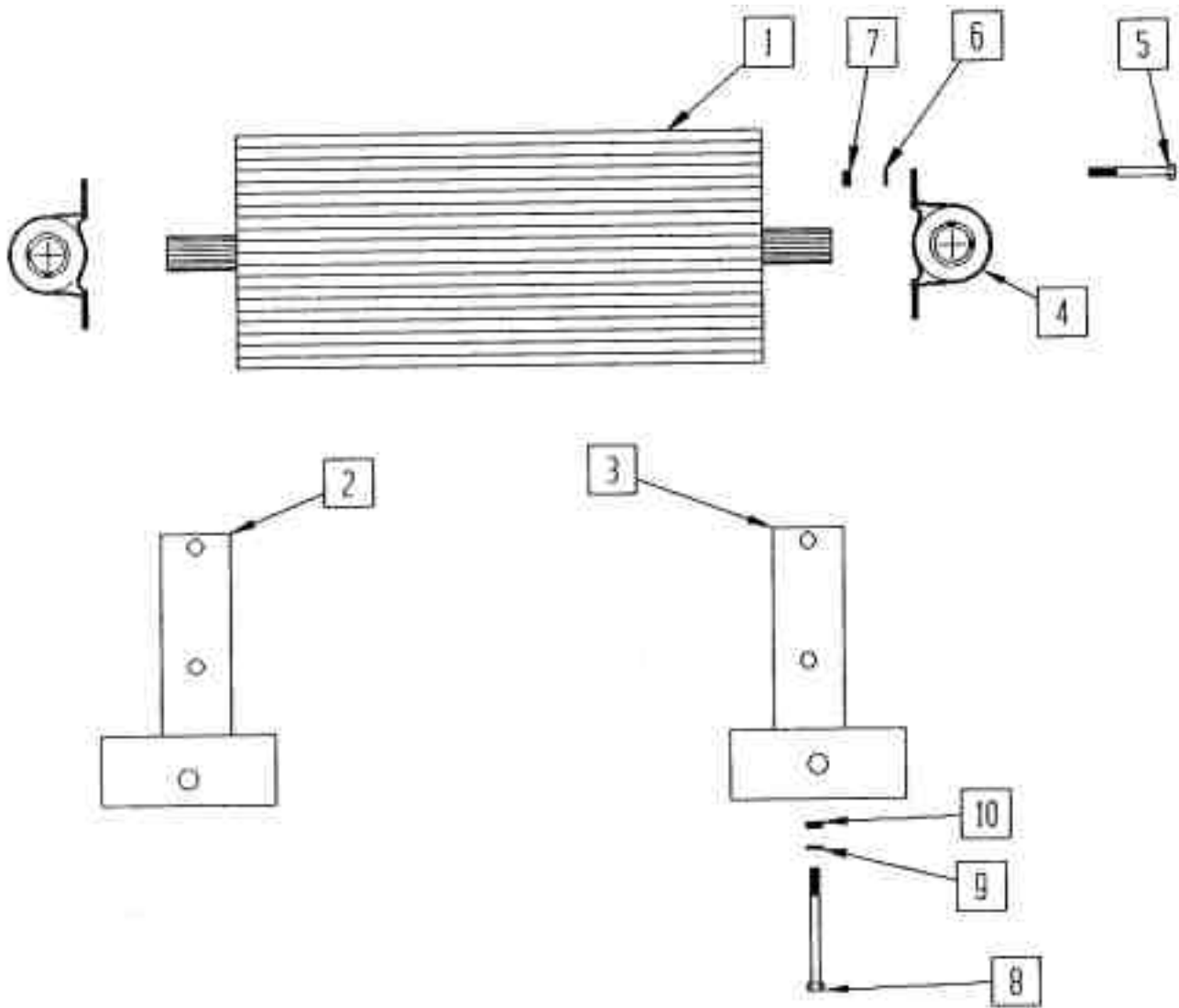
# Tail



## Tail

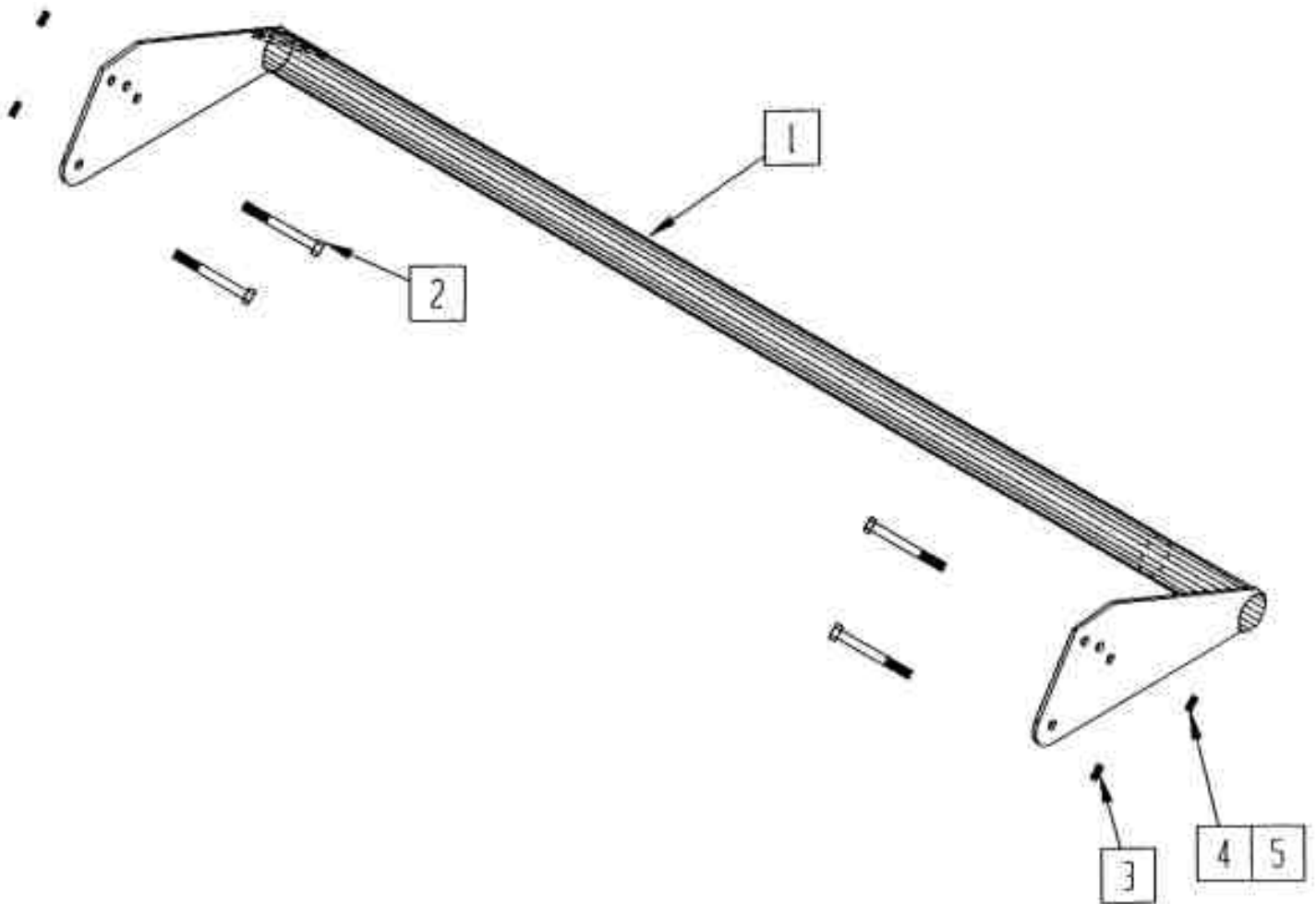
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-097	Tail Base
2	4	TL500-100-086	Large Roller
3	1	TL500-100-099	4" Roller
4	1	TL500-100-100	2" Roller
5	2	TL500-100-101	Retainer Bar
6	2	TL500-100-102	Long Wood Strip
7	1	TL500-100-103	2.5" x 16" Hydraulic Cylinder
8	8	TL500-100-091	5/16" x 3" Carriage Bolt
9	6	TL500-100-104	1/2" x 3-1/2" Carriage Bolt
10	6	TL500-100-075	1/2" Lockwasher
11	6	TL500-100-076	1/2" Nut
12	8	TL500-100-092	5/16" Lockwasher
13	8	TL500-100-093	5/16" Nut
14	1	TL500-100-109	Hinge Pin
15	1	TL500-100-110	Cotter Pin
16	1	TL500-100-111	Tail Tie Bar
17	1	TL500-100-112	Hair Pin
18	1	TL500-101-113	3/4" x 5" Hex Bolt
19	1	TL500-101-114	3/4" Locknut
20	1	TL500-101-223	Rear Roller Extension
21	4	TL500-100-046	3/8" x 1" Hex Bolt
22	4	TL500-100-190	3/8" Flatwasher
23	4	TL500-101-224	3/8" Locknut

## Short Roller



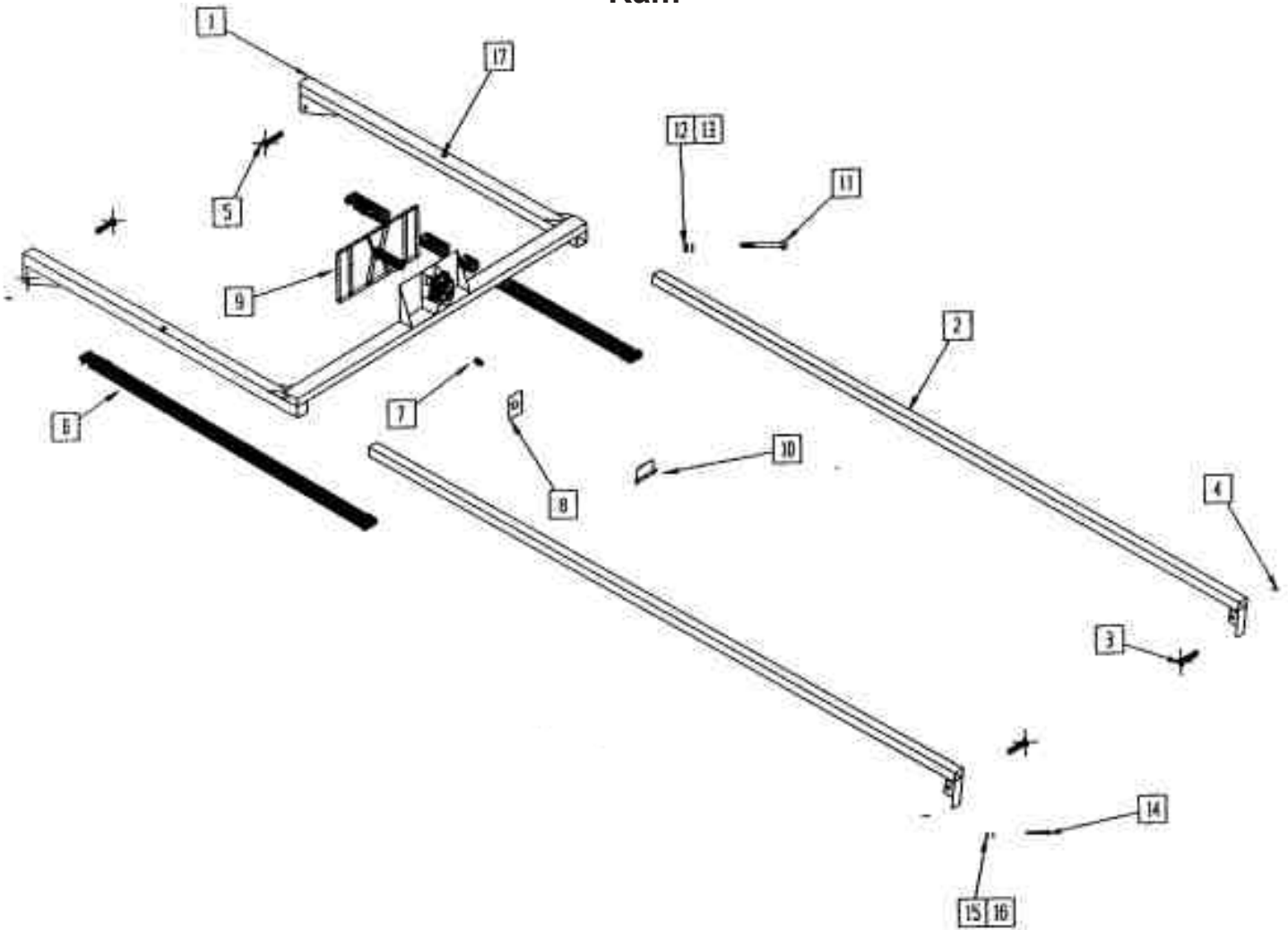
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-115	Short Roller
2	1	TL500-100-116	Left Bearing Bracket
3	1	TL500-100-117	Right Bearing Bracket
4	2	TL500-100-118	Bearing
5	4	TL500-100-119	3/8" x 1-1/4" Hex Bolt
6	4	TL500-100-038	3/8" Lockwasher
7	4	TL500-100-039	3/8" Nut
8	2	TL500-100-122	1/2" x 4" Hex Bolt
9	2	TL500-100-076	1/2" Nut

## Bale Saddle



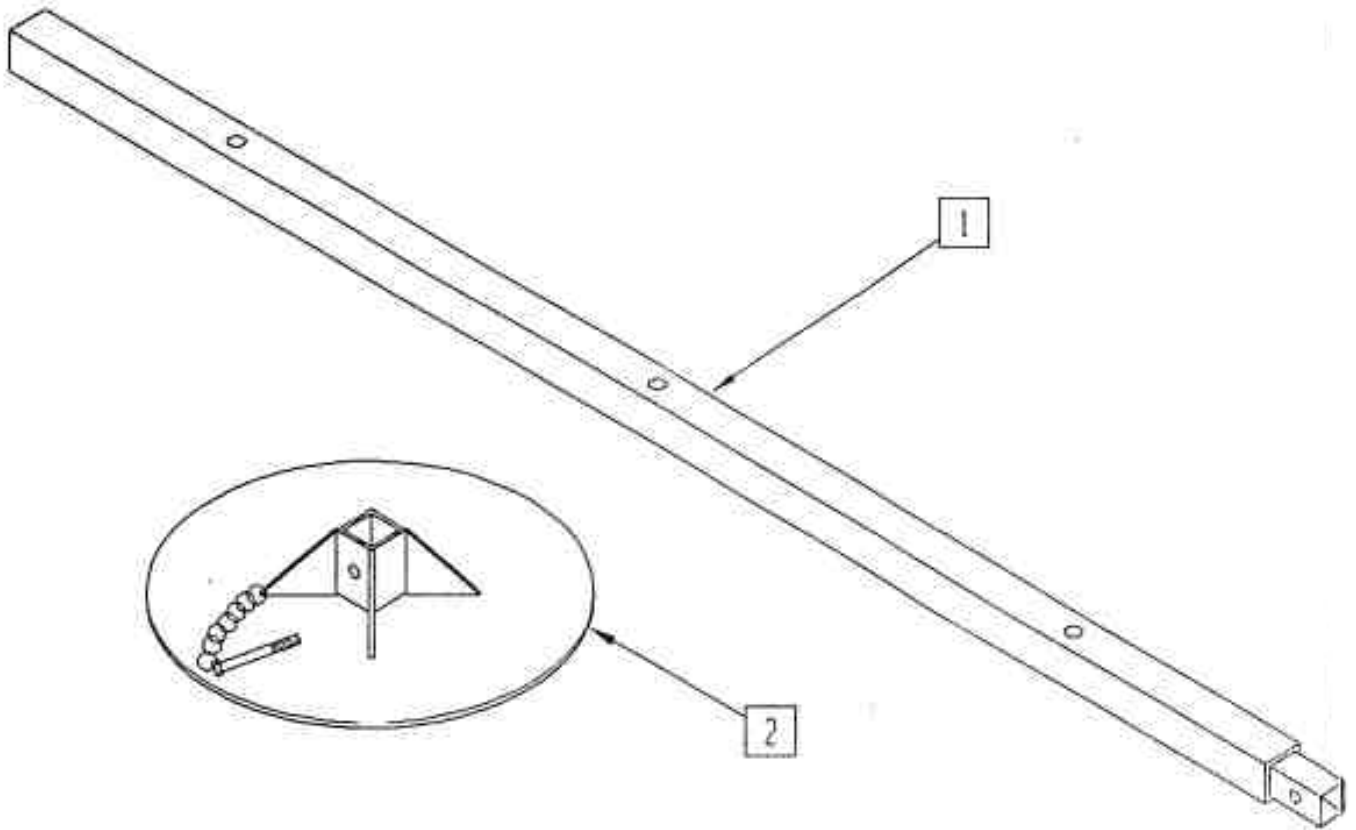
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	TL500-100-124	Bale Saddle
2	4	TL500-100-125	1/2' x 1-1/4" Hex Bolt
3	2	TL500-100-114	1/2" Locknut
4	2	TL500-100-076	1/2" Nut
5	2	TL500-100-075	1/2" Lockwasher

## Ram



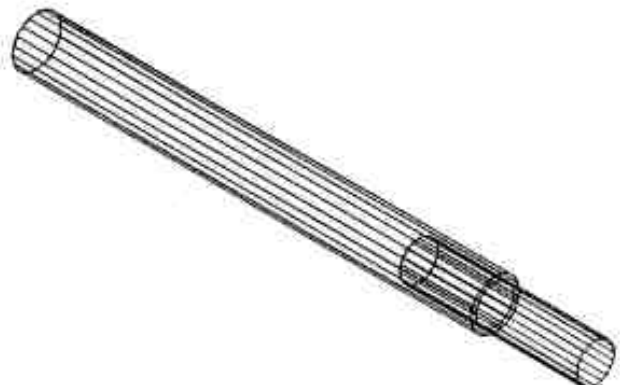
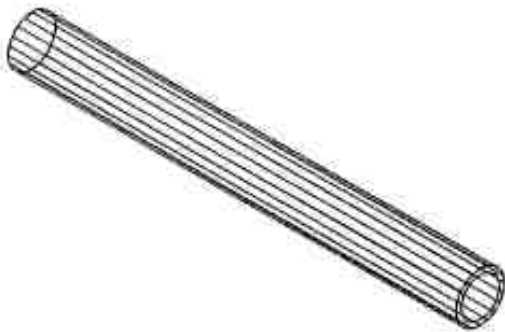
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-129	Ram
2	2	TL500-100-130	Slider Tube
3	2	TL500-100-131	Long Cylinder Pin
4	2	TL500-100-132	Short Cylinder Pin
6	2	TL500-100-134	Ram Hydraulic Cylinder
7	1	TL500-101-135	Pinch Plate Spring
8	4	TL500-101-136	Pinch Plate
9	1	TL500-101-137	Push Plate
10	1	TL500-101-114	Push Plate Lock Pin
11	2	TL500-100-139	1/2" x 4" Hex Bolt
12	2	TL500-100-076	1/2" Nut
13	2	TL500-100-075	1/2" Locknut
14	4	TL500-100-142	1/2" x 1-1/2" Hex Bolt
15	4	TL500-100-076	1/2" Nut
16	4	TL500-100-075	1/2" Lockwasher
17	2	TL500-100-145	Grease Fitting

## Push Tube & Plate - Used up to 1996



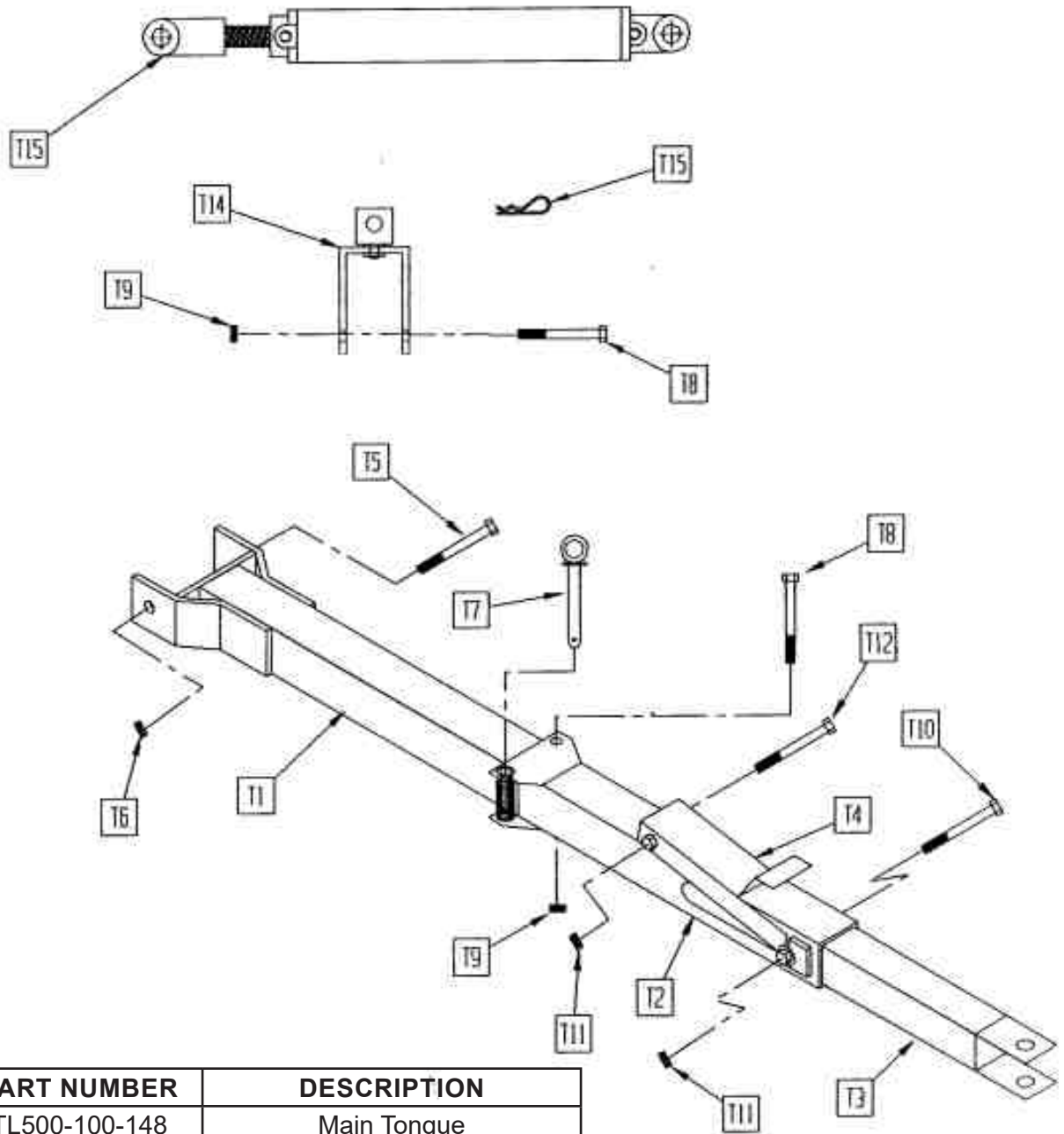
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-146	Push Tube
2	1	TL500-100-146	Push Plate

## TL500-101-146 - Push Tube - Used from 1997



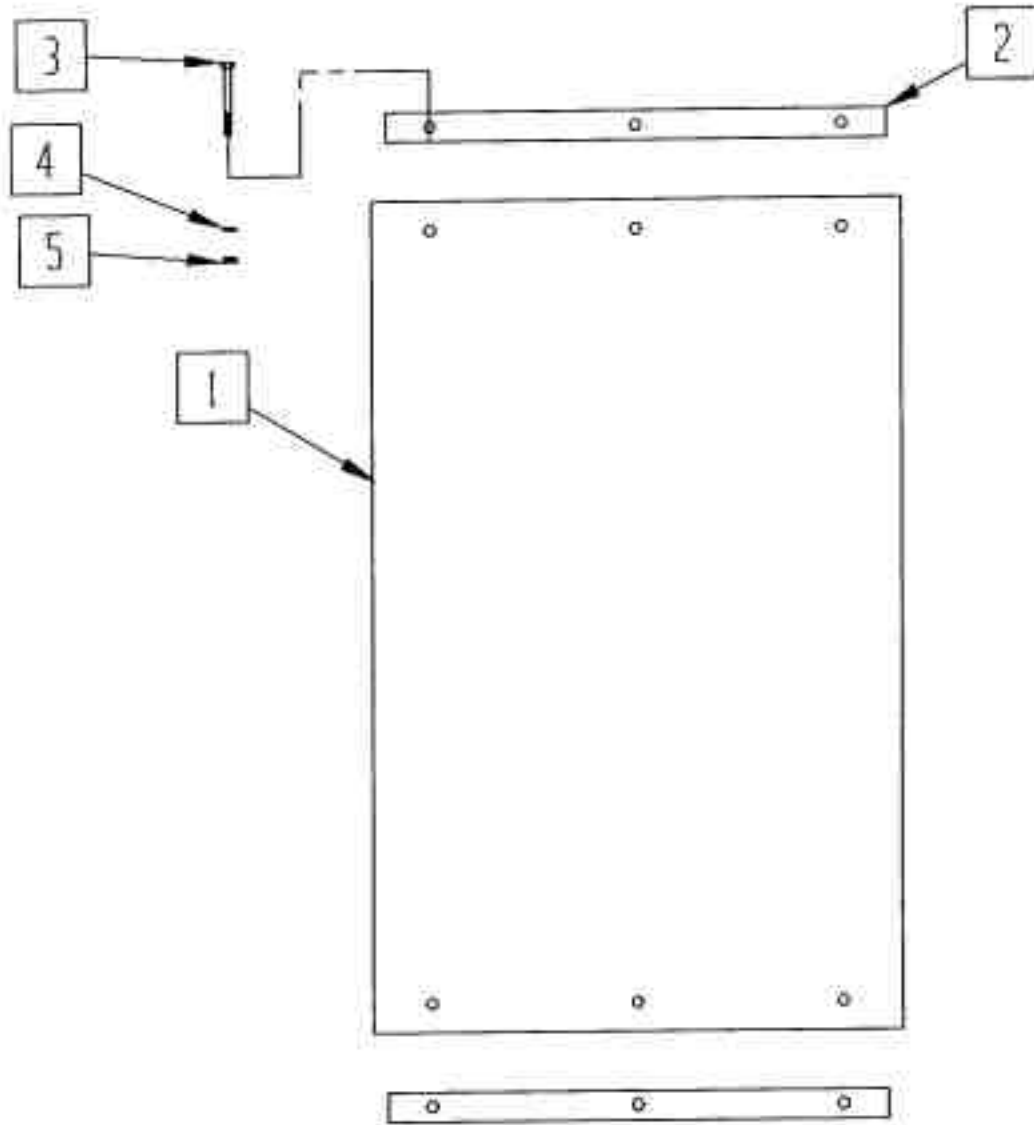


## Tongue



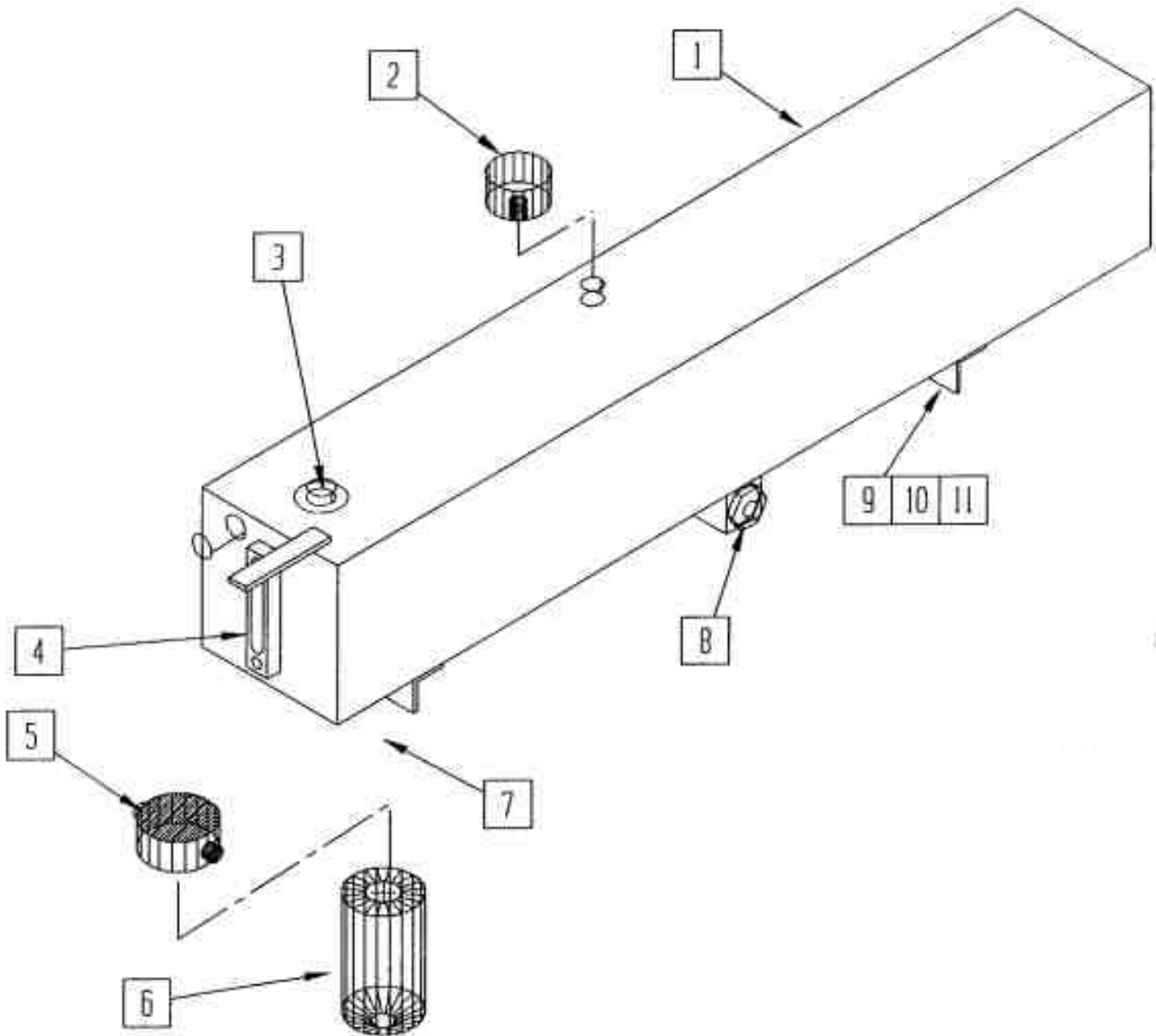
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-148	Main Tongue
2	1	TL500-100-149	Swinging Tongue
3	1	TL500-100-150	Sliding Tongue
4	1	TL500-100-151	Tongue Latch
5	1	TL500-100-152	3/4" x 8-1/2" Hex Bolt
6	1	TL500-100-153	3/4" Locknut
7	1	TL500-100-154	Tongue Pin
8	2	TL500-100-155	5/8" x 5" Hex Bolt
9	2	TL500-100-056	5/8" Locknut
10	1	TL500-100-157	5/8" x 4-1/2" Hex Bolt
11	1	TL500-100-056	5/8" Hex Nut
12	1	TL500-100-157	5/8" x 4-1/2" Hex Bolt
13	1	TL500-100-160	Tongue Holder
14	1	TL500-100-161	Hair Pin
15	1	TL500-100-103	2-1/2" x 16" Hydraulic Cylinder

## Mud Flap



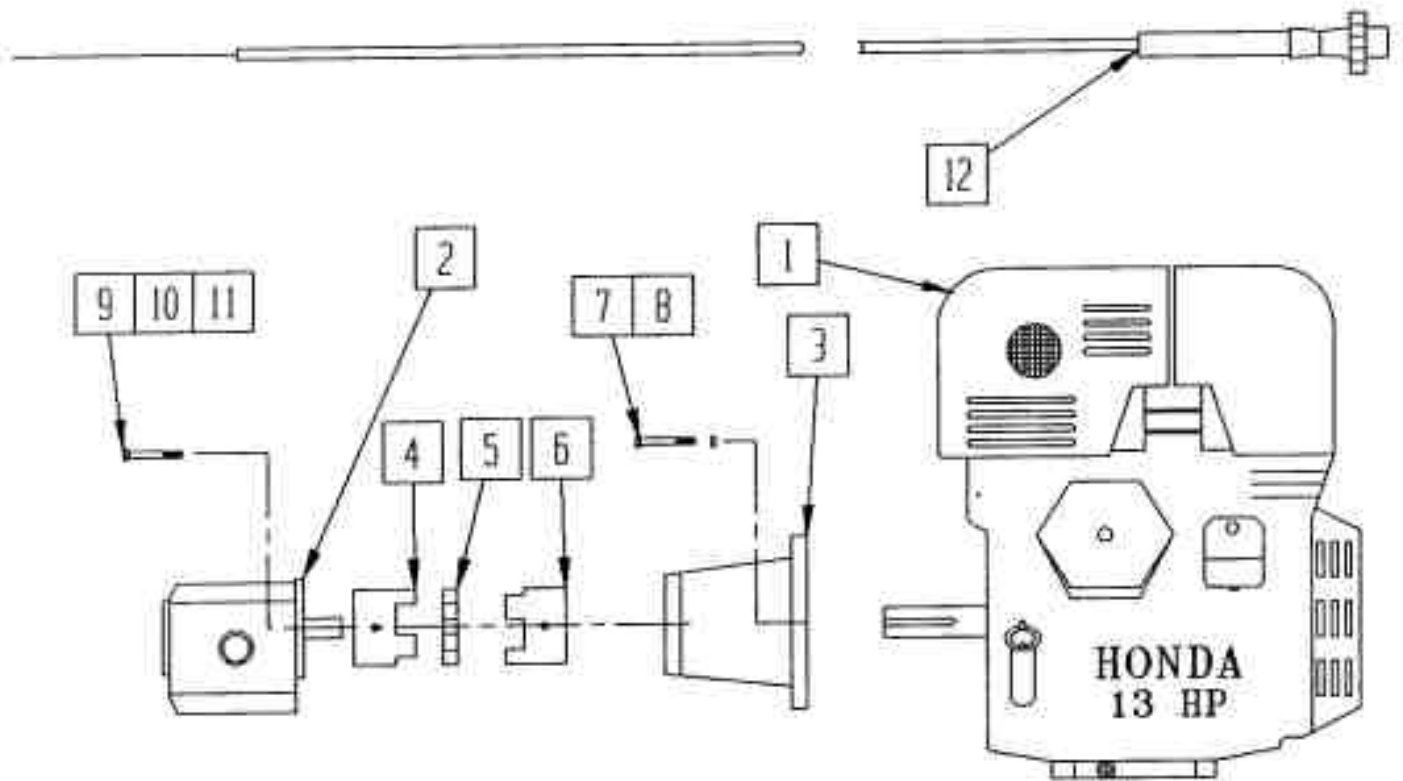
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	TL500-100-163	Mud Flap
2	4	TL500-100-164	Metal Strip
3	12	TL500-100-165	5/16" x 1" Hex Bolt
4	12	TL500-100-092	5/16" Lockwasher
5	12	TL500-100-093	5/16" Nut

## Hydraulic Tank



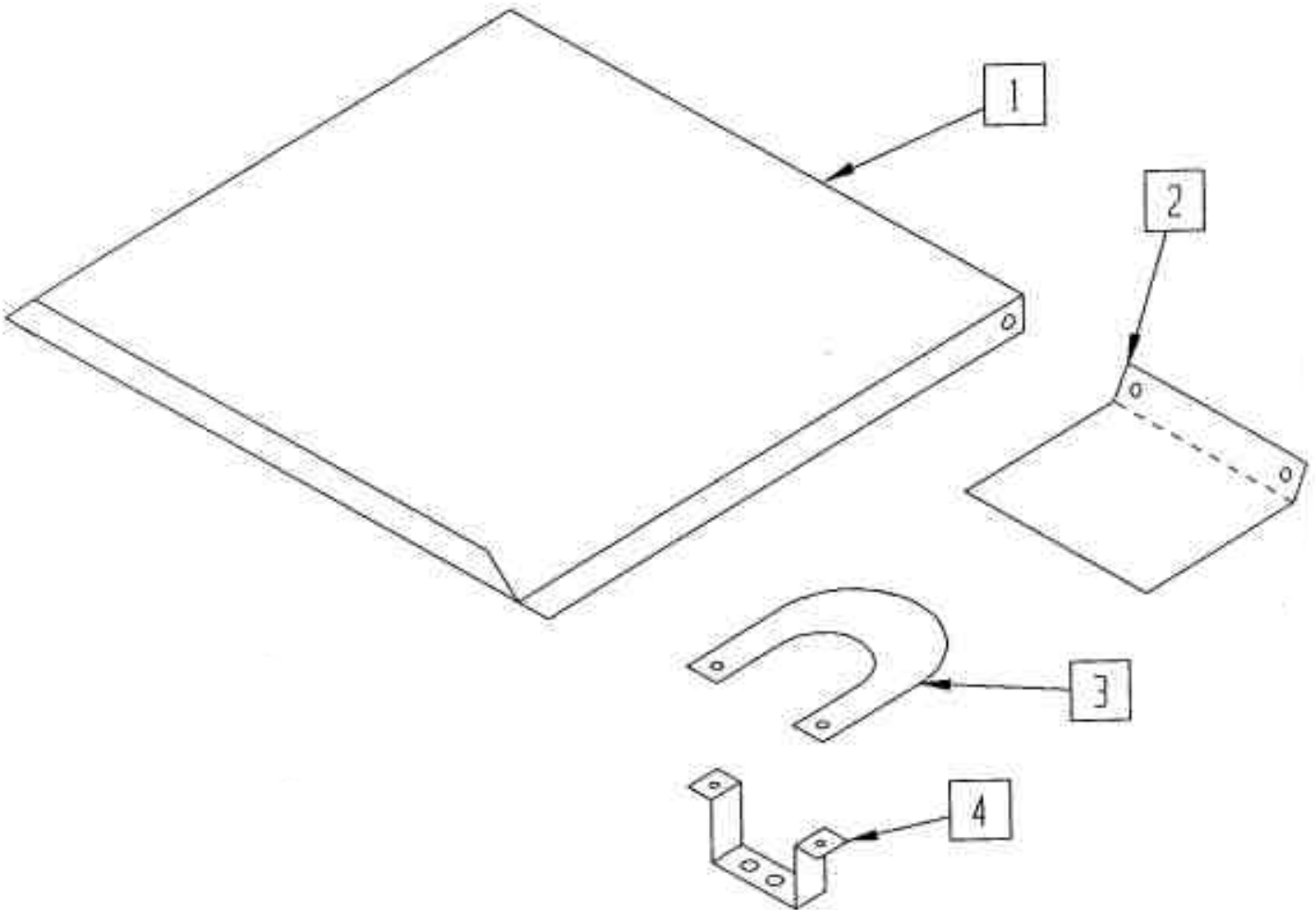
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-168	Hydraulic Tank
2	1	TL500-100-169	Breather Cap
3	1	TL500-100-170	Filter Plug 1-1/4" Pipe
4	1	TL500-100-171	Sight Gauge
5	1	TL500-100-172	Filter Base
6	1	TL500-100-173	10 Micron Filter
7	1	TL500-100-174	Magnetic Plug
8	1	TL500-100-175	Suction Filter
9	4	TL500-100-176	3/8" x 1" Bolt
10	4	TL500-100-038	3/8" Lockwasher
11	4	TL500-100-039	3/8" Nut

# Engine



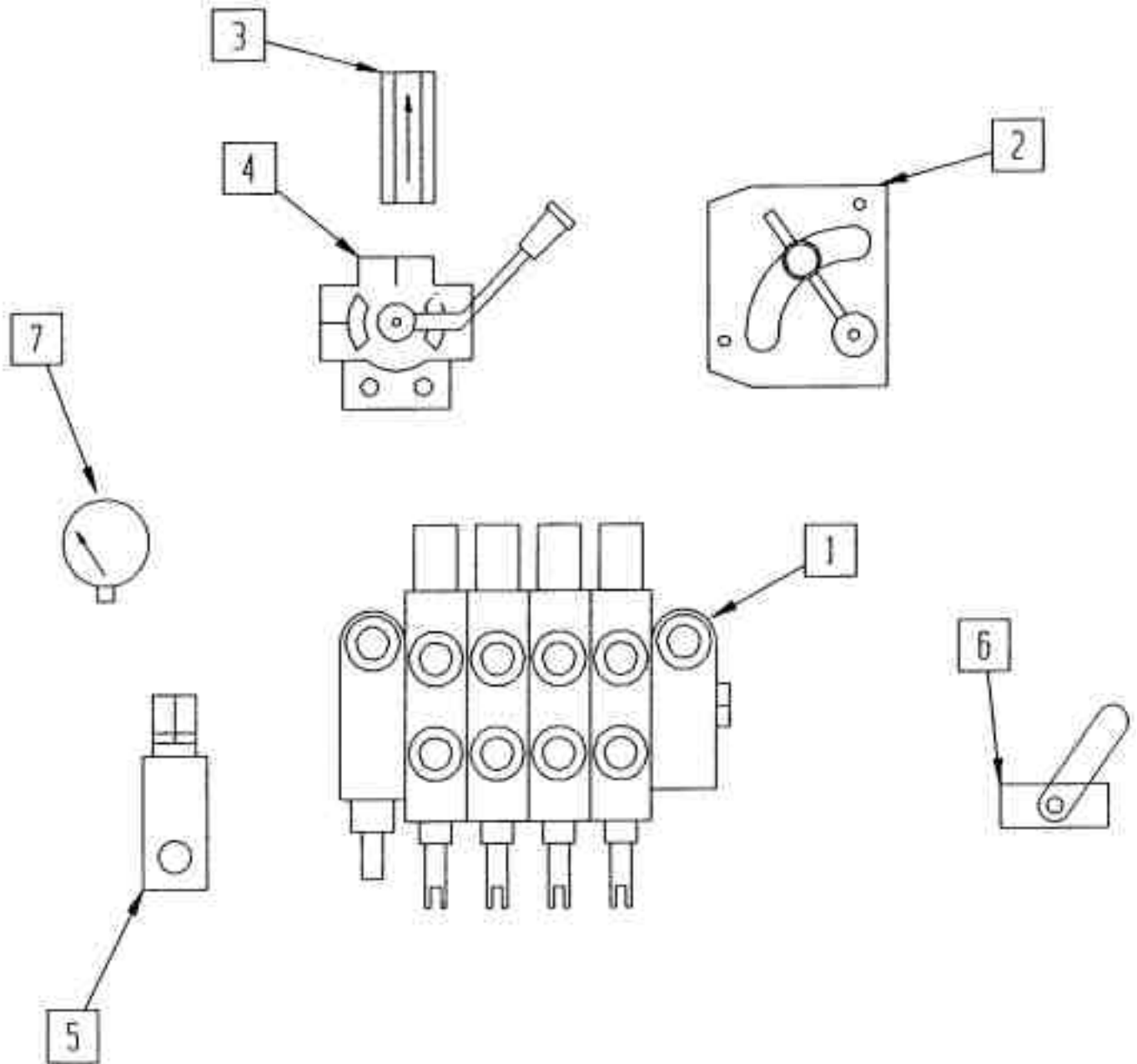
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
1	1	TL500-100-179	13hp Honda Engine - Pull Start	Manual
	1	TL500-100-180	13hp Honda Engine - E-Start	Auto
2	1	TL500-100-181	Hydraulic Pump	
3	1	TL500-100-182	Engine to Pump Adaptor	
4	1	TL500-100-183	Love Joy Coupling - Pump Side	
5	1	TL500-100-184	Coupling Spacer	
6	1	TL500-100-185	Love Joy Coupling - Engine Side	
7	4	TL500-100-186	3/8" x 1" Hex Bolt	
8	4	TL500-100-038	3/8" Lockwasher	
9	2	TL500-100-188	3/8" x 1-1/4" Hex Bolt	
10	2	TL500-100-038	3/8" Lockwasher	
11	2	TL500-100-190	3/8" Flatwasher	
12	2	TL500-100-191	Throttle Cable	Manual

# Engine Cover



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-196	Engine Cover
2	1	TL500-100-197	Valve Stack Decal Plate
3	1	TL500-100-198	Selector Valve Decal Plate
4	1	TL500-100-199	Selector Valve Decal Plate Bracket

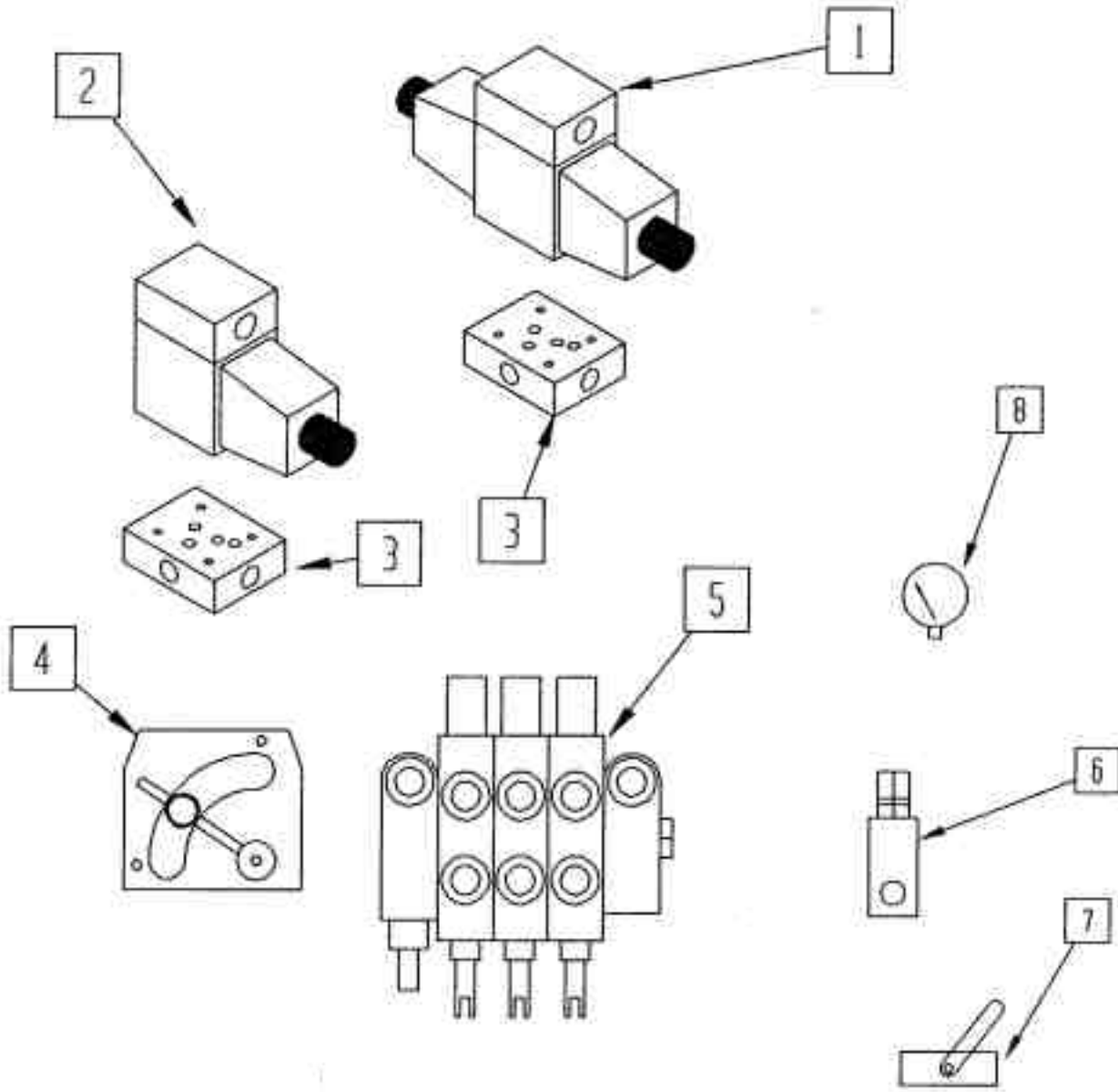
## Manual Valve Bank



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-192	Valve Stack
2	1	TL500-100-193	Flow Control
3	1	TL500-100-194	1/2" Check Valve
4	1	TL500-100-195	Selector Valve
5	1	TL500-100-226	Relief Valve
6	1	TL500-100-227	Ball Valve
7	1	TL500-100-228	Pressure Gauge

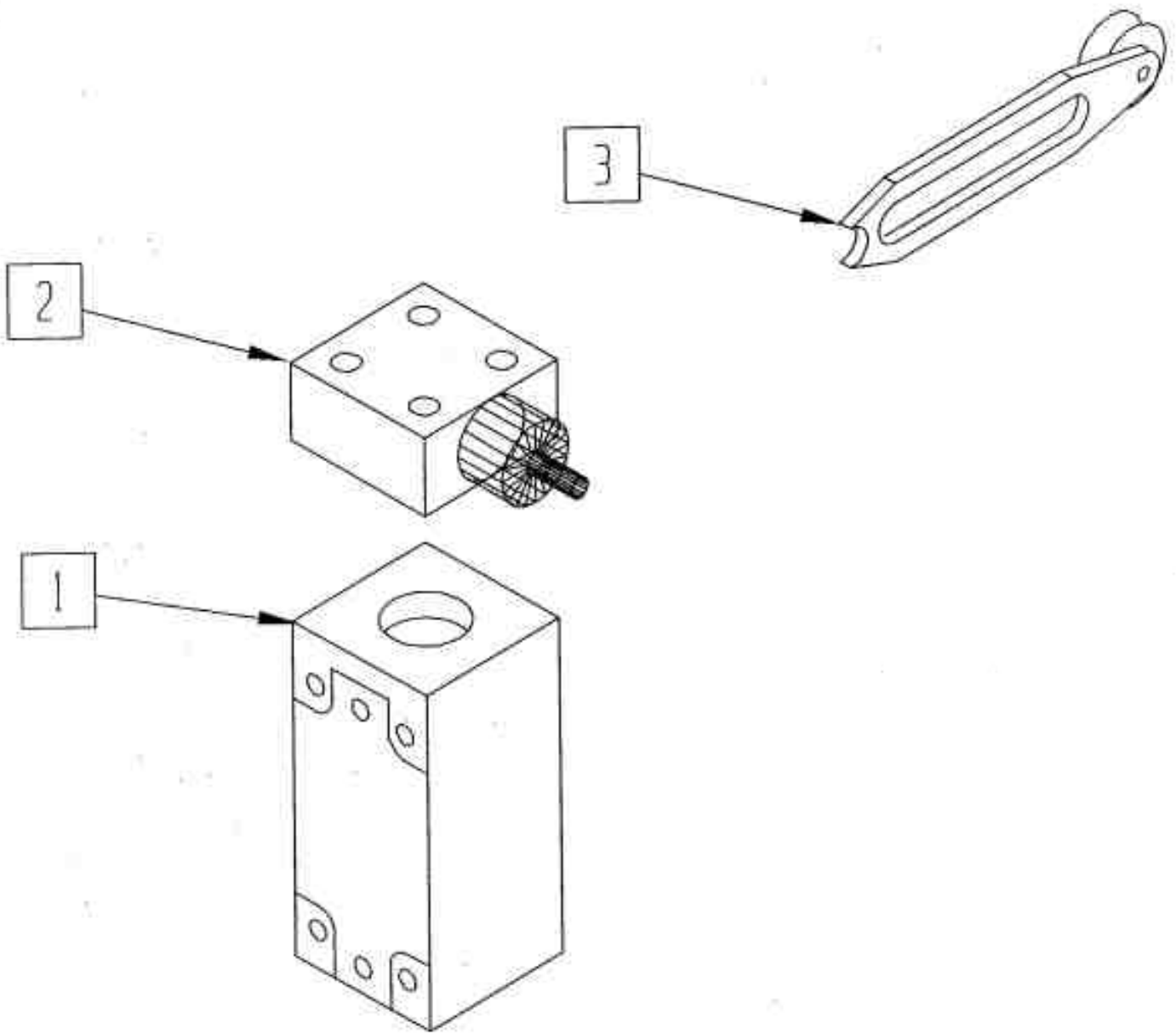


## Electric Solenoid Valve



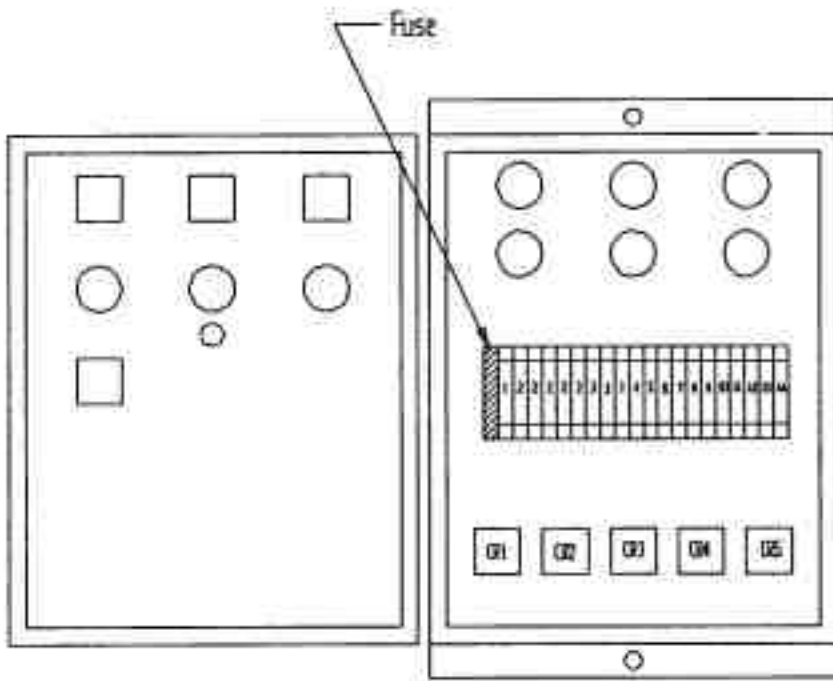
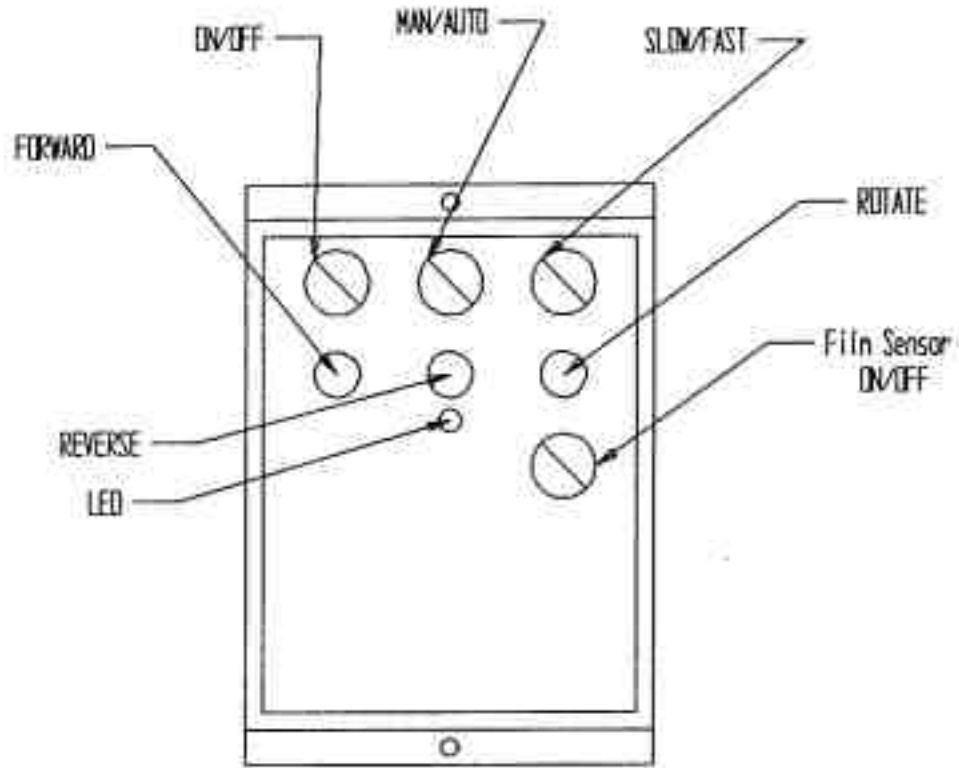
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-200	Tandem Center Solenoid 12V DC
2	1	TL500-100-201	Single Solenoid 12V DC
3	2	TL500-100-202	SAE Ported Subplate
4	1	TL500-100-203	Flow Control
5	1	TL500-100-209	Valve Stack
6	1	TL500-100-226	Relief Valve
7	1	TL500-100-227	Ball Valve
8	1	TL500-100-228	Pressure Gauge

## Limit Switch

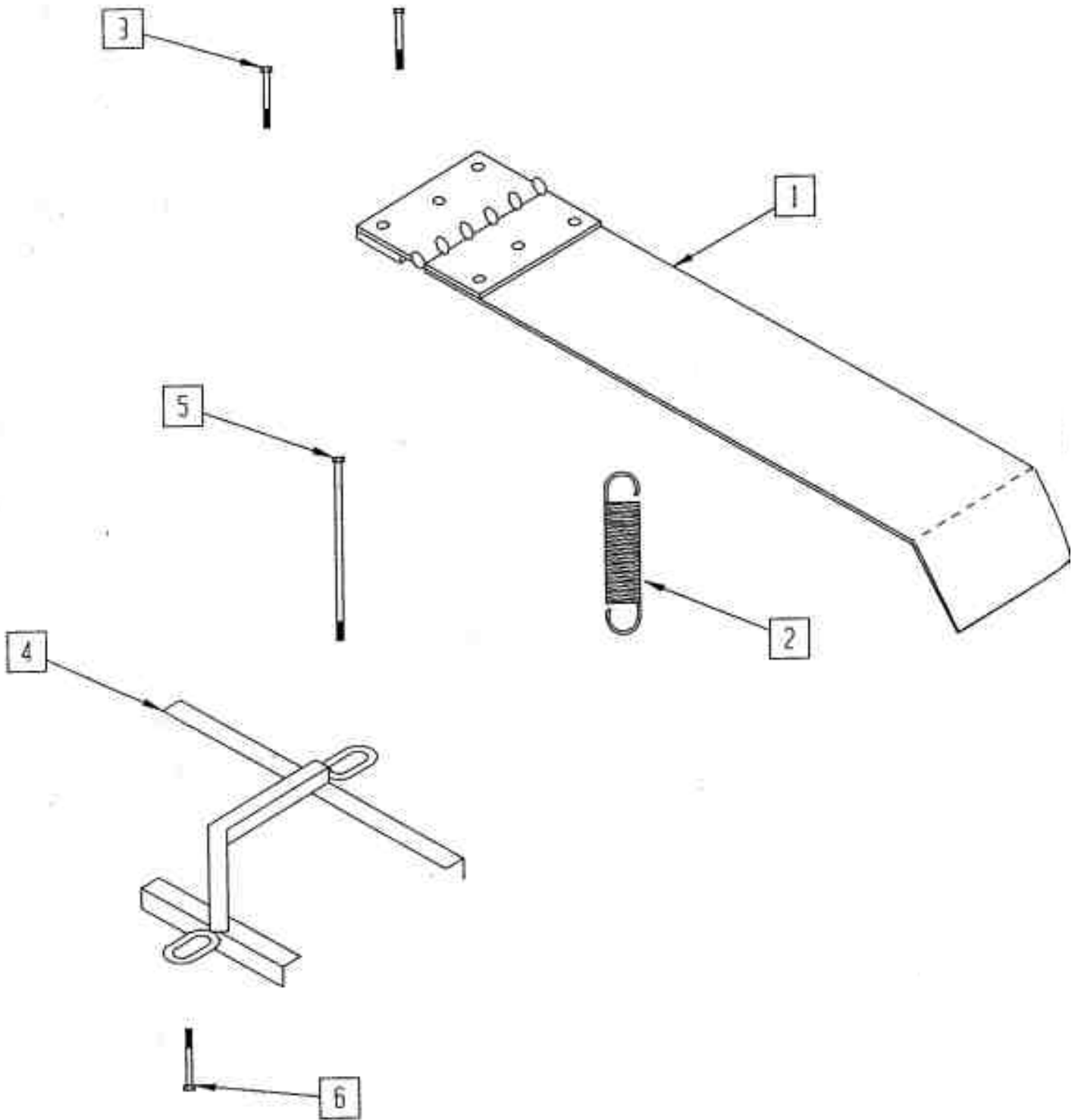


ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	TL500-100-204	Limit Switch Body
2	4	TL500-100-205	Limit Switch Actuator
3	4	TL500-100-206	Limit Switch Arm

# TL500-100-207 - Control Panel

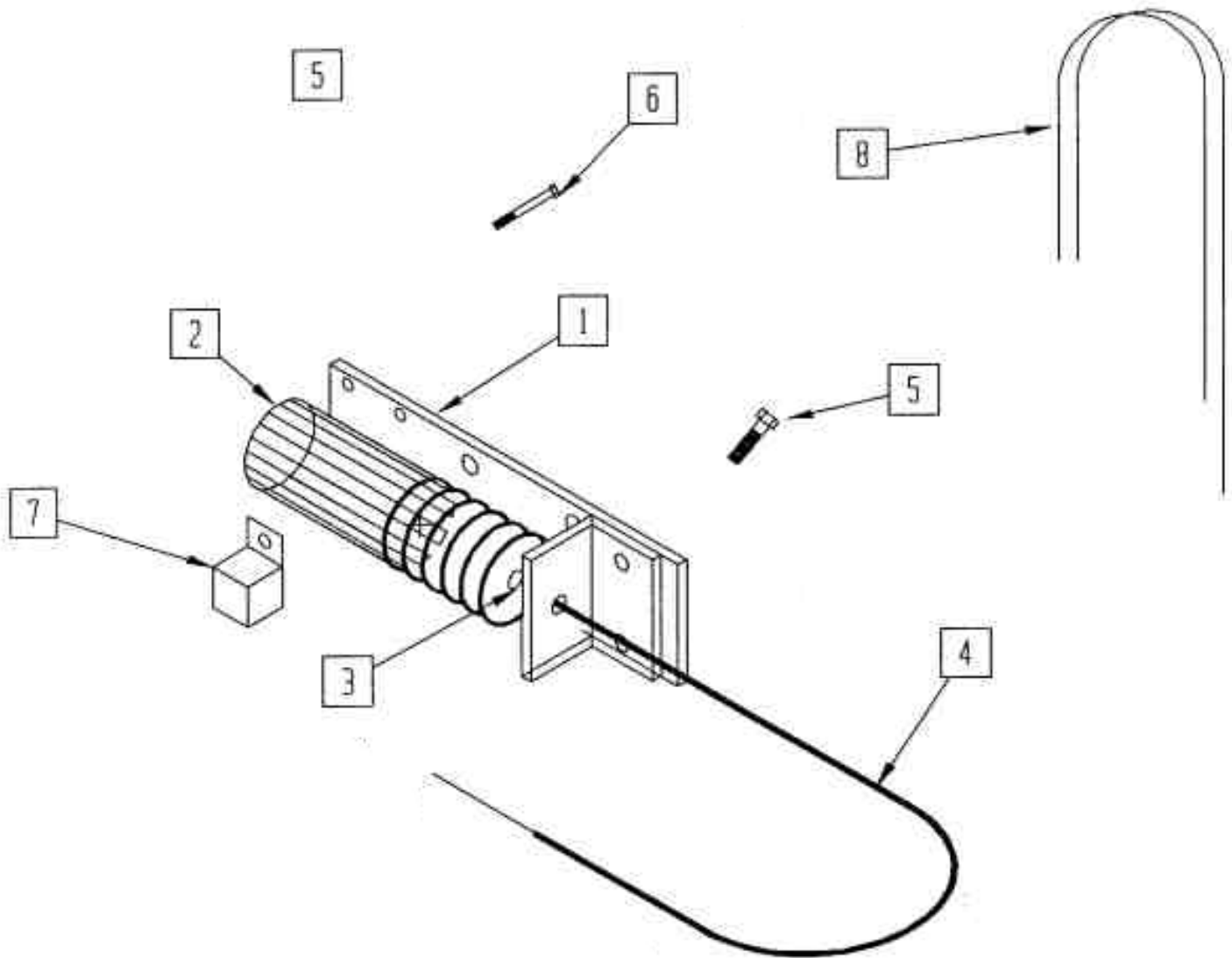


## Trigger & Battery Hold Down



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-208	Trigger Plate
2	1	TL500-100-135	Trigger Spring
3	2	TL500-100-210	1/4" x 1" Stove Bolt w/ lockwasher & nut
4	1	TL500-100-211	Battery Hold Down
5	1	TL500-100-212	5/16"x 7" Carriage Bolt w/ lockwasher & nut
6	1	TL500-100-213	5/16"x 2" Hex Bolt w/ lockwasher & nut

## Throttle Solenoid



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TL500-100-214	Solenoid Base
2	1	TL500-100-215	Throttle solenoid
3	1	TL500-100-216	Coupling Nut
4	1	TL500-100-217	Throttle Cable
5	2	TL500-100-046	3/8" x 1" Hex Bolt w/ lockwasher & nut
6	2	TL500-100-219	1/4" x 3/4" Hex Bolt w/ lockwasher & nut
7	1	TL500-100-220	70 Amp Relay
8	1	TL500-100-225	Solenoid Wire Harness

## Operation - Manual Hydraulics

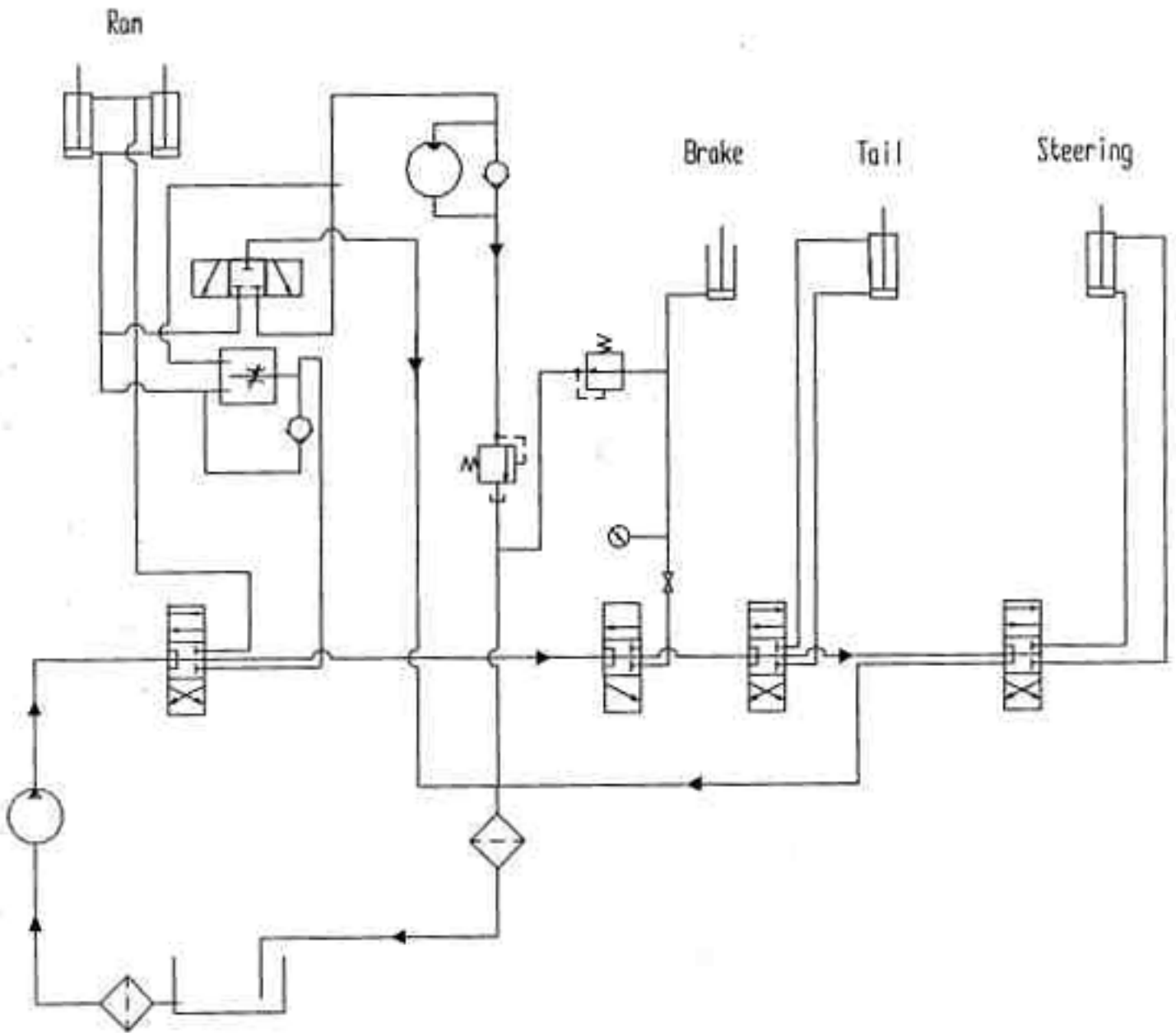
1. With valves in neutral position engine running, hydraulic fluid is pumped through valve stack and returned to reservoir.
2. Brakes, tail, steering are standard hydraulic cylinder operation.
3. Wrap Cycle - Push wrap valve in, detent will hold valve in position, fluid flows from valve through flow control end is split into 2 circuits, one circuit will go to ram cylinders and the other circuit will go to the hydraulic motor. These circuits are proportioned with the lever on flow control valve. With the selector valve handle, in "Both" position flow will go to cylinder and motor. By changing flow control handle, cylinders will speed up or slow down accordingly. At the same time motor will change speed inversely to cylinder ie. when cylinder slows down motor will speed up.
4. Selector valve is used to bleed either cylinder or motor back to tank or block circuits causing cylinder and motor to operate, ie. With handle in "Wrap Only" position, the fluid that would normally go to the cylinder will flow to tank. With the handle in "Ram Only" position, motor fluid will go to tank.
5. Wrap Cycle - Pull wrap valve out, detent will hold valve in position, fluid will flow from valve port to cylinder causing cylinder to retract. Fluid from the other end of cylinder will return through the check valve, at flow control back through valve stack and to tank.
6. Check valve at motor lets motor freewheel in one direction without cavitating. Relief valve at motor return acts as restrictor valve to keep motor from turning when ram cylinder is retracting.

## Operation - Electric over Hydraulic (Automatic)

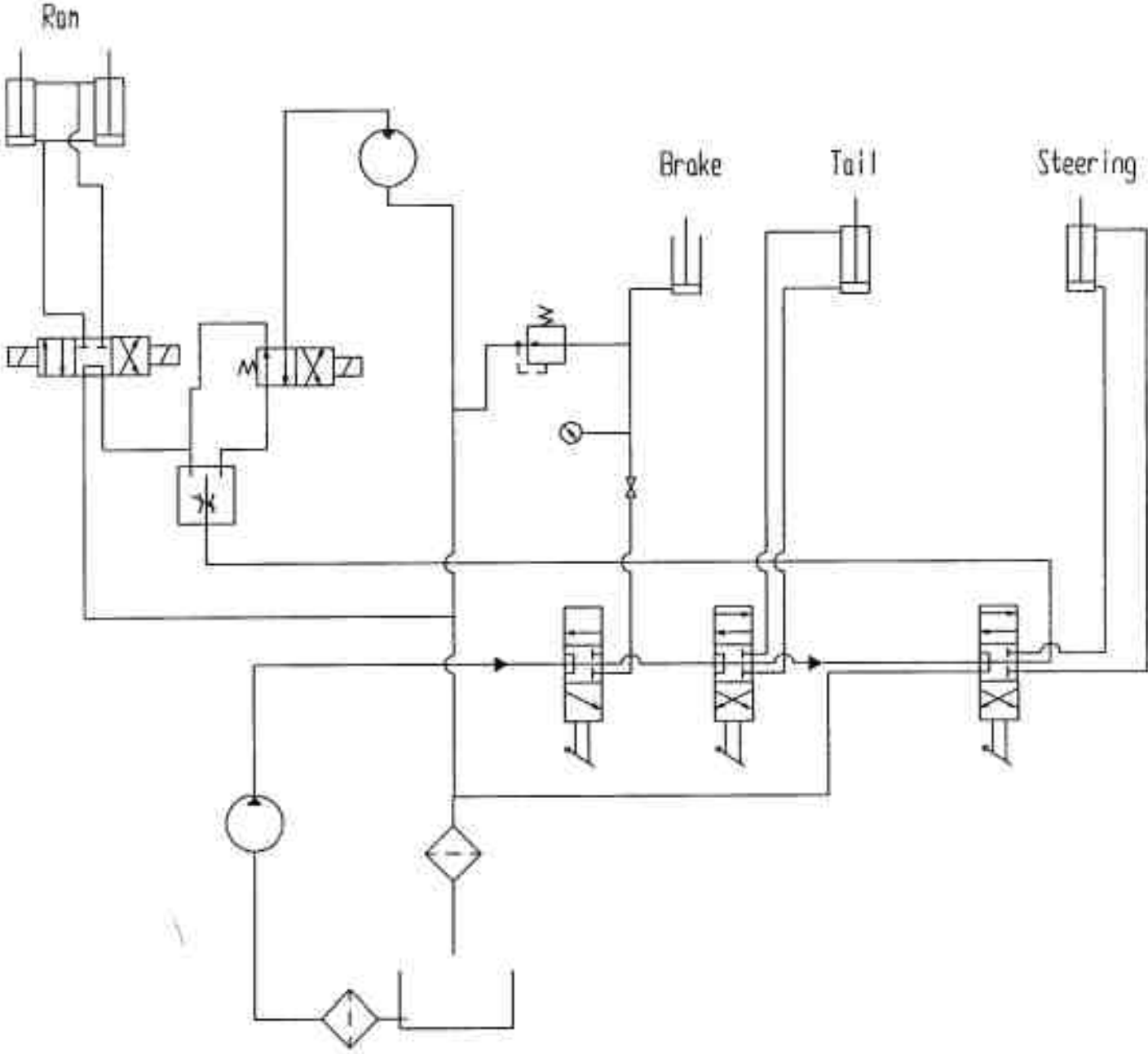
1. With valves in neutral position, control panel ON/OFF position set to OFF, engine running fluid is pumped through valve stack and returned to reservoir.
2. Brakes, tail, steering are standard hydraulic cylinder operation.
3. Wrap Cycle - Fluid flows from power beyond port to flow control, and is split into 2 circuits. One circuit goes to the double solenoid valve for ram cylinder, the other circuit goes to single solenoid valve for hydraulic hoop motor. By moving flow control handle more or less, fluid will flow to cylinder or motor, ie. as more fluid flows to cylinder, less fluid will flow to motor and vice versa.
4. Electric Control Panel - With "Fast-Slow" switch turned to "Slow", and with "Man-Auto" switch turned to "Man", turn "On-Off" switch to "On". The red light will light up indicating 12V power is at control circuits. With Engine running, turn "Fast-Slow" switch to "Fast" and the engine will speed up to max, approximately 3500rpm.  
Push and hold "Forward" button to energize solenoid A on double solenoid valve. Ram cylinder extends.  
Push and hold "Reverse" button to energize solenoid B on same valve. Ram cylinder retracts.  
Push and hold "Rotate" button to rotate hydraulic motor.
5. When "Man-Auto" switch is turned to "Auto", engine throttle "Fast-Slow" switch and push buttons no longer function. Depress trigger switch located on bale table, and the engine throttle and hydraulic valve are energized. The engine will speed up and the ram cylinder will extend until the bale on table starts to move the bale in wrap chamber. This will cause the roller with sprocket to turn, tripping the limit switch thereby energizing the single solenoid valve and turning the hoop motor. When ram is extended to limit switch at end of stroke, single solenoid valve and double solenoid A will turn off. Solenoid B will energize causing ram cylinder to retract until it trips limit switch at the front end of bale table, solenoid B and throttle solenoid will turn off, the ram cylinder will stop and engine will idle down.



# Hydraulic Schematic - Manual



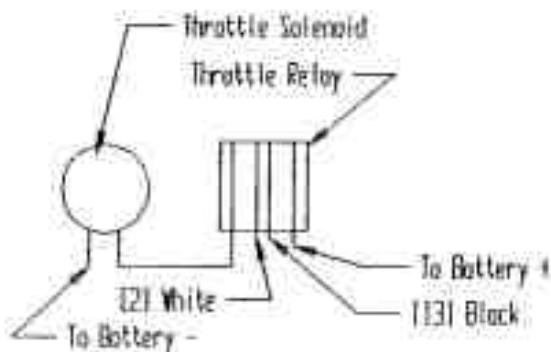
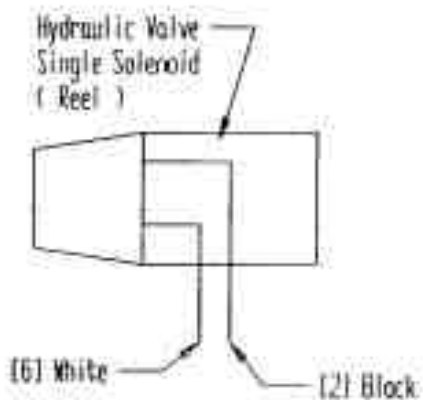
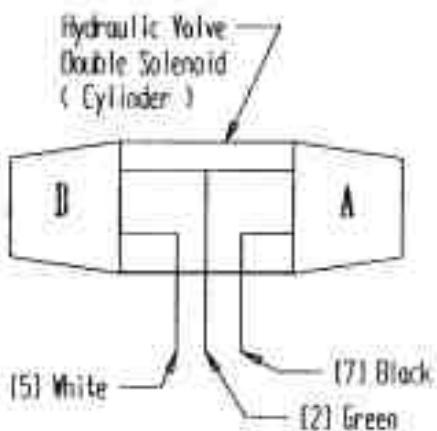
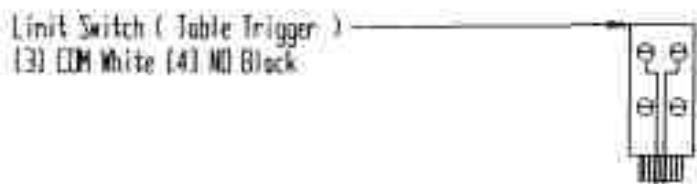
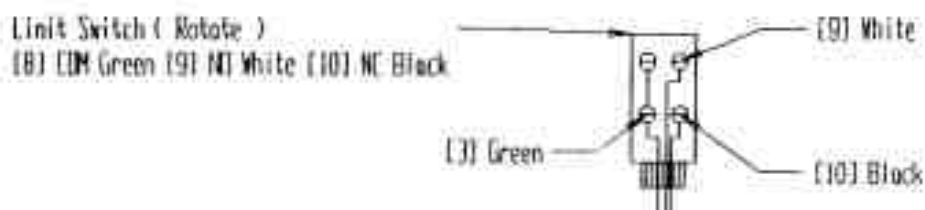
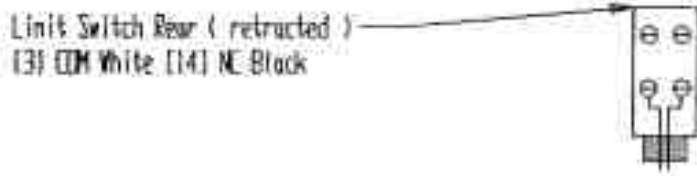
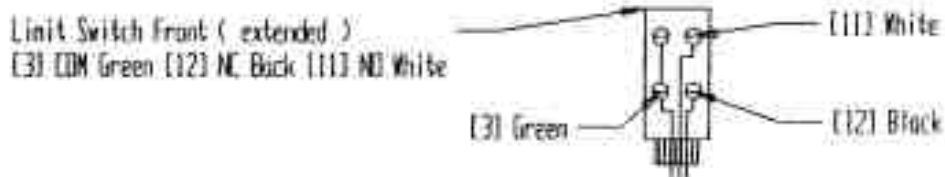
# Hydraulic Schematic - Automatic



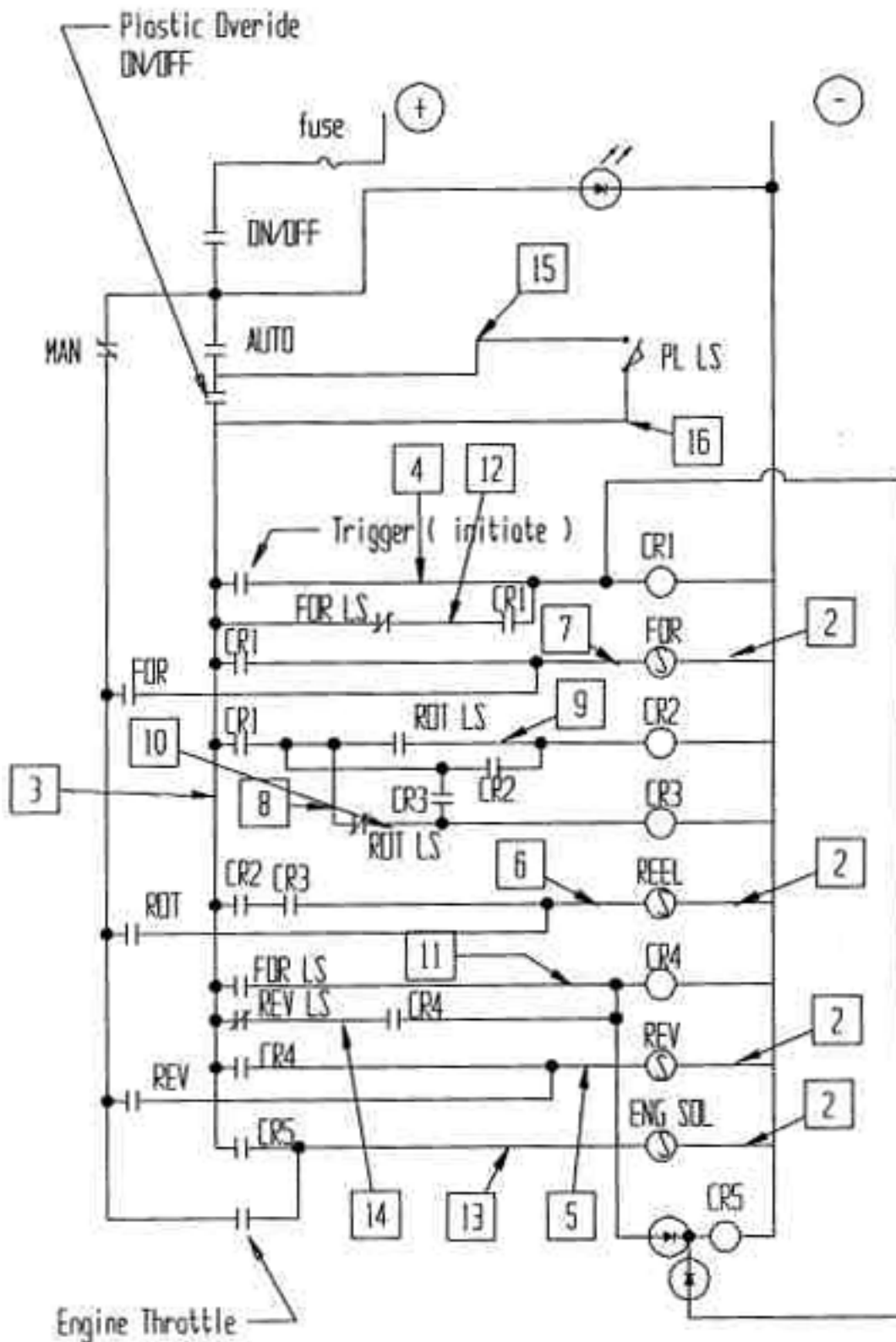
# 12V Battery

(+1 Black)(-2 White)

Number in [ ] matches terminal strip numbers



## Electrical Schematic - Automatic



- Terminal Strip #
- ⊕ Positive Battery Post
- ⊖ Negative Battery Post
- Ⓢ Hydraulic Valve Solenoid
- LS Limit Switch
- CRx Control Relay



## Electrical Functions

Electric solenoid valves can be manually operated by pushing and holding a small punch into the end of spool.

**CAUTION:** Stay away from hoop when engine is running!

Control relays inside control panel are numbered CR1 to CR5 from left to right.

CR1 activates ram cylinder extend solenoid valve and CR5. CR5 controls throttle solenoid.

CR2 and CR3 are wired to motion sensor switch at rear roller. When switch arm is between teeth on sprocket, CR3 is energized. As roller turns, switch arm will be pushed to top of sprocket tooth, energizing CR2 and vice versa. After both CR2 and CR3 are activated, wrap solenoid is energized causing hoop motor to turn.

When ram cylinder is extended to the limit switch at the engine, CR1, CR2, CR3 will turn off and CR4 turns on. Hoop motor will stop and ram cylinder will retract until ram cylinder trips limit switch at front end of table. All control relays will turn off.

Testing can be done by pushing trigger plate down, then going to rear and turning roller with sprocket, wait until machine goes through the cycle. Alternatively, you can push the small square button on control relay 1, then buttons on CR2 and CR3, whichever is not activated. Wait for the machine to finish cycle.












When running machine through cycle and hoop motor or cylinders do not function, check flow control valve to set to allow flow to both functions.

Engine is stopped by grounding ignition, in case of ignition failure, make sure that stop switch wire is not shorting to frame and engine switch is not in closed position.

Engine throttle solenoid must be able to fully retract to engage the folding coil.

Failure to retract fully will cause solenoid coil to burn out. Check to make sure throttle cable moves freely and does not bind. To test solenoid, use a jumper wire across large terminals on 70amp relay. Solenoid will draw 55amps until it is seated, then it will draw 1amp on the holding coil.

# Torque Values - Imperial

SAE Grade and Head Markings	NO MARK	1 or 2 <sup>b</sup> 	5 	5.1 	5.2 	8 	8.2 
	NO MARK	2 	5 			8 	

Size	Grade 1				Grade 2 <sup>b</sup>				Grade 5, 5.1, or 5.2				Grade 8 or 8.2			
	Lubricated <sup>a</sup>		Dry <sup>a</sup>		Lubricated <sup>a</sup>		Dry <sup>a</sup>		Lubricated <sup>a</sup>		Dry <sup>a</sup>		Lubricated <sup>a</sup>		Dry <sup>a</sup>	
	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft
1/4	3.7	2.8	4.7	3.5	6	4.5	7.5	5.5	9.5	7	12	9	13.5	10	17	12.5
5/16	7.7	5.5	10	7	12	9	15	11	20	15	25	18	28	21	35	26
3/8	14	10	17	13	22	16	27	20	35	26	44	33	50	36	63	46
7/16	22	16	28	20	35	26	44	32	55	41	70	52	80	58	100	75
1/2	33	25	42	31	53	39	67	50	85	63	110	80	120	90	150	115
9/16	48	36	60	45	75	56	95	70	125	90	155	115	175	130	225	160
5/8	67	50	85	62	105	78	135	100	170	125	215	160	240	175	300	225
3/4	120	87	150	110	190	140	240	175	300	225	375	280	425	310	550	400
7/8	190	140	240	175	190	140	240	175	490	360	625	450	700	500	875	650
1	290	210	360	270	290	210	360	270	725	540	925	675	1050	750	1300	975
1-1/8	400	300	510	375	400	300	510	375	900	675	1150	850	1450	1075	1850	1350
1-1/4	570	425	725	530	570	425	725	530	1300	950	1650	1200	2050	1500	2600	1950
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2150	1550	2700	2000	3400	2550
1-1/2	1000	725	1250	925	990	725	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

Make sure fasteners threads are clean and that you properly start thread engagement. This will prevent

them from failing when tightening.

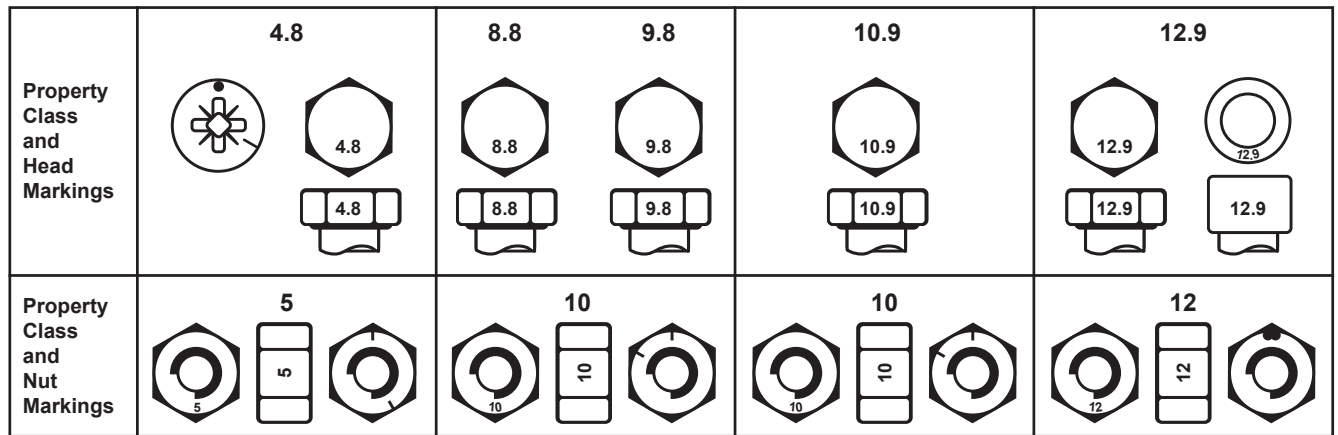
Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

<sup>a</sup> "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated without any lubrication.

<sup>b</sup> Grade 2 applies for hex cap screws (not hex bolts) up to 152 mm (6-in.) long. Grade 1 applies for hex cap screws over 152 mm (6-in.) long, and for all other types of bolts and screws of any length.



# Torque Values - Metric



Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated <sup>a</sup>		Dry <sup>a</sup>		Lubricated <sup>a</sup>		Dry <sup>a</sup>		Lubricated <sup>a</sup>		Dry <sup>a</sup>		Lubricated <sup>a</sup>		Dry <sup>a</sup>	
	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft
M6	4.8	3.5	6	4.5	9	6.5	11	8.5	13	9.5	17	12	15	11.5	19	14.5
M8	12	8.5	15	11	22	16	28	20	32	24	40	30	37	28	47	35
M10	23	17	29	21	43	32	55	40	63	47	80	60	75	55	95	70
M12	40	29	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	47	80	60	120	88	150	110	175	130	225	165	205	150	260	190
M16	100	73	125	92	190	140	240	175	275	200	350	255	320	240	400	300
M18	135	100	175	125	260	195	330	250	375	275	475	350	440	325	560	410
M20	190	140	240	180	375	275	475	350	530	400	675	500	625	460	800	580
M22	260	190	330	250	510	375	650	475	725	540	925	675	850	625	1075	800
M24	330	250	425	310	650	475	825	600	925	675	1150	850	1075	800	1350	1000
M27	490	360	625	450	950	700	1200	875	1350	1000	1700	1250	1600	1150	2000	1500
M30	675	490	850	625	1300	950	1650	1200	1850	1350	2300	1700	2150	1600	2700	2000
M33	900	675	1150	850	1750	1300	2200	1650	2500	1850	3150	2350	2900	2150	3700	2750
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2750	4750	3500

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

Make sure fasteners threads are clean and that you

properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

<sup>a</sup> "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated without any lubrication.

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