

HYDRAMASTER

Corporation
11015 47th Avenue W, Mukilteo, WA 98275

CM 302 Service Manual

Machine Serial Number _____

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HYDRAMASTER® Corporation
Mukilteo, Washington

182-302

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Revised October 8, 1998

REVISIONS DONE

January 20, 1998

CM 302

Service Manual:

Section 3, pp. 5, 10
Added item 95.

May 12, 1998

CM 302

Tech. Safety Manual:

Section 2, pp. 8, 9 Rev'd Propane Flow (ECR 1189)

Service Manual: (ECRs 978, 1039, 1122, 1161, 1174, 1189)

Section 3, pp. 12, 13-16, 17 Rev'd Engine, Mix Tank, Blwr/Pump Assys

Section 10, pp. 3, 4 Rev'd Propane Flow

Section 11, pp. 2-4 Rev'd Wiring Schematic and Diags (again)

Section 13, pp. 3-7 Added CA Emission Control Warranty

June 18, 1998

CM 302

Service Manual:

Section 3, pp. 18-21 Rev'd Cart/Recov Tank Assy as per Revs D-F (ECRs 1166, 1171, 1084).

Sept. 8, 1998

CM 302

Service Manual:

Section 3, p. 38 Updated spare parts list.

Oct. 8, 1998

SFs, CM302, Dag

Service Manual:

TOC

Section 6, all New Pump Info

REVISIONS DONE

May 27, 1997

CM 302

Installation Manual:

Section 2, p. 5 A caution for the ramp was added.
The Technician Training Form was slightly modified.

Technician's Safety Manual:

Section 4, p. 3 A caution for the ramp was added.
Section 5, p. 6-16 Info regarding the Carbon Monoxide Detector was added.
Section 8, p. 4-10 Added "NOX" definition to glossary.

Service Manual:

Section 2, p. 6-9 The Local Water Precautions Section was added.

July 22, 1997

CM 302

Installation Manual:

Section 2, pp. 4-8 Installation Options and Ramp

Technician's Safety Manual:

Section 4, pp. 2-6 Installation Options and Ramp

Service Manual:

Section 3, p. 35 CO Sensor Bracket Change

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Machine Specifications

CM 302

Section 1-1

Frame: 22"W x 29"L x 27"H
Steel with baked-on Epoxy finish

Weight: CM 302: 350 lbs.

Engine: Vanguard 14 HP Briggs and Stratton
Pressurized oil system
Spin-on filter and oil PSI protection switch

Ignition: Electronic, keystart

Vacuum Blower: Roots 33 RAI

Chemical System: Electro-mechanical, meter controlled

Heating System: 1 Stainless steel exhaust exchanger
1 Copper shell and tube exchanger
1 Copper and aluminum block exchanger

Instruments: Water Pressure Gauge, liquid filled, 0-1000 PSI
Hour Meter, machine runtime
Keyed Ignition, start/stop
Chemical Flowmeter, clear acrylic, 0-10 GPH

Recovery Cart: 35 Gallon Aluminum, Epoxy finish

Cleaning Wand: Stainless steel with heat shield
Replaceable grip
Rebuildable solution valve

Propane Cylinder: 30 lbs. Horizontal (D.O.T. approved)

High Pressure Hose: 1/4" High temperature lined / vinyl covered
Hose rated to 1250 PSI

Vacuum Hose: 2" reinforced, 1 1/2" reinforced.

Base Equipment Package: Machine Power Console
ECD Emissions Control Computer
Tank and Cart Assembly
Propane Cylinder
Carpet Wand
100 Ft Vacuum Hose
100 Ft Solution Line
Chemical Jug
Owner's Manuals

Indoor Equipment Package: HushKit Silencer Package
(With Base Package) APO Auto Pump-Out System

Commercial Equipment Package: Vehicle Mounting Rails
(With Base Package) Console Loading Rail Bridge
Console Loading Rollers
Tank and Cart Loading Ramp
Tank and Cart Mounting Bracket

High Volume In-House Equipment Package: Wheeled 302 Accessory Cart
(With Base Package) 50 Ft Additional Vacuum Hose
50 Ft Additional Solution Line

Precautions

CM 302

Section 2-1

PROPANE CAUTIONS

◆ **WARNING** ◆

Prior to machine start up, check the fuel tank, hoses and fuel lines for leaks.

◆ **WARNING** ◆

Always operate the machine in a well ventilated area.

◆ **WARNING** ◆

When the equipment is not in use remove the propane tank and store outside in an appropriate outdoor area. Do not store propane tanks indoors.

◆ **WARNING** ◆

Remove the propane tank from the equipment before refueling.

◆ **CAUTION** ◆

Do not fill propane container(s) to more than 80% capacity.

◆ CAUTION ◆

Propane cylinders must be stored in accordance with the National Fire Protection Association standard 58 chapter 5.

◆ CAUTION ◆

Transportation of portable propane cylinders must be in accordance with National Fire Protection Association standard 58 chapters 3 and 6.

◆ WARNING ◆

Carpet cleaning equipment should only be used by fully trained machine technicians.

◆ CAUTION ◆

Freezing this equipment can be costly. Take all necessary precautions to protect this equipment from freezing temperatures.

◆ WARNING ◆

During the operation of this equipment, many surfaces on the machine will become very hot. When near the equipment for any reason care must be taken not to touch any hot surface, such as heating systems, engine, exhaust, etc.

◆ WARNING ◆

It is unsafe to smoke in the vicinity of this equipment.

◆ WARNING ◆

Never touch any part of the machine that is in motion. Severe bodily injury may result.

◆ WARNING ◆

The engine exhaust from this product contains chemicals know to the State of California to cause cancer, birth defects or other reproductive harm.

◆ WARNING ◆

Escaping propane vapor can freeze skin tissue causing frost bite.

◆ WARNING ◆

Propane vapor is heavier than air and will collect in the lowest confined space in the event of a leak.

◆ WARNING ◆

Propane smell... If you smell gas:

- a) Extinguish any open flames, pilot lights, and all smoking materials.
- b) Do not touch electrical switches.
- c) Shut off the gas supply at the tank valve.
- d) Open doors and other ventilating openings.

- e) Leave the area until odor clears.
- f) Have the gas system checked and leakage source corrected before using again.

◆ WARNING ◆

All propane fuel system connections shall be checked periodically for leaks with soapy water or equivalent.

◆ WARNING ◆

Never use a match or flame to check for leaks.

◆ WARNING ◆

Propane container valves shall be closed when equipment is not in use and while transporting.

◆ WARNING ◆

Propane containers may only be filled by qualified persons.

◆ WARNING ◆

Always follow the engine manufacturers recommendations for proper engine maintenance and operation.

◆ CAUTION ◆

The owner of a propane carpet cleaning machine shall ensure that the technician has participated in a training course on the safe handling of propane and the proper operation of the equipment.

◆ CAUTION ◆

This unit weighs over 350 pounds. Care must be used when transporting this equipment. **Do not** try to lift the equipment!

Local Water Precautions

CM 302

Section 2-6

The quality of water varies greatly. Many areas have an excess of minerals in the water which results in what is commonly called "hard water." These minerals tend to adhere to the insides of heater coils and other parts of the machines causing damage and a loss of cleaning effectiveness. This influences the reliability and efficiency of equipment in direct proportion to the level of hardness.

HARD WATER ADVISORY

HydraMaster recognizes that any hard water deposits which might occur within the water system of our truckmounts is a serious problem. The precision technology of truckmount heat exchanger systems is intolerant of any foreign material. Hard water deposits will ultimately decrease the performance of the system and are expected to seriously lower the reliability of the machine.

To validate a machine's warranty, HydraMaster requires that all machines operating in designated "Hard Water Areas" (3.5 grains or more per gallon) be fitted with a water softening system or a properly installed magnetic-type de-scaler must be used and maintained. Periodic de-scaling or acid-rinsing alone is *not* adequate in these areas. HydraMaster does not recommend any particular type or brand, however the relative effectiveness of some types of magnetic de-scalers or softeners may require additional periodic use of de-scaling agents.

HydraMaster also recommends, in the strongest possible terms, that machines in *all areas* be fitted with a water softening system for improved operation and reliability.

HydraMaster has included five hard water test strips with your machine. These can be used to test the water in your immediate and surrounding areas as they

can vary greatly. Assume all water obtained from wells is hard.

◆ CAUTION ◆

Failure to take appropriate measures to prevent scale build up can result in **system failure and loss of warranty** on affected parts.

HARD WATER AREA MAP

The following map defines areas in the United States which compromise fluid related components such as hoses, fittings, heaters, pumps, valves and water cooled engines. For other countries, hard water area maps can be obtained from geological societies.

WATER SOFTENER

Cleaning efficiency and equipment life is increased, chemical use decreased, and the appearance of cleaned carpets enhanced when water softeners are incorporated in hard water areas. The manufacturer strongly urges the use of water softener units in areas exceeding 3½ grains per gallon. Failure to use a water softener in these areas will invalidate the machine's warranty. Using a hard water area map as a reference, determine the quality of water in your area and take action immediately, if necessary.

Reports from several of our machine users commending the results of the use of water softeners in conjunction with their machines prompts us to recommend the procedure to everyone in a "hard water" area.

The relatively low cost of a water softener service is more than made up for by an increased life of machine parts, reduced chemical costs and continued cleaning efficiency. The water softener will also increase the *effectiveness* of the cleaning chemicals, therefore less chemical will be needed.

Contact a water softener distributor in your area for information on the rental of a simple water treatment unit to carry in your truck. Be sure to change the water softener in accordance with the capability of the softener. For example: If the softener will treat 900 gallons of water and the machine uses an average of 30 gallons per hour, for an average of 5 hours a day, this equals 150 gallons per day. In 6 days the machine would use 900 gallons of water. Therefore, the softener would need to be changed every 6 working days for maximum softening.

WASTE WATER DISPOSAL ADVISORY

There are laws in most communities prohibiting the dumping of recovered "gray" water from carpet cleaning in any place but a sanitary treatment system.

This cleaning rinse water, recovered into your unit's vacuum tank, contains materials such as detergents. These must be processed before being safe for streams, rivers and reservoirs.

IN ACCORDANCE WITH THE EPA, STATE AND LOCAL LAWS, DO NOT DISPOSE OF WASTE WATER INTO GUTTERS, STORM DRAINS, STREAMS, RESERVOIRS, ETC.

In most cases, an acceptable method of waste water disposal is to discharge into a municipal sewage treatment system after first filtering out solid material such as carpet fiber. Access to the sanitary system can be obtained through a toilet, laundry drain, RV dump, etc. Permission should first be obtained from any concerned party or agency.

One disposal method which usually complies with the law is to accumulate the waste water and haul it to an appropriate dump site. Another solution to the disposal problem is to equip yourself with an Automatic Pump-Out System. These systems are designed to remove waste water from the extractor's recovery system and actively pump the water through hoses to a suitable disposal drain. Properly designed, they will continuously monitor the level of waste water and pump it out simultaneously to the cleaning operation. The

hidden benefit of this process is that the technician does not have to stop his cleaning to empty the recovery tank. HydraMaster makes an A.P.O. System available which can be ordered with new equipment or installed later.

The penalties for non-compliance can be serious. Always check local laws and regulations to be sure you are in compliance.

- e) Leave the area until odor clears.
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Never use a match or flame to check for leaks.

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WATER SOFTENER

Cleaning efficiency and equipment life is increased, chemical use decreased, and the appearance of cleaned carpets enhanced when water softeners are incorporated in hard water areas. The manufacturer strongly urges the use of water softener units in areas exceeding 3 1/2 grains per gallon. Using a hard water area map as a reference, determine the quality of water in your area and take action immediately, if necessary.

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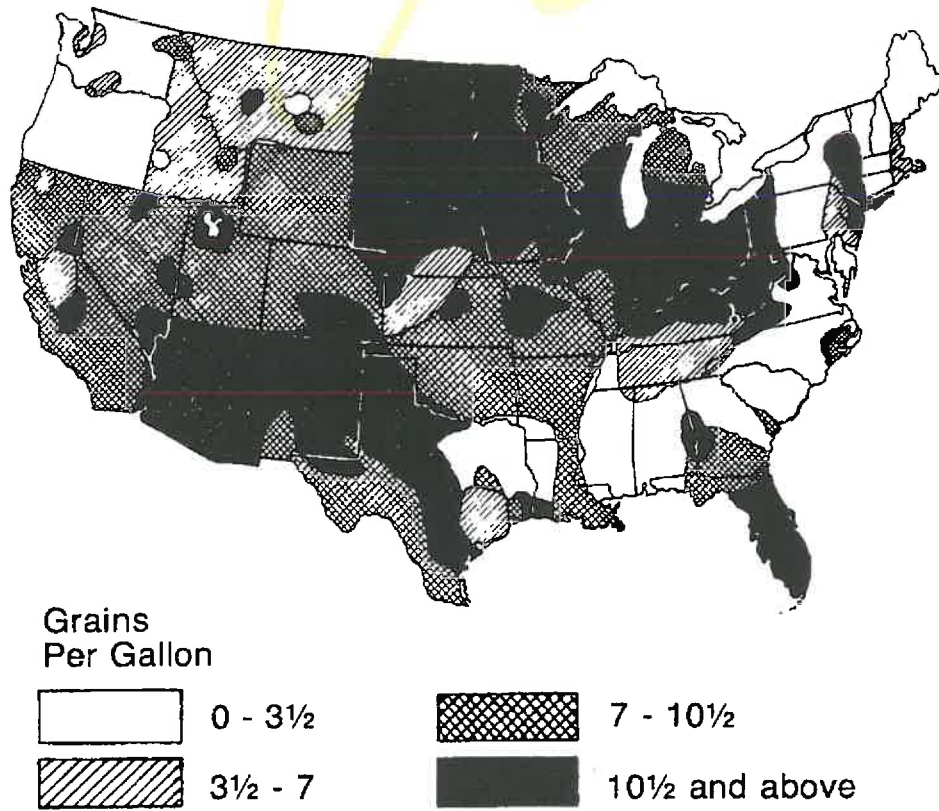
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Figure 1-1: Hard Water Map



Machine Parts

CM 302
Section 3-1

Figure 3-1: Final Machine Assembly

D3059, Rev A

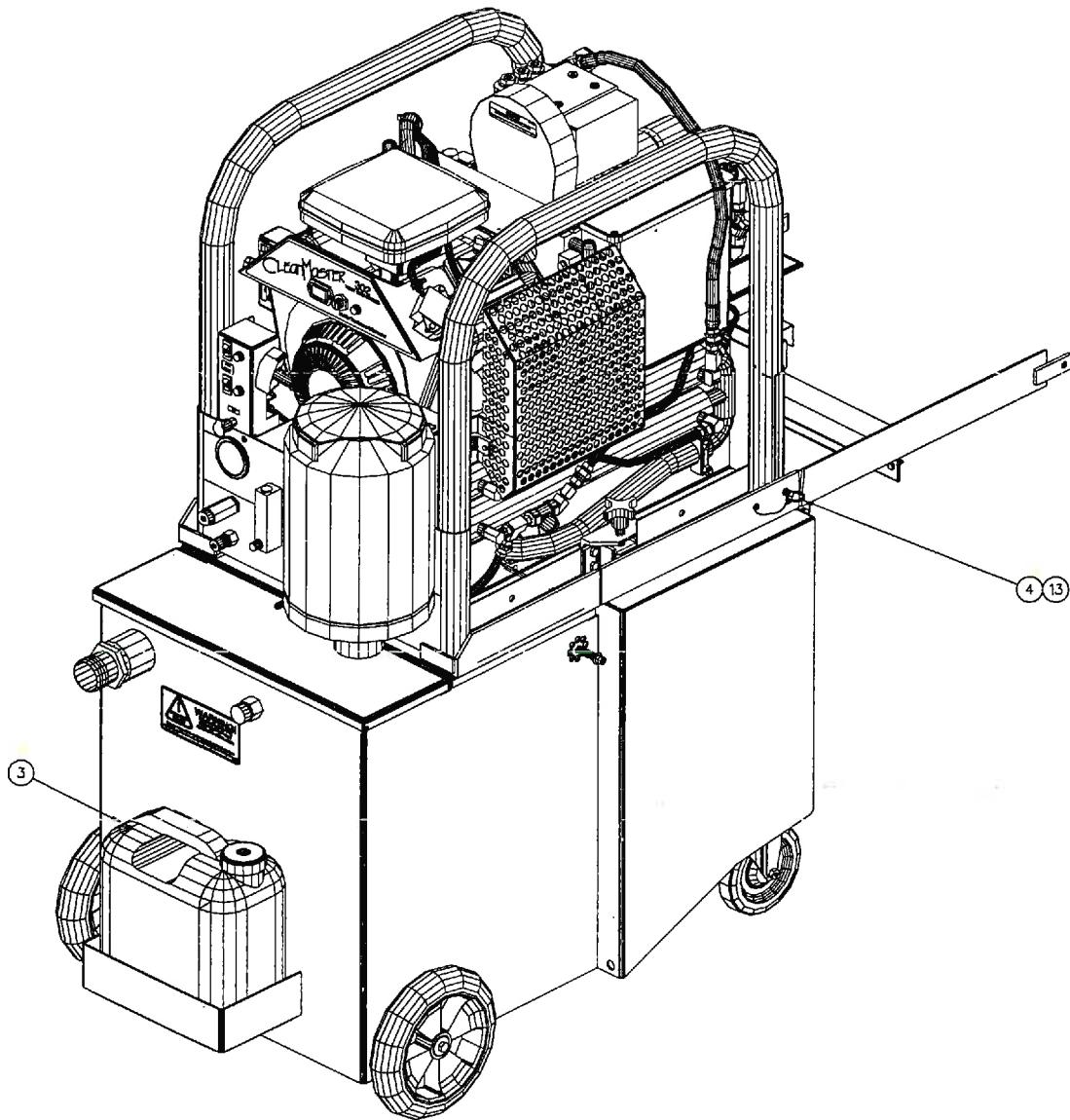
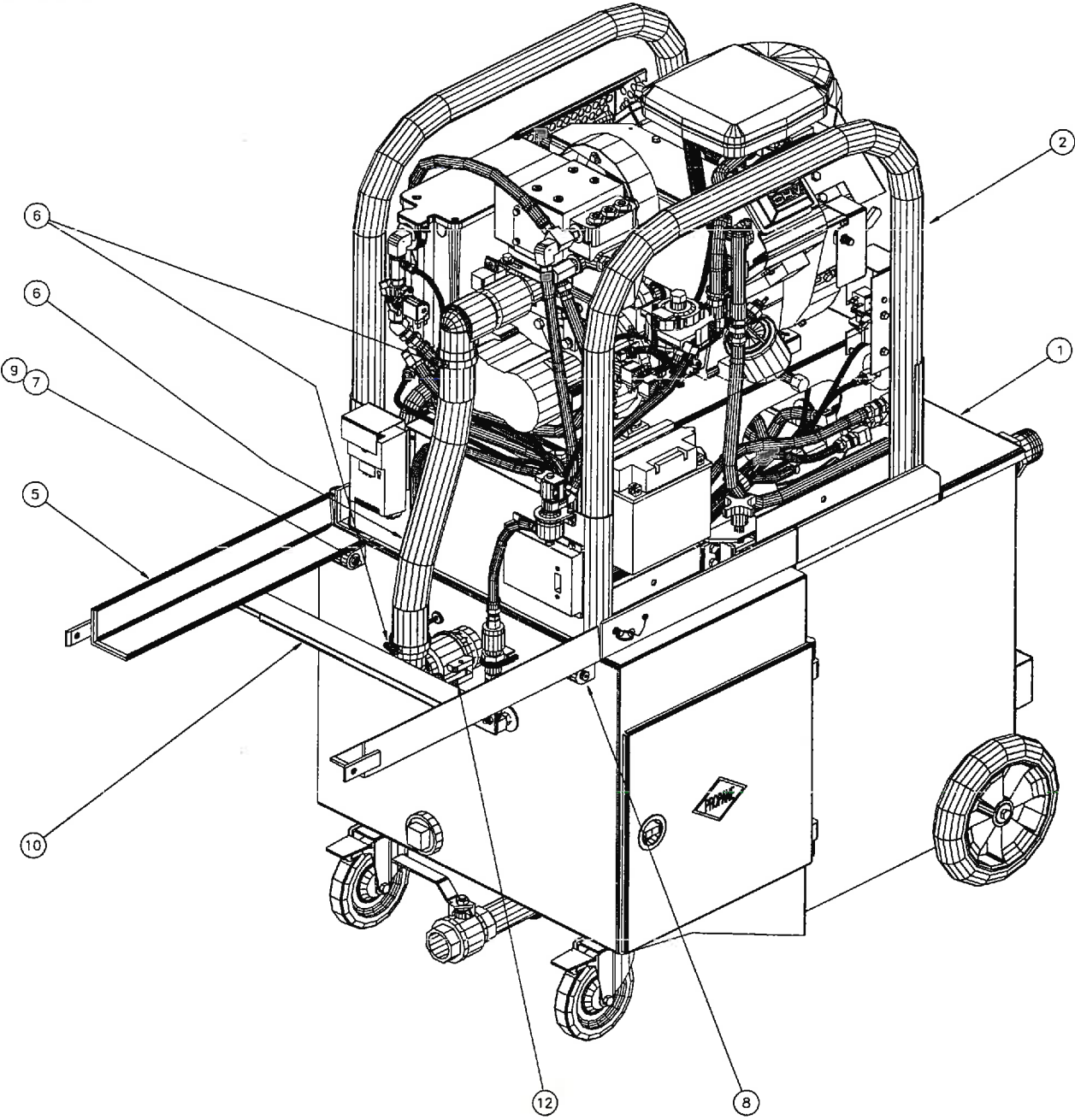


Figure 3-2
D3059, Rev A



Final Machine Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	Figure 3-11	Cart and Recovery Tank Assembly	1
2	Figures 3-3 to 6	Machine Assembly (Power Unit with Silencer)	1
3	159-023	Jug, 2½ Gallon Chemical	1
4	103-028	Pin Assembly, CM302 Machine to Tank/Cart	2
5	015-290	Bracket, Rail to Truckmount	1
6	068-276	Hose, 2" x 36" Air Vent	1
7	094-035	Nut, ⁵ / ₁₆ - 18 s/s Nylock Half	2
8	143-163	Bolt, ³ / ₈ " x 2" Shoulder with ⁵ / ₁₆ " Threads s/s	2
9	174-049	Washer, ⁵ / ₁₆ " s/s Flat	2
10	131-028	Gasket, Trimlok Recovery Tank Material	2 Ft
11	033-010	Clamp, Size 32 Hose	2
12	052-498	Coupler, 90 Deg. Female Cam 90 x 2" Hose	1
13	143-533	Screw, 10-24 x ¼" Pan Hd Phillips	2

Figure 3-3: Machine Assembly

D3060, Rev B

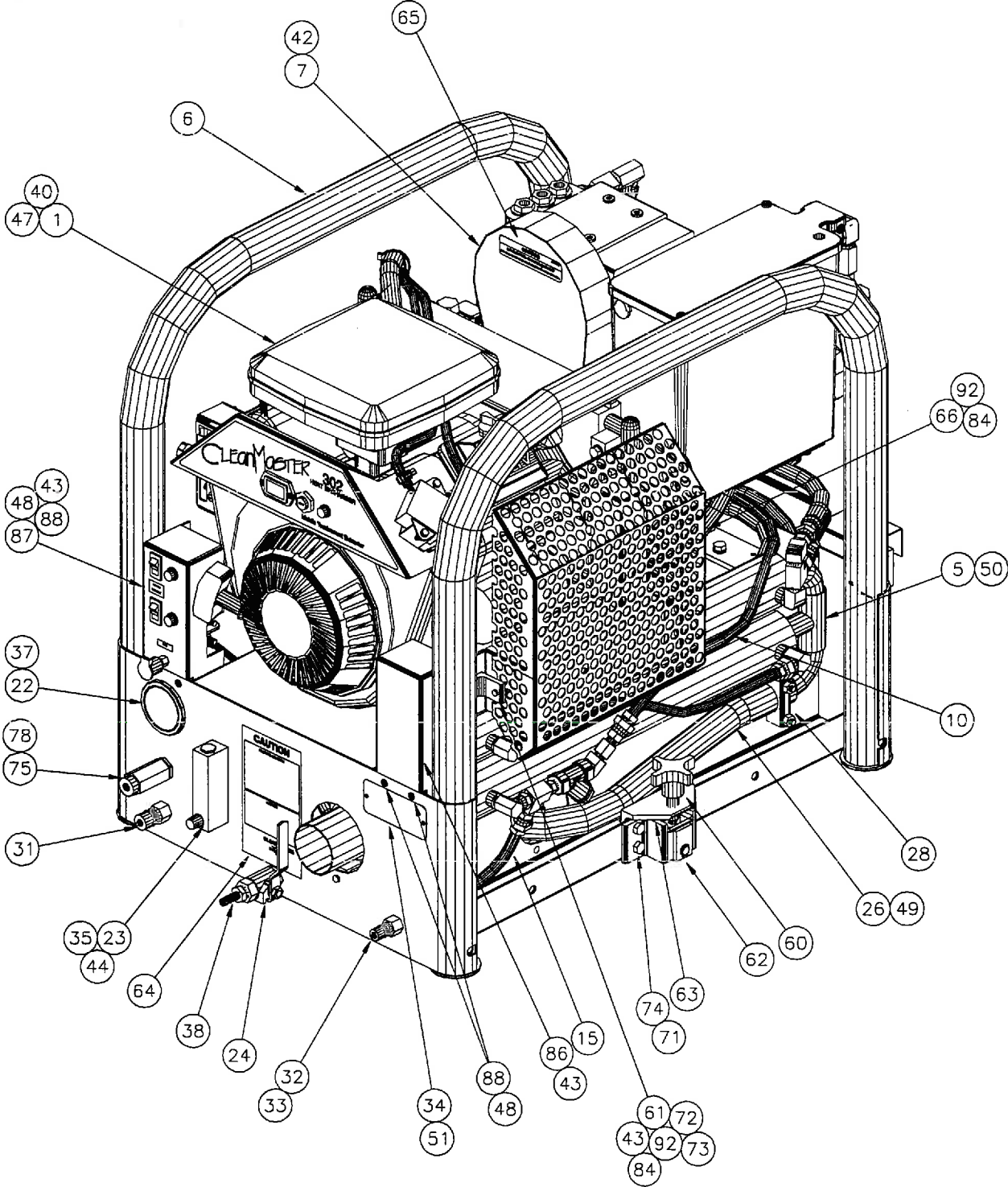


Figure 3-4
D3060, Rev C

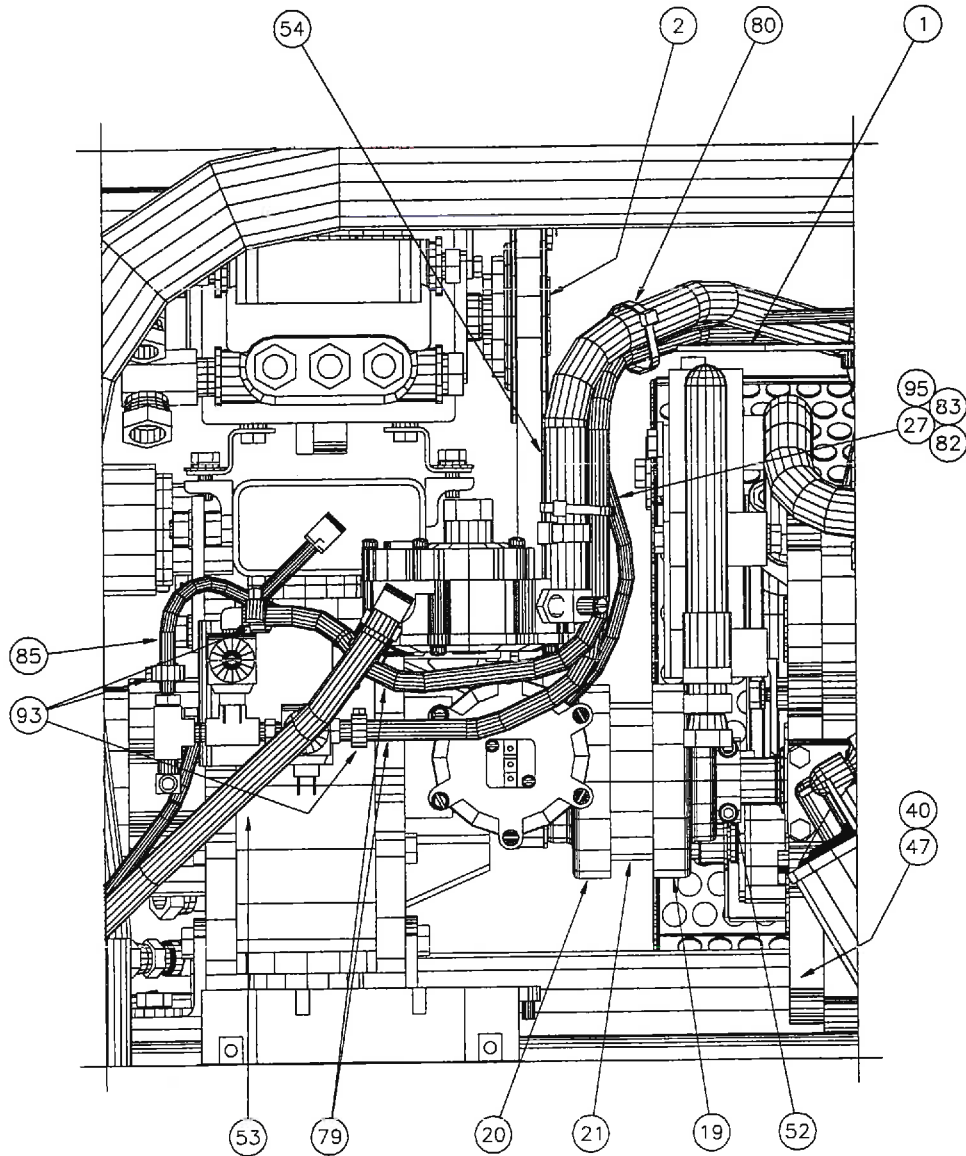


Figure 3-5

D3060, Rev B

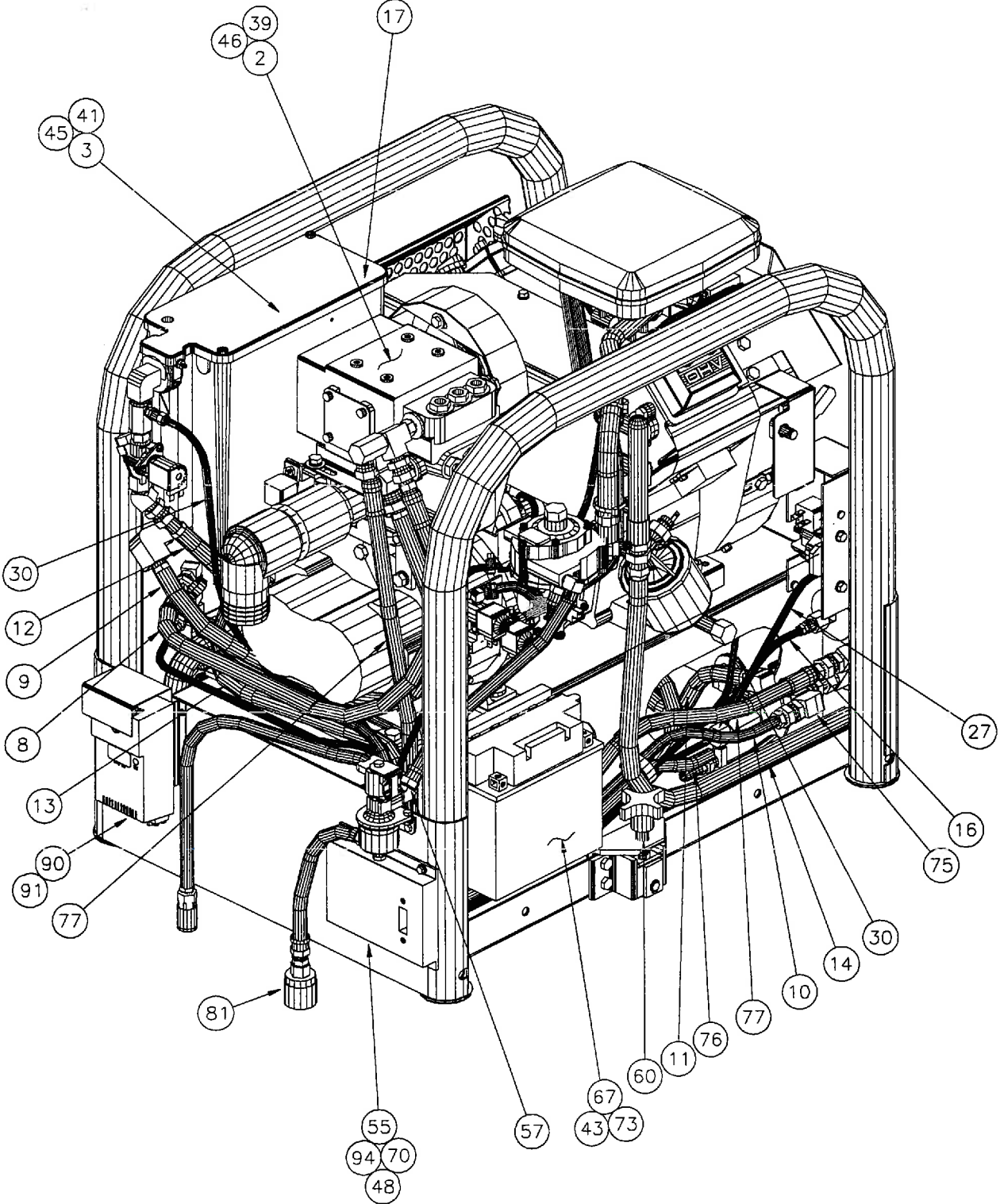
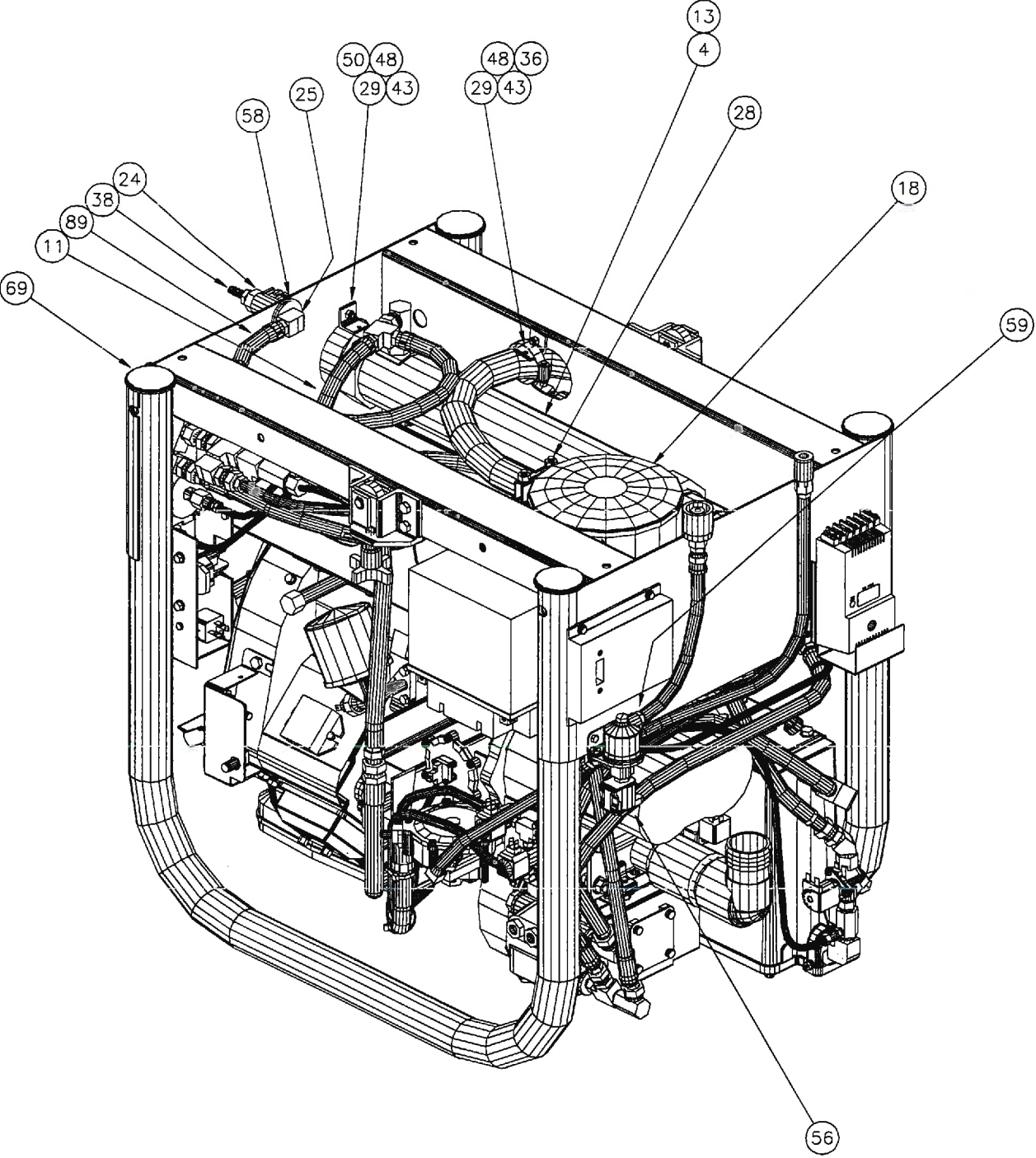


Figure 3-6

D3060, Rev B



Machine Assembly Parts List

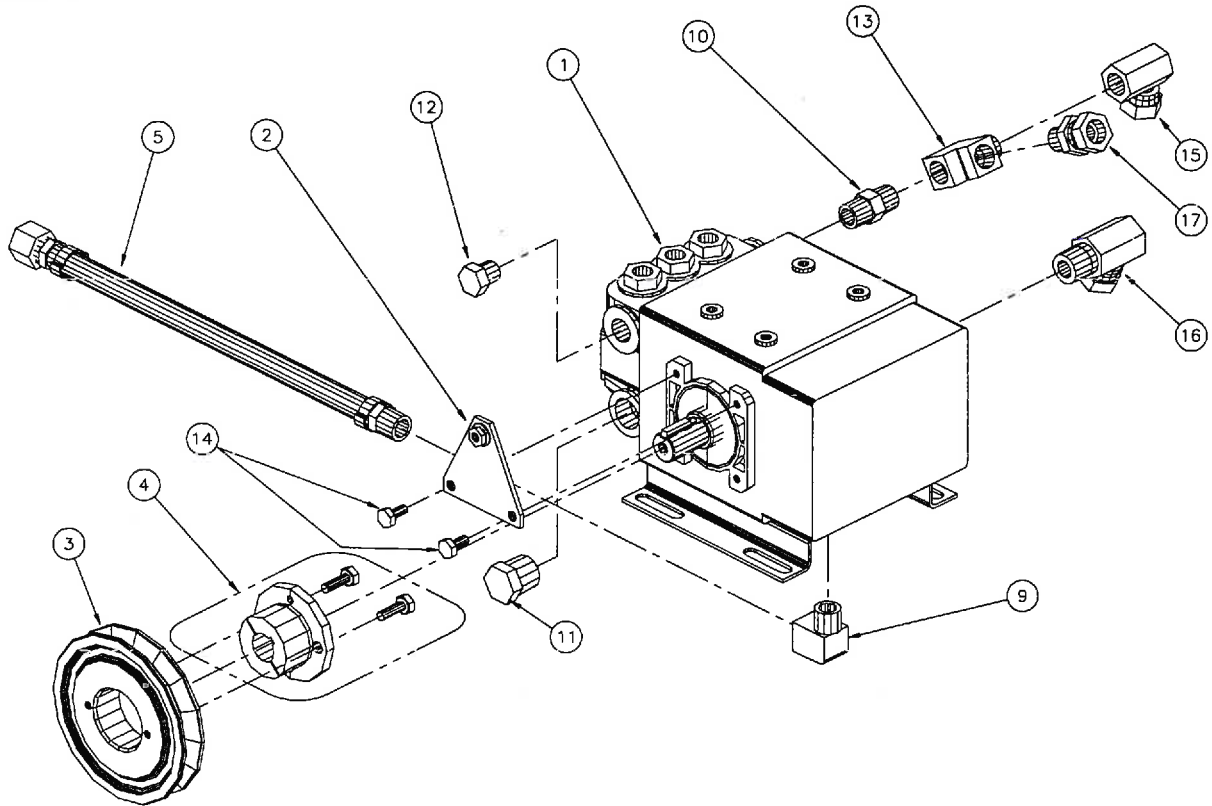
ITEM	PART NO	DESCRIPTION	QTY
1	Figure 3-8	Engine Assembly	1
2	Figure 3-9	Blower and Pump Assembly	1
3	Figure 3-10	Mix Tank Assembly	1
4	Figure 3-17	Lower Heat Exchanger Assembly	1
5	Figure 3-18	Dual Heat Exchanger Assembly	1
6	055-019	Frame	1
7	108-041	Protector, Belt Guard	1
8	068-301	Hose, 3/8" x 32" Throb High Pressure Portable	1
9	068-411	Hose, 3/4" x 25 1/2" Pump Pickup with 1/2" Ends	1
10	068-074	Hose, 3/8" x 62" Teflon	1
11	068-297	Hose, 1/2" x 8" Red with 3/8" Ends	1
12	068-262	Hose, 1/2" x 24" Red with 3/8" End, 1/2" Thr. End	1
13	068-264	Hose, 1/2" x 69" Red with 3/8" Ends	1
14	068-265	Hose, 1/2" x 23" Black with 3/8" Ends	1
15	068-267	Hose, 3/8" x 9" Teflon	1
16	068-175	Hose, Sol. Valve to Rotary Union	1
17	-----	Hose Assembly, Radiator Fill	1
18	093-027	Silencer, 2" Compact - Quiet	1
19	039-017	Coupler, #6 x 1"	1
20	039-014	Coupler, #6 x 3/4"	1
21	152-008	Sleeve, #6 Drive Coupler	1
22	074-003	Gauge, High PSI (0-1000)	1
23	074-013	Meter, Chemical Flow	1
24	169-064	Valve, 3/8" Full Port Ball	1
25	052-086	Elbow, 3/8" Brass Street	1
26	068-260	Hose, 1 1/4" x 32 1/2" s/s Exhaust Flex	1
27	068-030	Hose, 5/32" Rubber/Vacuum	1
28	033-027	Clamp, 1 3/8" Muffler	2
29	015-236	Bracket, Air Duct Mount	2
30	068-015	Hose, 1/4" Rubber	5 Ft
31	052-052	Quick Connect, 660 Male with Viton - Standard	1
32	052-050	Quick Connect, 440 Male with Viton Standard	1
33	052-013	4M-6UFS	1
34	105-012	Plate, Machine Serial ID	1
35	052-097	Insert, #24	2

ITEM	PART NO	DESCRIPTION	QTY
36	033-009	Clamp, Size 24 Hose	1
37	052-066	Coupler, 1/8 x 1/4 Female Brass	1
38	052-104	Insert, #66	1
39	143-027	Screw, 7/16 - 14 x 1 1/4" HHC	4
40	143-020	Screw, 3/8 - 16 x 1 1/2" HHC Grade 5 Zinc	4
41	143-012	Screw, 5/16 - 18 x 3/4" HHC s/s	2
42	143-141	Screw, 1/4 - 20 x 1/2" Whiz Lock	2
43	143-126	Screw, 10 - 24 x 1/2" s/s HHC	5
44	143-059	Screw, 10 - 32 x 3/8" HHC - Slotted	2
45	174-018	Washer, 5/16" s/s Lock	2
46	094-018	Nut, 7/16 - 14 Hex	4
47	094-015	Nut, 3/8 - 16 Two-Way Lock Zinc Plated Steel	4
48	094-034	Nut, 10 - 24 s/s Nylock	8
49	131-046	Ins. Sleeving, .054" x 1 1/2" Exh. Tube Wrap	3 Ft
50	033-012	Clamp, Size 44 Hose	3
51	140-015	Rivet, 1/8" x 1/4" Aluminum Pop	2
52	020-012	Collar, Engine Shaft - Double Screw Type	1
53	068-392	Hose, Prop. Solenoid to Propane Regulator	1
54	068-393	Hose, Propane Reg. To Carburetor Inlet	1
55	149-030	Sensor, Electronic Emission Control Device	1
56	169-030	Valve, Beam Filterlock Propane Shut-Off	1
57	052-491	Elbow, 3/8" Flare x 1/4" x 45 Degree MPT	1
58	174-008	Washer, 5/8 Flat	2
59	052-490	Nipple, 3/8" Flare x 1/4" MPT	1
60	061-021	Knob, Lifting Mechanism - Lift	2
61	015-287	Bracket, Lower Catalytic Guard	1
62	Figure 3-16	Jack Bearing Assembly	2
63	015-273	Bracket, Jack Screw - Lifting Mechanism	2
64	081-075	Label Set, CM 302 4-Piece	1
65	081-032	Label, Caution - Hot Surface and Rotating Equip.	1
66	108-051	Protector, Catalytic Housing Guard	1
67	013-010	Box, Battery	1
68	-----	Battery, 12 Volt (not included)	1
69	106-040	Plug, Frame End	4
70	143-132	Screw, 10 - 24 x 3/4" HHC s/s	4
71	094-023	Nut, 5/16 - 18 Whiz	8

ITEM	PART NO	DESCRIPTION	QTY
72	094-027	Nut, 10 - 24 s/s Hex	1
73	174-001	Washer, #10 s/s Flat	3
74	143-160	Screw, ⁵ / ₁₆ - 18 x 1" HHCS Grade 8	8
75	Figure 5-2	By-Pass Valve Assembly	1
76	-----	Dump Hose Assembly	1
77	068-295	Hose, ³ / ₈ " x 46" Throb	1
78	174-028	Washer, ⁷ / ₈ " ID Flat s/s x 1 1/2" OD x .09 Thk	1
79	068-026	Hose, 1/4" Rubber Fuel Line	3 Ft
80	162-002	Tie Wrap, 6" Nylon	2
81	068-391	Hose, Tank/Cart to Propane Solenoid	1
82	052-138	Insert, #22 (¹ / ₈ " NPT x ¹ / ₈ " Barb)	1
83	052-137	Insert, #12 (¹ / ₁₆ " NPT x ¹ / ₈ " Barb)	1
84	174-013	Washer, ³ / ₈ Fender	2
85	068-030	Hose, ⁵ / ₃₂ " Rubber Vacuum	6"
86	041-194	Cover, Right Front Heat Exchanger	1
87	Figure 3-20	Starter Solenoid Cover Assembly	1
88	143-128	Screw, 10 - 24 x ⁵ / ₈ " Btn Hd Cap	4
89	068-298	Hose, 1/2" x 18" Yellow with ³ / ₈ " Ends	1
90	Figure 3-22	Carbon Monoxide Detector Assembly	1
91	143-050	Screw, 8 - 32 x 1/2" Round Head Mach.	4
92	143-148	Screw, ⁵ / ₁₆ -18 x 1/2" HHCS s/s	2
93	033-003	Clamp, Size 4 Mini Hose	6
94	174-036	Washer, #10 s/s Flat - Rubber Back	8
95	052-135	Insert, ³ / ₁₆ " x ³ / ₁₆ " - Barb to Barb	1

Figure 3-7: Pump Assembly

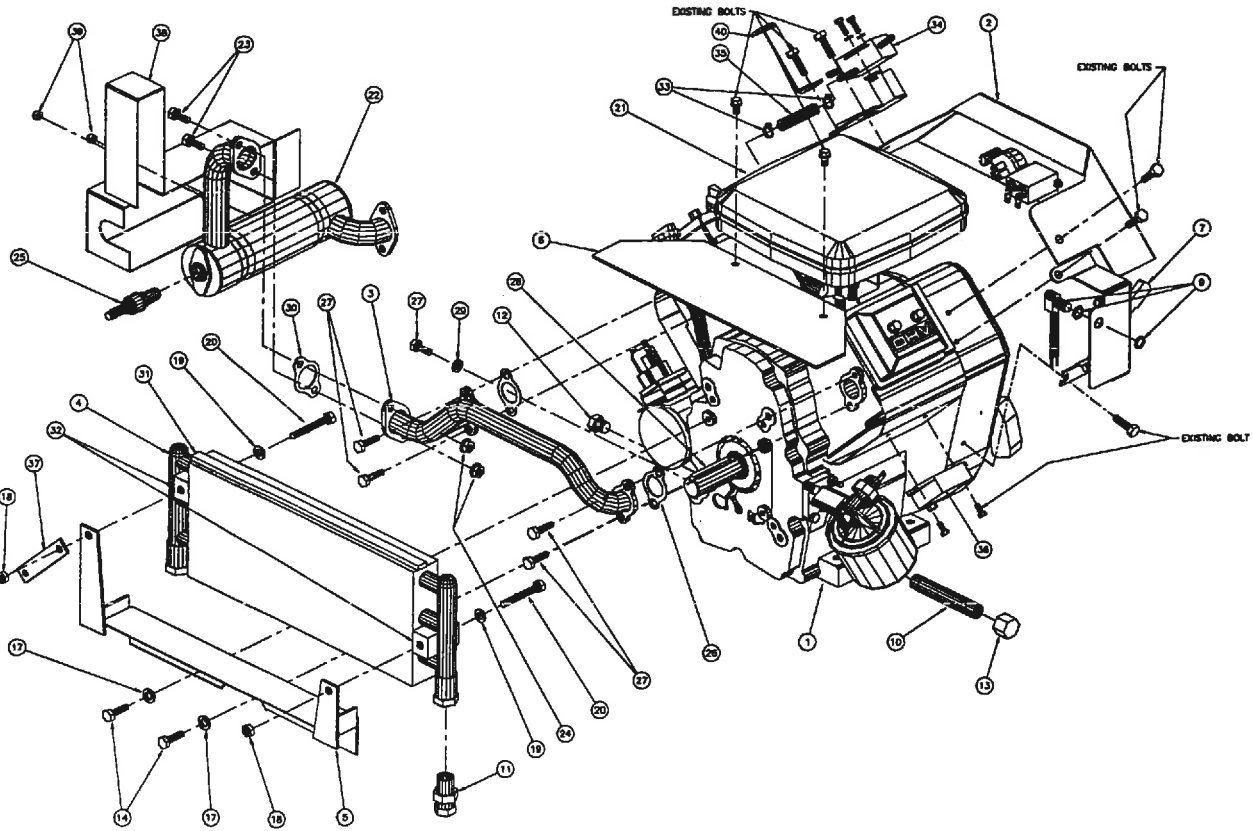
C3239, Rev B



ITEM	PART NO	DESCRIPTION	QTY
1	111-041	Pump, Triplex 3.5 GPM	1
2	154-057	Spacer, Upper Belt Guard - Triplex Pump	1
3	109-020	Pulley, AK46H Pump	1
4	020-021	Bushing, H x 3/4" Hub	1
5	068-219	Hose, Pump Drain	1
9	052-086	Elbow, 3/8" Brass Street	1
10	052-074	Nipple, 3/8 Brass Hex	1
11	106-004	Plug, 1/2" Brass	1
12	106-003	Plug, 3/8" Brass	1
13	052-023	Tee, 3/8" Male Branch - Brass	1
14	143-221	Screw, 6M - 1 x 13mm HHCS	2
15	052-026	6FA-6UFS	1
16	052-036	8MA-8UFS	1
17	052-019	6M-6UFS	1

Figure 3-8: Engine Assembly

D3088, Rev D

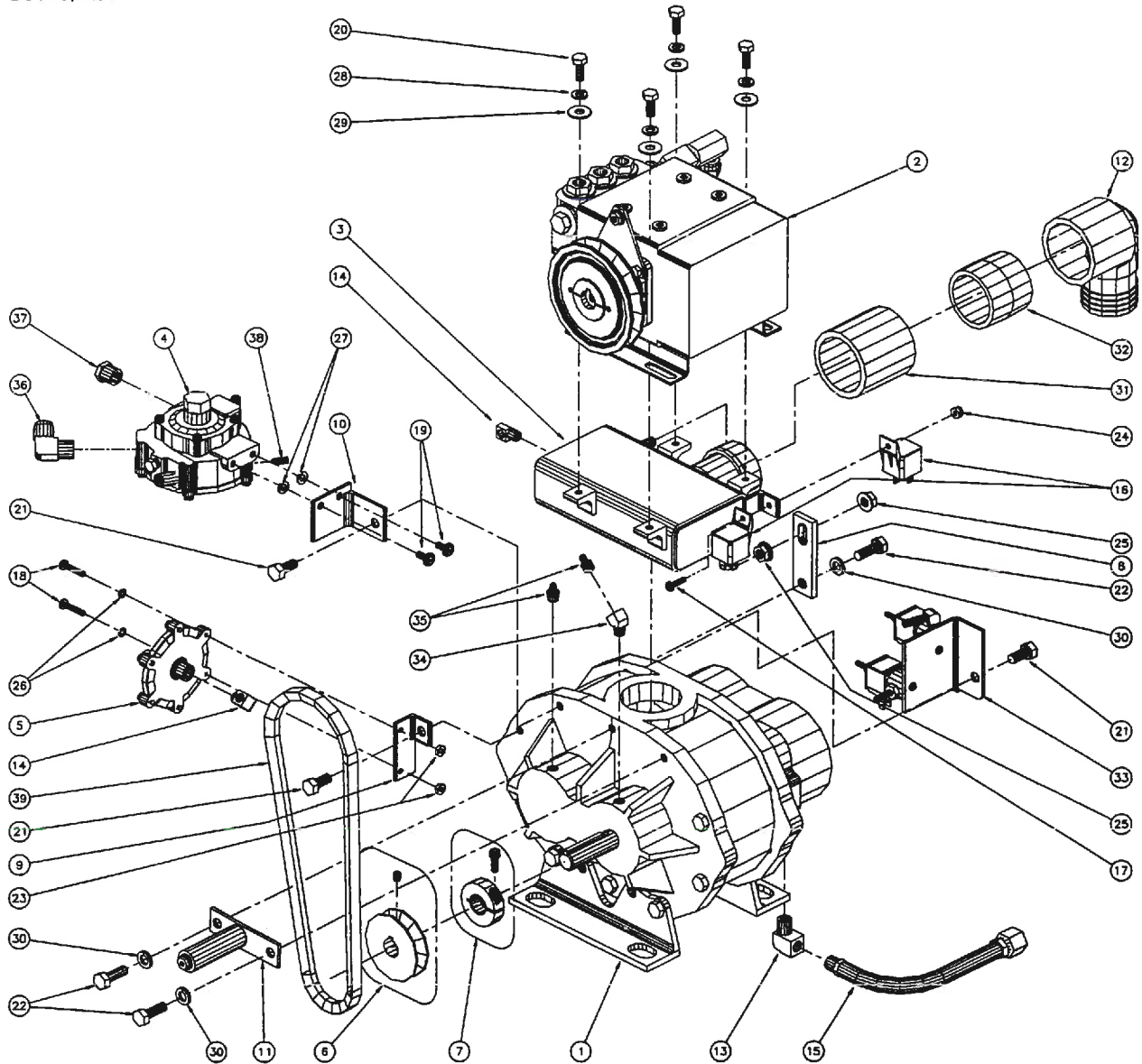


Engine Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	047-010	Engine, B & S 14HP Propane Vanguard	1
2	Figure 3-13	Dash Assembly	1
3	090-034	Manifold, CM 302 Exhaust Mod.	1
4	113-002	Radiator	1
5	015-242	Bracket, Lower Radiator Mount	1
6	041-202	Cover, Secondary Silencer - 8" Tank Hd	1
7	-----	Throttle Box Modification	1
9	157-009	Switch, Momentary, Normally Closed	1
10	052-408	Nipple, 3/8" x 4" Brass	1
11	052-032	8M-6UFS	1
12	106-003	Plug, 3/8" Brass	1
13	027-008	Cap, 3/8" Brass Pipe	1
14	143-090	Screw, 5/16-24 x 1" HHCS	2
17	174-018	Washer, 5/16" s/s Lock	2
18	094-035	Nut, 5/16-18 s/s Nylock Half	2
19	174-049	Washer, 5/16" s/s Flat	2
20	143-092	Screw, 5/16" x 2 1/4" HHCS s/s	2
21	Figure 3-15	Propane Conversion Assembly	1
22	090-038	Manifold, Catalytic Conv. Assembly	1
23	143-012	Screw, 5/16-18 x 3/4" HHC s/s	2
24	094-023	Nut, 5/16 - 18 Whiz	2
25	149-031	Sensor, Non-Heated Oxygen	1
26	057-010	Gasket, Exhaust Manifold - Vanguard	2
27	143-185	Screw, 8mm x 20mm, Grade 8.8 HHCS	5
28	077-006	Key, Briggs 16 HP Engine	1
29	174-018	Washer, 5/16" s/s Lock	1
30	057-016	Gasket, P-220 Exhaust Manifold	1
31	057-026	Gasket, 1/2" x 18 1/8" x 1/4" Kawasaki Brow Seal	1
32	012-003	Block, Rubber - Radiator Mount Pad	2
33	162-001	Tie Wrap, 4" Nylon	2
34	111-015	Pump, Mod. Fuel Pulse for ECD	1
35	068-019	Hose, 1/4" Rubber Vacuum	1
36	-----	Voltage Regulator Modification	1
37	015-288	Bracket, Upper Catalytic Guard	1
38	108-035	Protector, Catalytic Converter Heat Shield	1
39	094-090	Nut, 10-24 Acorn - Chrome	2
40	015-420	Bracket, Catalytic Heat Shield Stabilizer	1

Figure 3-9: Blower and Pump Assembly

D3148, Rev B

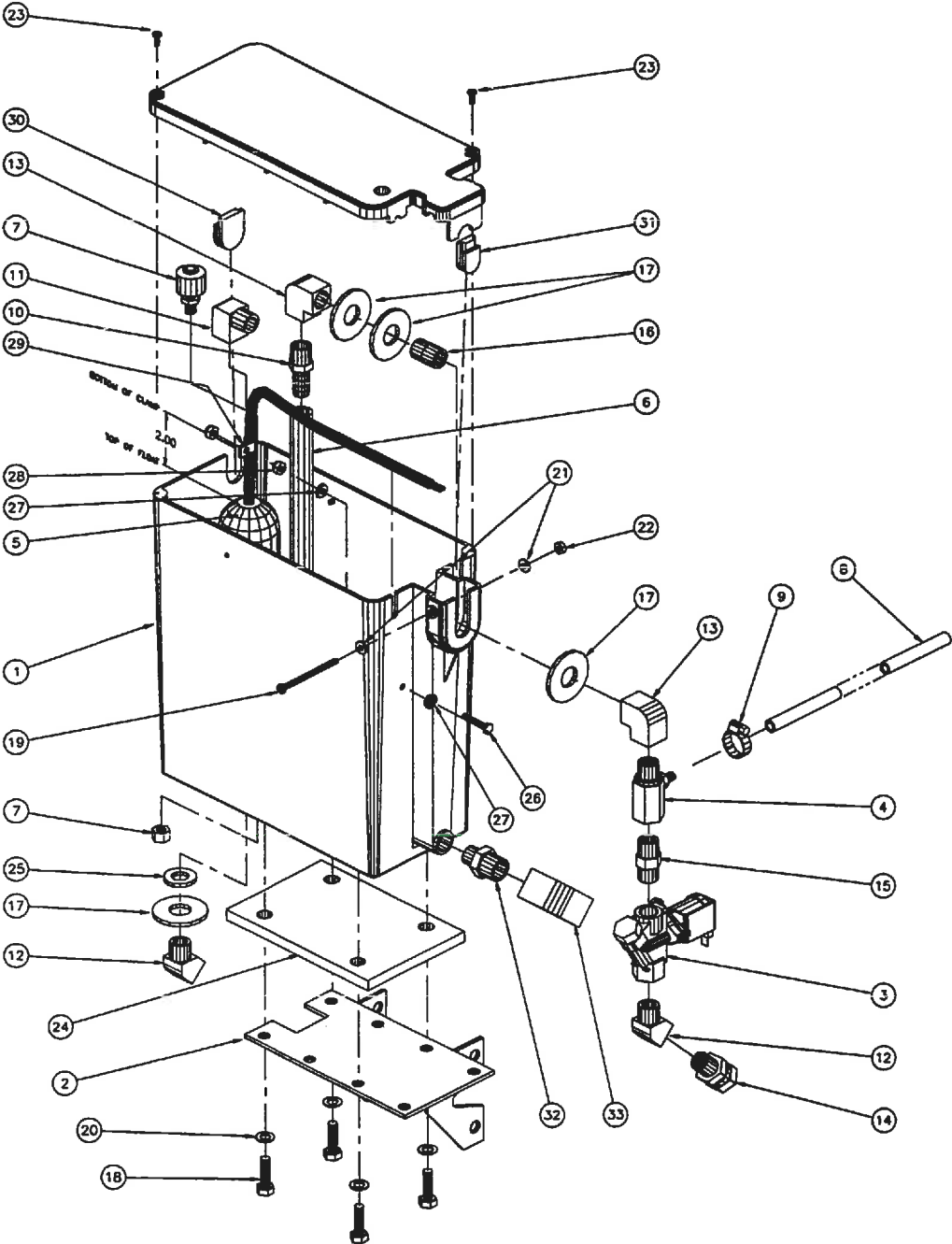


Blower and Pump Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	111-020	Blower, 3.2 Roots	1
2	Figure 3-7	Pump Assembly	1
3	015-266	Bracket, Pump Mnt Collector Box - Triplex Pmp	1
4	135-005	Regulator, Engine Propane B&S 14 HP	1
5	157-018	Switch, Micro - Vacuum Solenoid	1
6	109-004	Pulley, 2 3/4" x 3/4" - Pump Drive	1
7	020-011	Collar, Blower Shaft - Single Screw Type	1
8	015-267	Bracket, Mount Straps - Pump Mnt with Triplex	1
9	015-280	Bracket, CM 302 Vacuum Switch Mount	1
10	015-279	Bracket, CM 302 Propane Regulator Mount	1
11	154-052	Spacer, Lower Belt Guard	1
12	052-222	Elbow, 2" Comb - Insert x FPT	1
13	052-085	Elbow, 1/4" Brass Street	1
14	052-084	Elbow, 1/8" Brass Street	2
15	068-221	Hose, 3/8" x 24" Pump Drain	1
16	157-022	Switch, Relay	2
17	143-126	Screw, 10-24 x 1/2" s/s HHC	1
18	143-224	Screw, 5mm x .8mm x 25mm Slot Head	2
19	143-317	Screw, 1/4-20 x 1/2" Pan Hd, Zinc Plated, Phil.	2
20	143-012	Screw, 5/16 - 18 x 3/4" HHC s/s	4
21	143-017	Screw, 3/8 - 16 x 3/4" HHC	3
22	143-019	Screw, 3/8-16 x 1 1/4" HHC, Grade 5 Zinc	3
23	094-067	Nut, 5mm x .8mm	2
24	094-034	Nut, 10-24 s/s Nylock	1
25	094-016	Nut, 3/8 - 16 Whiz	2
26	174-014	Washer, #10 s/s Lock	2
27	174-017	Washer, 1/4" Lock	2
28	174-018	Washer, 5/16" s/s Lock	4
29	174-004	Washer, 5/16 Flat	4
30	174-021	Washer, 3/8 Lock	3
31	052-205	Coupler, 2" Aluminum	1
32	052-228	Nipple, 2" Close PVC SCH 80	1
33	Figure 3-21	ECD Solenoid Assembly	1
34	052-078	Elbow, 1/8" Brass 45 Street	1
35	-----	Grease Fitting (Included with 111-020)	2
36	052-495	Elbow, 1/2" Flare x 3/8" MPT 90 Deg.	1
37	052-061	Bushing, 3/8 M x 1/4 F Brass	1
38	-----	Insert, 1/4" Hose (Part of Kit 078-350)	1
39	010-060	Belt, #9305 - Pump Drive	1

Figure 3-10: Mix Tank Assembly

D2795, Rev H

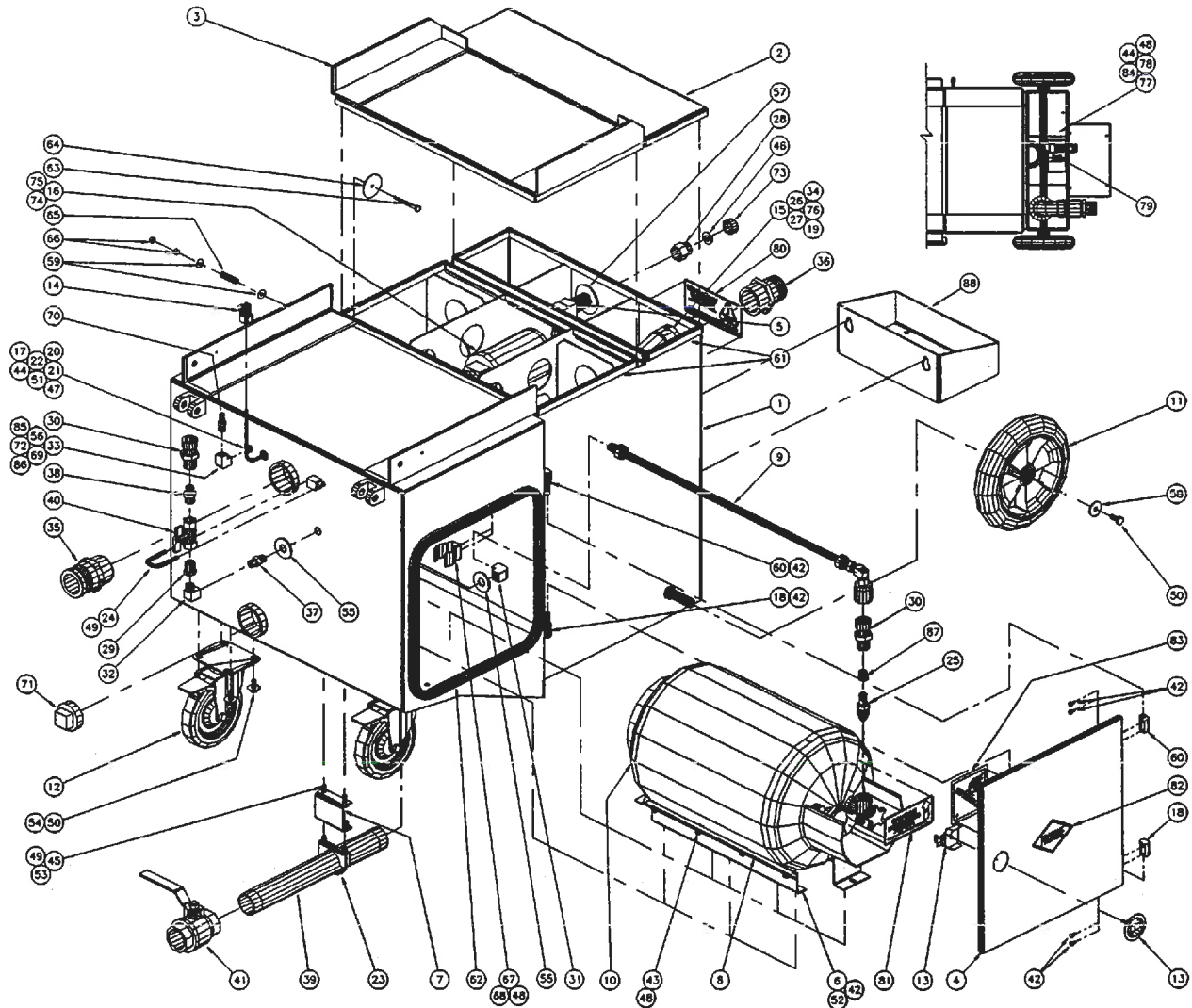


Mix Tank Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	159-042	Tank, SF Mix - Mod.	1
2	015-299	Bracket, Mix Tank Mount	1
3	169-120	Valve, Chemical System Solenoid - 12 v	1
4	181-008	Venturi, Low PSI Injector	1
5	157-0012	Switch, Tetherd Float Heavy-Duty Liquid Level	1
6	068-327	Hose, ½ " Clear Braid	1
7	157-004	Switch, Mini Liquid Level Reed Kill	1
8	068-015	Hose, ¼ " Rubber	1
9	033-004	Clamp, Size 6 Mini Hose	1
10	052-105	Insert, #68	1
11	052-086	Elbow, ⅜" Brass Street	1
12	052-083	Elbow, ⅜" Brass 45 Street	2
13	052-142	Elbow, ⅜" F x F Brass	2
14	052-019	6 M - 6 UFS	1
15	052-074	Nipple, ⅜" Brass Hex	1
16	052-077	Nipple, ⅜" Brass Close	1
17	174-034	Washer, .688 ID x 1.5 OD x .078 Thick s/s	4
18	143-143	Screw, 5/16 - 18 x 1" HHC s/s	4
19	143-311	Screw, #8 - 32 x 2½" PANHMS	1
20	174-059	Washer, 5/16" s/s External Star	4
21	174-047	Washer, #8 Flat	2
22	094-059	Nut, #8 - 32 Nylock	1
23	143-314	Screw, #8 x ½" PNHD	2
24	057-028	Gasket, Mix Tank to Bracket Vibration Dmp.	1
25	057-055	Gasket, Garden Hose	1
26	143-134	Screw, 10-24 x 1" HHCS s/s	1
27	174-036	Washer, #10 s/s Flat - Rubber Back	2
28	094-034	Nut, 10-24 s/s Nylock	2
29	033-021	Clamp, ¼ Nylon Hose	1
30	106-039	Plug, Mix Tank 0.75"	1
31	106-038	Plug, Mix Tank 0.41"	1
32	052-075	Nipple, ⅜" x ½" Brass Hex	1
33	052-143	Elbow, ½" F x F Brass	1

Figure 3-11: Cart and Recovery Tank Assembly

D3061, Rev F



Cart and Recovery Tank Assembly Parts List

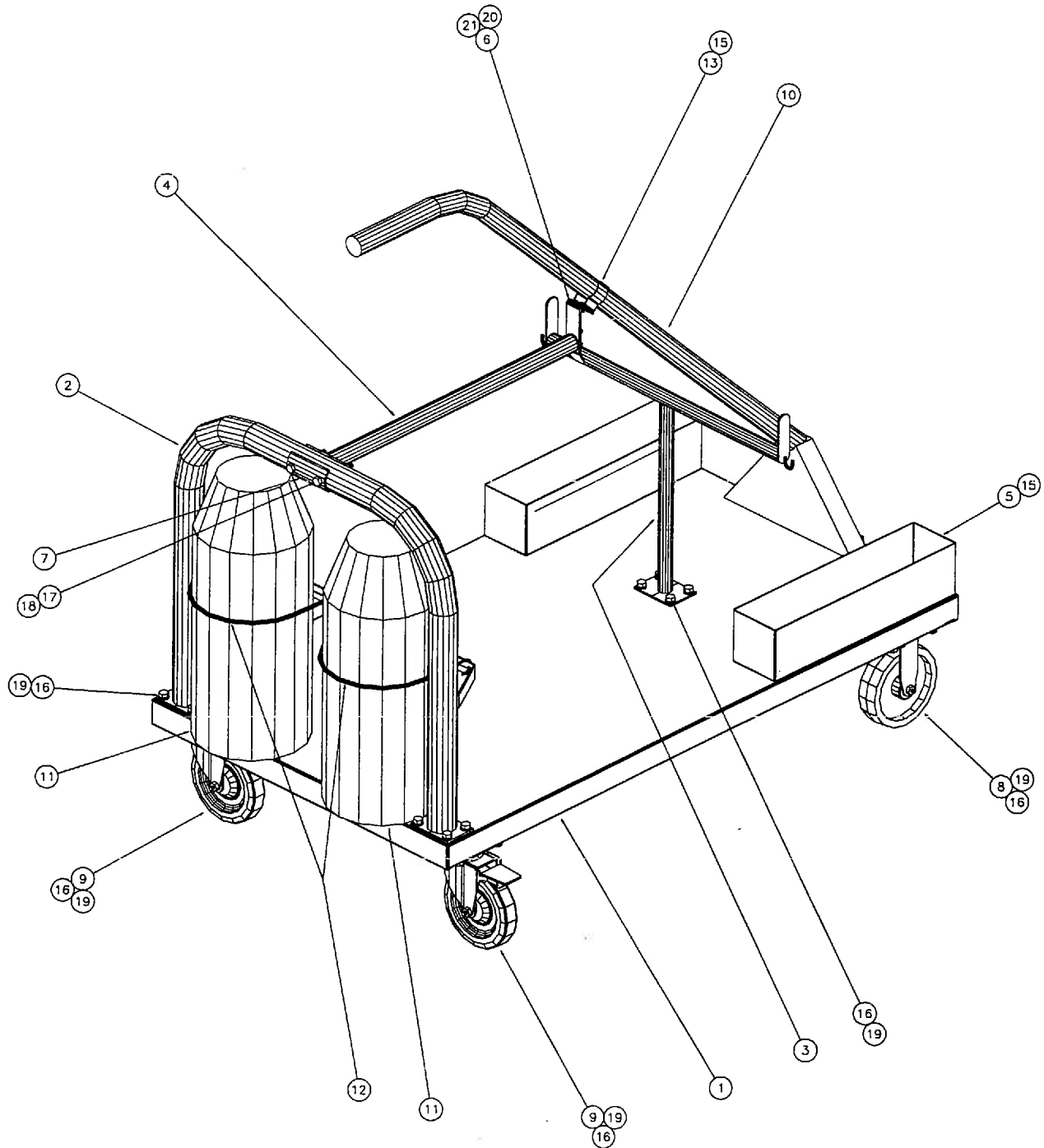
ITEM	PART NO	DESCRIPTION	QTY
1	159-047	Tank and Cart - CM 302	1
2	041-201	Cover, CM 302 Front Recovery Tank	1
3	041-197	Cover, CM 302 Rear Recovery Tank	1
4	041-199	Cover, CM 302 Side Access	1
5	Figure 3-14	APO Assembly	1
6	015-268	Bracket, CM 302 Propane Tank	2
7	015-269	Bracket, CM 302 Waste Wtr Drain Pipe Hngr	1
8	114-001	Rail, CM 302 Propane Tank Guide	2
9	068-391	Hose, Propane - Tank/Cart to Propane Sol.	1
10	159-012	Propane Tank, 30 lb CM 302 Horizontal	1
11	177-026	Wheel, 10 x 2 - 1/8 Smooth Tread Balloon Tire	2
12	177-025	Caster, CM 302 with Brake	2
13	086-014	Latch, Access Door	1
14	037-050	Connector, 4 Pole Male - Water Tight	1
15	049-030	Filter Bag, 92+ Truckmount	1
16	049-007	Filter, s/s Vacuum Pump - Blower	1
17	060-007	Grommet, 3/8" Rubber	1
18	067-017	Hinge Set, Left - Recovery Tank	2
19	125-014	Pipe, 2" Sch. 40, PVC x 20 Ft Long.	1
20	108-050	Protector, Electric Cord Lock Bulk Head Fitting	1
21	157-0012	Switch, Tethered Float Hvy Duty Liquid Level	1
22	033-021	Clamp, 1/4 Nylon Hose	1
23	033-061	Clamp, 1 7/8" Muffler	1
24	143-091	U-Bolt, 5/16" x 1" Diameter	1
25	052-494	Nipple, POL x 1/4" M Propane	1
26	052-242	Adapter, 2" MPT x 2" M - Slip ABS	1
27	052-404	Adapter, 3" F Slip x 2" F Slip	1
28	052-413	Bushing, 3/4" M Garden x 3/4" FPT - Brass	1
29	052-064	Bushing, 1/2 M x 3/8 F Brass	1
30	052-046	Propane Quick Connect, Male	2
31	052-142	Elbow, 3/8" F x F Brass	1
32	052-086	Elbow, 3/8" Brass Street	1
33	052-088	Elbow, 1/4" Brass Female	1
34	052-223	Elbow, 2" F Slip x M Slip ABS	1
35	052-499	Coupler, Male CAM x 2" MPT	1

ITEM	PART NO	DESCRIPTION	QTY
36	052-221	Insert, 2" NPT x 2" Plastic Barb	1
37	052-074	Nipple, 3/8 Brass Hex	1
38	052-075	Nipple, 3/8" x 1/2" Brass Hex	1
39	052-493	Nipple, 1 1/2" x 15" Steel	1
40	169-032	Valve, 1/2" Propane Shut-Off	1
41	169-022	Valve, 1 1/2" Full Port Brass Dump	1
42	143-166	Screw, 10-24 x 3/8" s/s HHC	14
43	143-060	Screw, 10-24 x 3/8" Flat Hd Machine	8
44	143-062	Screw, 10-24 x 3/4" s/s PANHDMS Phillips	3
45	143-012	Screw, 5/16-18 x 3/4" HHC s/s	2
46	057-055	Gasket, Garden Hose	1
47	094-027	Nut, 10-24 s/s Hex	1
48	094-034	Nut, 10-24 s/s Nylock Hex	12
49	094-012	Nut, 5/16-18 s/s Hex	4
50	143-017	Screw, 3/8-16 x 3/4" HHC	10
51	174-001	Washer, #10 s/s Flat	1
52	174-014	Washer, #10 s/s Lock	6
53	174-018	Washer, 5/16" s/s Lock	2
54	174-005	Washer, 3/8 Flat	8
55	174-034	Washer, .688 ID x 1.5 OD x .078 Thk s/s	2
56	174-040	Washer, 9/16 ID Flat	2
57	174-050	Washer, 1" s/s Flat	1
58	174-013	Washer, 3/8 Fender	2
59	174-003	Washer, 1/4" s/s Flat	2
60	067-018	Hinge Set, Right - Recovery Tank	1
61	131-028	Gasket, Trimlok Recovery Tank Gasket Mat.	10 Ft
62	131-041	Trimlok, Side Bulb	6 Ft
63	143-009	Screw, 1/4-20 x 2 1/2" HHC s/s	1
64	105-005	Plate, Vacuum Relief	1
65	155-002	Spring, s/s Vacuum Relief Valve	1
66	094-010	Nut, 1/4-20 s/s Hex	2
67	033-039	Clamp, 1 1/2" Spring - Wand Holder	1
68	143-126	Screw, 10-24 x 1/2" s/s HHC	2
69	052-085	Elbow, 1/4" Brass Street	1
70	052-435	Quick Connect, 1/4 M x 1/4" NPT	1
71	106-018	Plug, 2" Plastic	1

ITEM	PART NO	DESCRIPTION	QTY
72	068-394	Hose, 3/8" x 18" Rubber with 1/4" Ends	1
73	027-014	Cap, Brass Garden Hose	1
74	052-228	Nipple, 2" Close PVC SCH 80	1
75	052-205	Coupler, 2" Aluminum	1
76	143-118	Screw, #8 x 1/2" HXWSHD SM	1
77	157-013	Switch, Ball Float without Cover	1
78	041-001	Cover, New Style Vac Tank Stop Switch	1
79	162-005	Tie Wrap, 12" Nylon	1
80	081-086	Label, "Breathing Hazard"	1
81	081-085	Label, "Do Not Overfill..."	1
82	081-077	Label, "Propane Symbol"	1
83	081-078	Label, Red "Flammable Gas"	1
84	015-342	Bracket, Recovery Tank Float Switch	1
85	052-102	Insert, #46	1
86	033-004	Clamp, Size 6 Mini Hose	1
87	052-061	Bushing, 3/8 M x 1/4 F Brass	1
88	166-005	Soap Jug Tray	1

Figure 3-12: Utility Cart Assembly

D3149, Rev A



Utility Cart Assembly Parts List

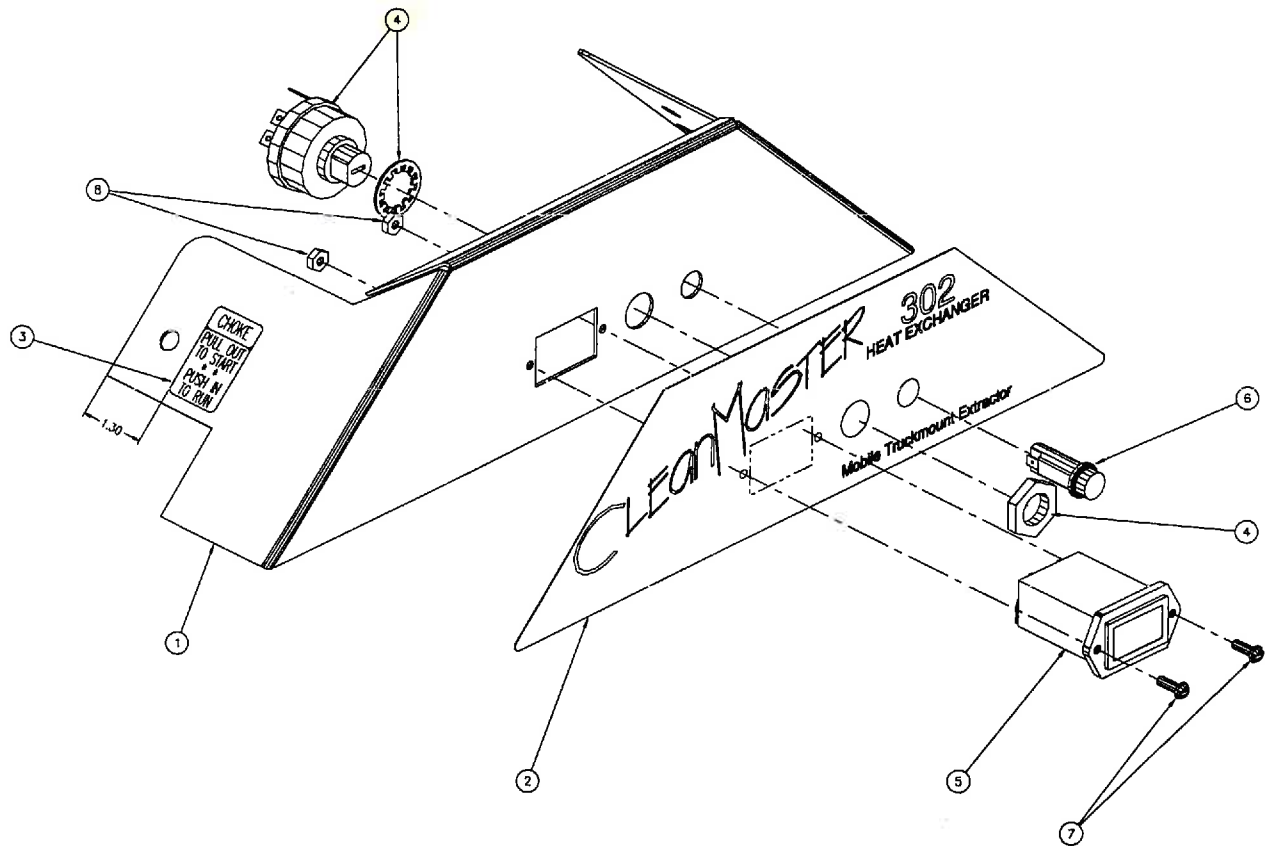
ITEM	PART NO	DESCRIPTION	QTY
1	163-061	Base, Utility Cart *	1
2	163-061	Handle, Utility Cart *	1
3	163-061	Bracket, Utility Cart Accessory Hose *	1
4	163-061	Bracket, Vacuum Hose *	1
5	163-061	Box, Accessory *	2
6	163-061	Bracket, Vacuum Hose Capture *	1
7	163-061	Bracket, Vacuum Hose Clamp *	1
8	177-024	Caster, Cart - Fixed	2
9	177-025	Caster, with Brake	2
10	-----	Wand ♦	1
11	-----	Pump-Up Sprayer ♦	2
12	-----	Bungee Cord, 8" ♦	2
13	033-039	Clamp, 1 ½" Spring - Wand Holder	1
15	143-126	Screw, 10 - 24 x ½" s/s HHC	6
16	143-017	Screw, ⅜ - 16 x ¾" HHC	28
17	143-023	Screw, ⅜ - 16 x 3" HHC	2
18	094-016	Nut, ⅜ - 16 Whiz	2
19	174-021	Washer, ⅜ Lock	28
20	094-075	Nut, ⅝" Wingnut	1
21	143-194	Screw, 4-40 x ¼" Socket Head Cap	1

* Parts make up welded accessory cart.

♦ Not included.

Figure 3-13: Dash Panel Assembly

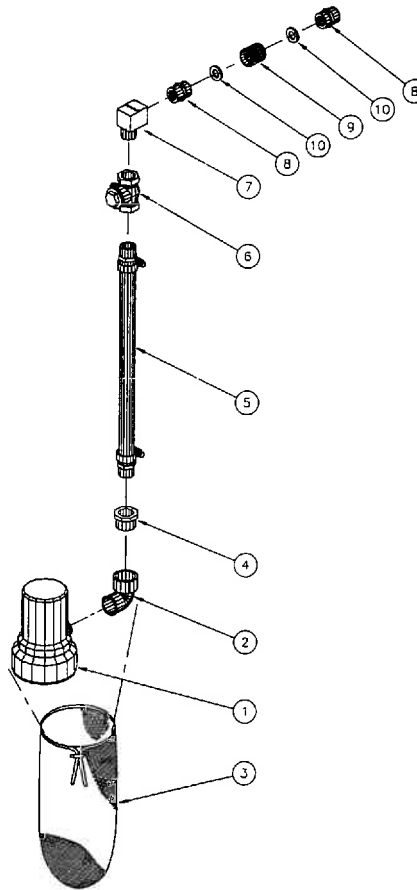
D3143, Rev A



ITEM	PART NO	DESCRIPTION	QTY
1	100-046	Panel, CM 302 Dash	1
2	081-075	Label Set (Dash Label Shown)	1
3	081-073	Label, "Choke" Briggs & Stratton	1
4	157-017	Switch, Ignition - B&S 14 HP	1
5	074-011	Meter, Rectangular Hour	1
6	084-006	Lamp, Red Pilot - Round	1
7	143-050	Screw, 8-32 x 1/2" Round Head Mach.	2
8	094-002	Nut, 8-32 s/s Hex	2

Figure 3-14: APO Assembly

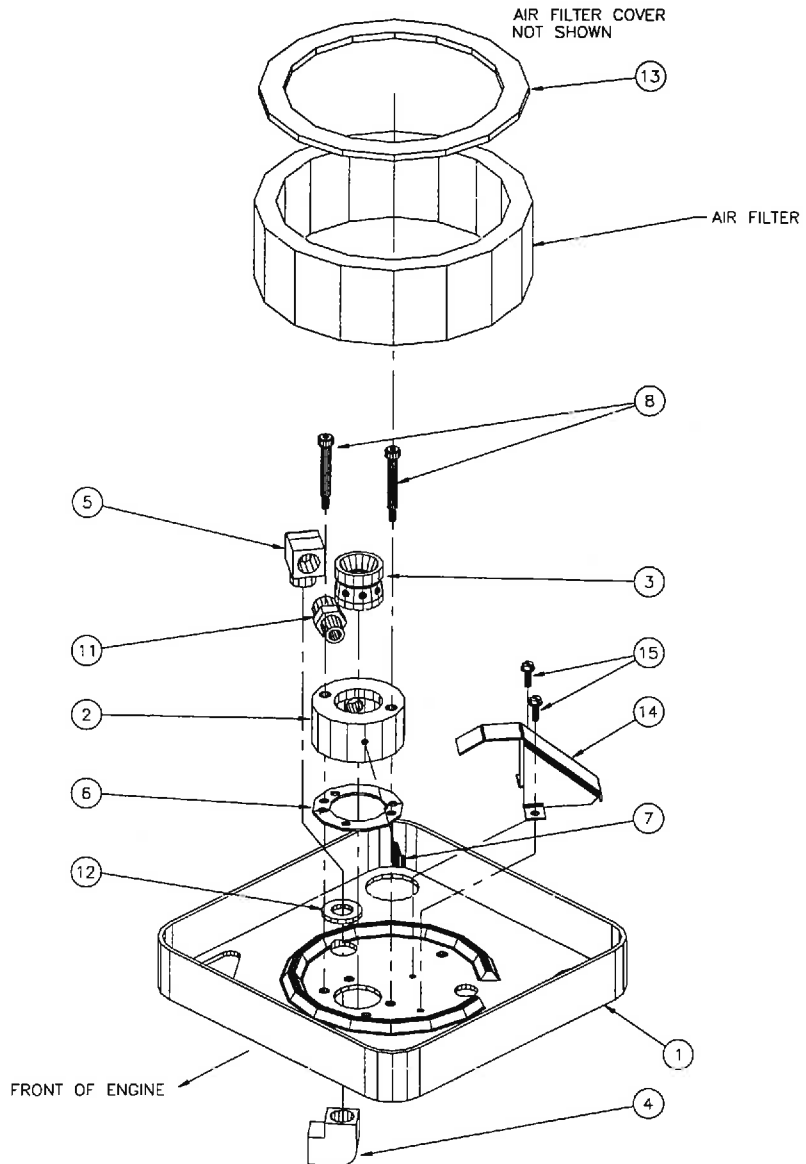
C3128



ITEM	PART NO	DESCRIPTION	QTY
1	111-013	Pump, APO Pump Out	1
2	052-239	Elbow, APO Pump (90 Deg. Elbow Adapter)	1
3	049-030	Filter Bag	1
4	052-240	Bushing, 1" MPT x 3/4" FPT PVC	1
5	068-278	Hose, 3/4" x 17" Synflex with 3/4" Ends	1
6	169-009	Valve, 3/4" Swing Check - CVP	1
7	052-340	Elbow, 3/4" Brass Street	1
8	052-281	Nipple, 3/4" NPT x 3/4" M Garden Hose	2
9	052-244	Swivel, 3/4" Female Garden x 3/4" F Garden	1
10	057-055	Gasket, Garden Hose	2

Figure 3-15: Propane Conversion Assembly

C3156, Rev A

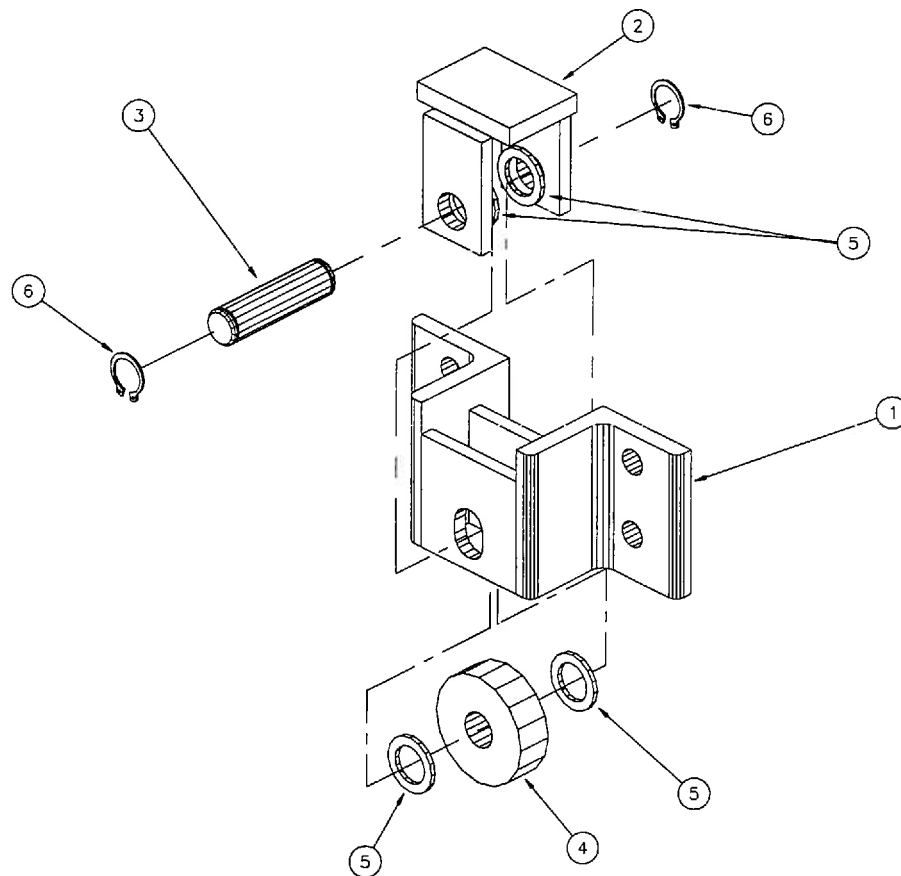


Propane Conversion Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	042-060	Housing, Engine Air Filter	1
2	001-031	Adapter Set, Propane Carb. Inlet	1
3	181-010	Venturi, Beam Propane	1
4	052-142	Elbow, 3/8" F x F Brass	1
5	052-086	Elbow, 3/8" Brass Street	1
6	-----	Gasket (Part of Kit 001-030)	1
7	-----	Screw, #10-24 x 3/4" (Part of Kit 001-030)	1
8	143-222	Screw, 6mm x 40mm Socket Head	2
11	052-073	Nipple, 1/4" x 3/8" Brass Hex	1
12	057-055	Gasket, Garden Hose	1
13	057-029	Gasket, Air Filter Cover	1
14	015-329	Bracket, Breather Tube	1
15	143-118	Screw, #8 x 1/2" HXWSHD SM	2

Figure 3-16: Jack Bearing Assembly

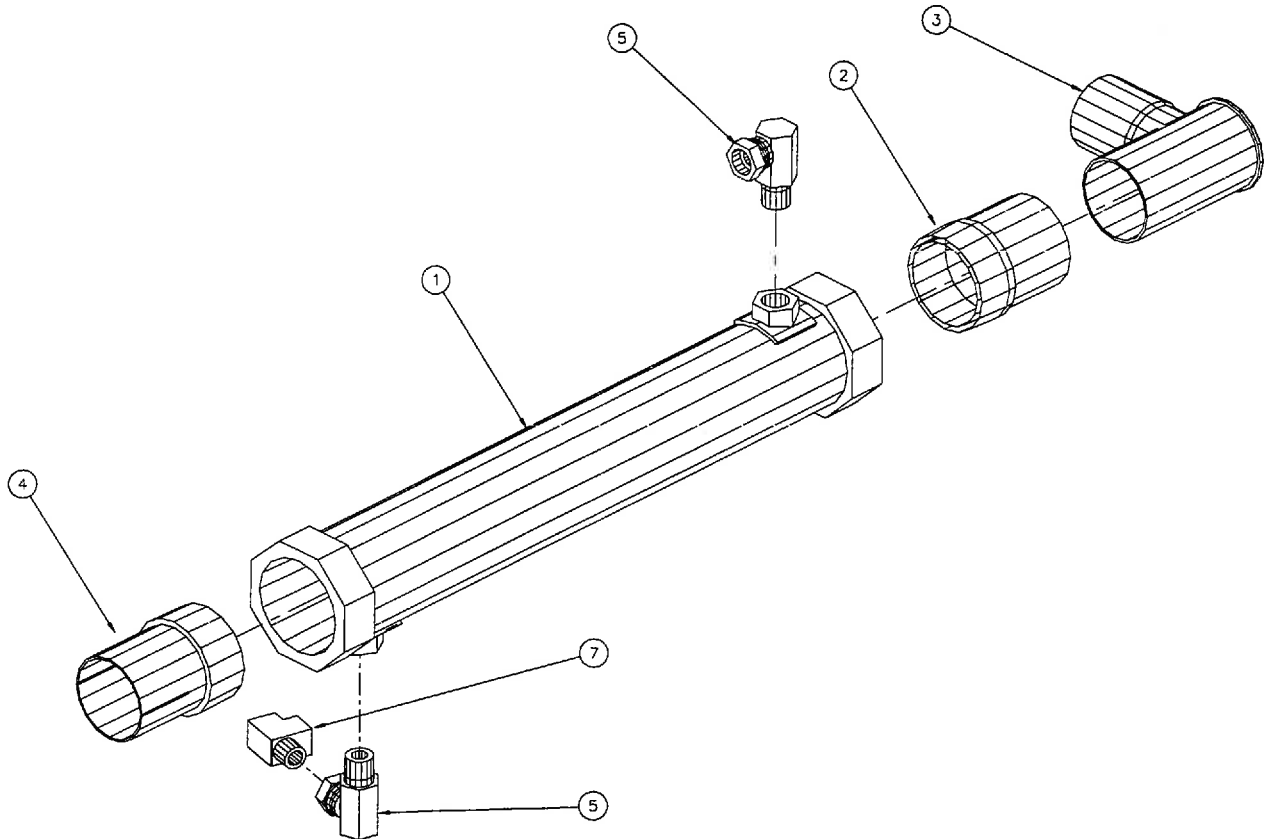
C3138



ITEM	PART NO	DESCRIPTION	QTY
1	015-274	Bracket, Jack Bearing Mount Lifting Mech.	1
2	015-275	Bracket, Yoke - Lifting Mech.	1
3	150-030	Shaft, Jack Bearing - Lifting Mech.	1
4	008-013	Bearing, Idler 6301 2RS	1
5	174-064	Washer, Thrust - Lifting Mech.	4
6	139-017	Ring, ½" External Snap - Lifting Mech.	2

Figure 3-17: Lower Heat Exchanger Assembly

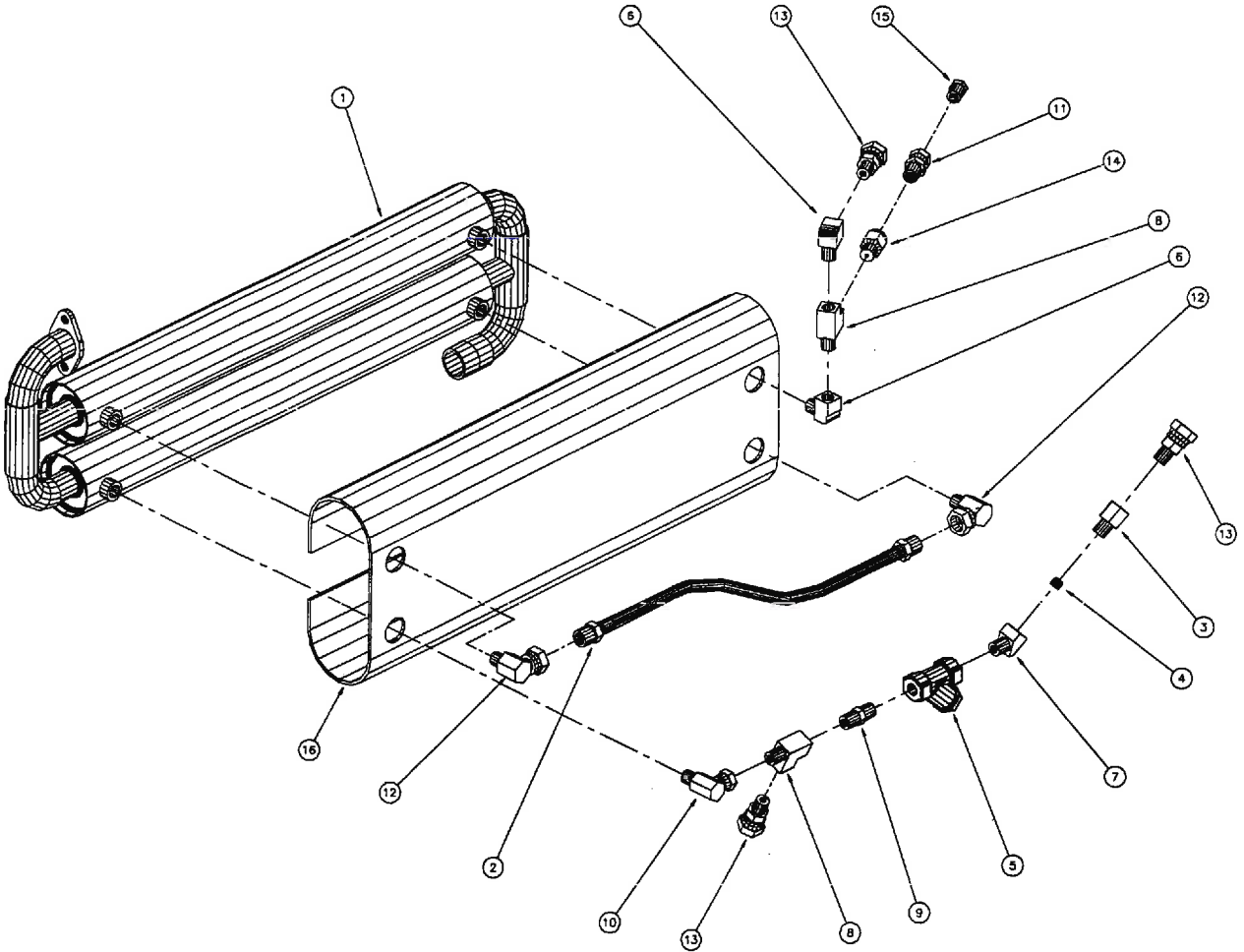
C3238



ITEM	PART NO	DESCRIPTION	QTY
1	038-018	Core, 3" Copper Heat Exchanger	1
2	052-343	Adapter, Heat Exchanger Inlet	1
3	001-017	Adapter, 2" ID x 2½" OD Silencer Outlet	1
4	001-029	Adapter, Final Exhaust	1
5	052-036	8MA-8UFS	2
7	052-023	Tee, ⅜" Male Street - Brass	1
Not Shown:			
	131-009	Insulation, 1' x ⅛" x 15' Duct	1

Figure 3-18: Dual Heat Exchanger Assembly

D3090, Rev A

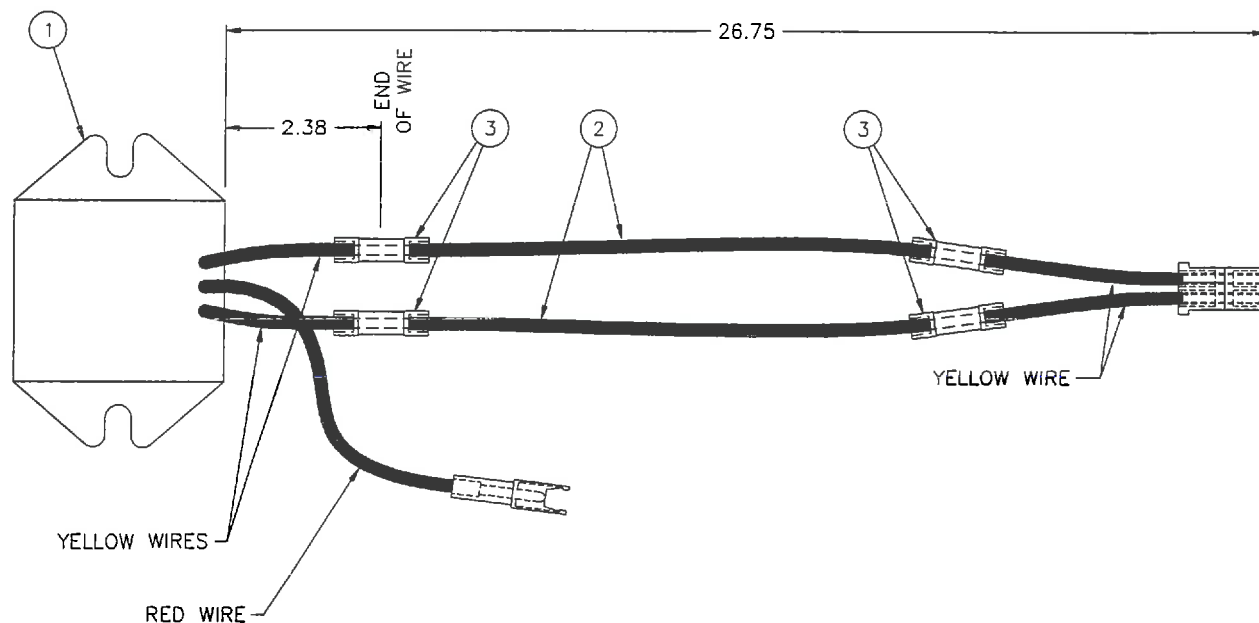


Dual Heat Exchanger Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	038-026	Heat Exchanger, s/s	1
2	068-078	Hose, 3/8" x 18" Teflon	1
3	052-423	Bushing, Mod. Set Screw Orifice Housing	1
4	180-002	Orifice, Set Screw - .039"	1
5	049-033	Filter, 1/4" Inline V	1
6	052-085	Elbow, 1/4" Brass Street	2
7	052-082	Elbow, 1/4" Brass 45 Street	1
8	052-090	Tee, 1/4" Male Branch M-F-F	2
9	052-071	Nipple, 1/4" Brass Hex	1
10	052-006	4MA-4UFS	1
11	052-005	4M-4UFS	1
12	052-014	4MA-6UFS	2
13	052-013	4M-6UFS	3
14	135-052	Regulator, High PSI Snubber	1
15	052-059	Bushing, 1/4 M x 1/8 F Brass	1
16	108-023	Protective Insulation Blanket	1

Figure 3-19: B & S Voltage Regulator Modification

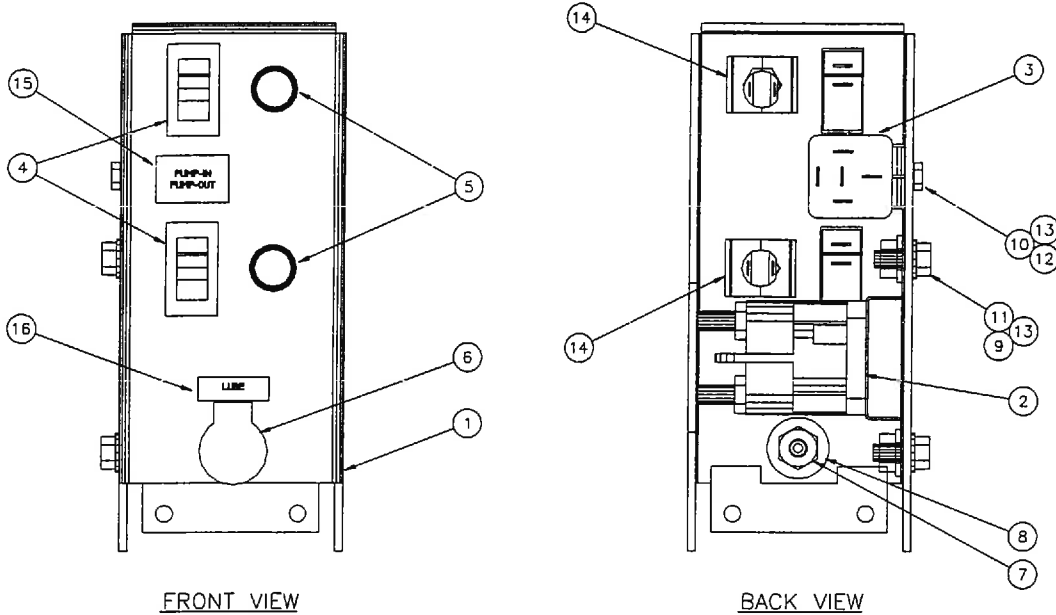
B3475



ITEM	PART NO	DESCRIPTION	QTY
1	-----	Briggs & Stratton Voltage Regulator (Incl. with engine, part nos. 047-007 or 011)	1
2	178-026	Wire, 16 AWG Yellow	2
3	037-033	Connector, #22 Pink Butt	4

Figure 3-20: **Starter Solenoid Cover Assembly**

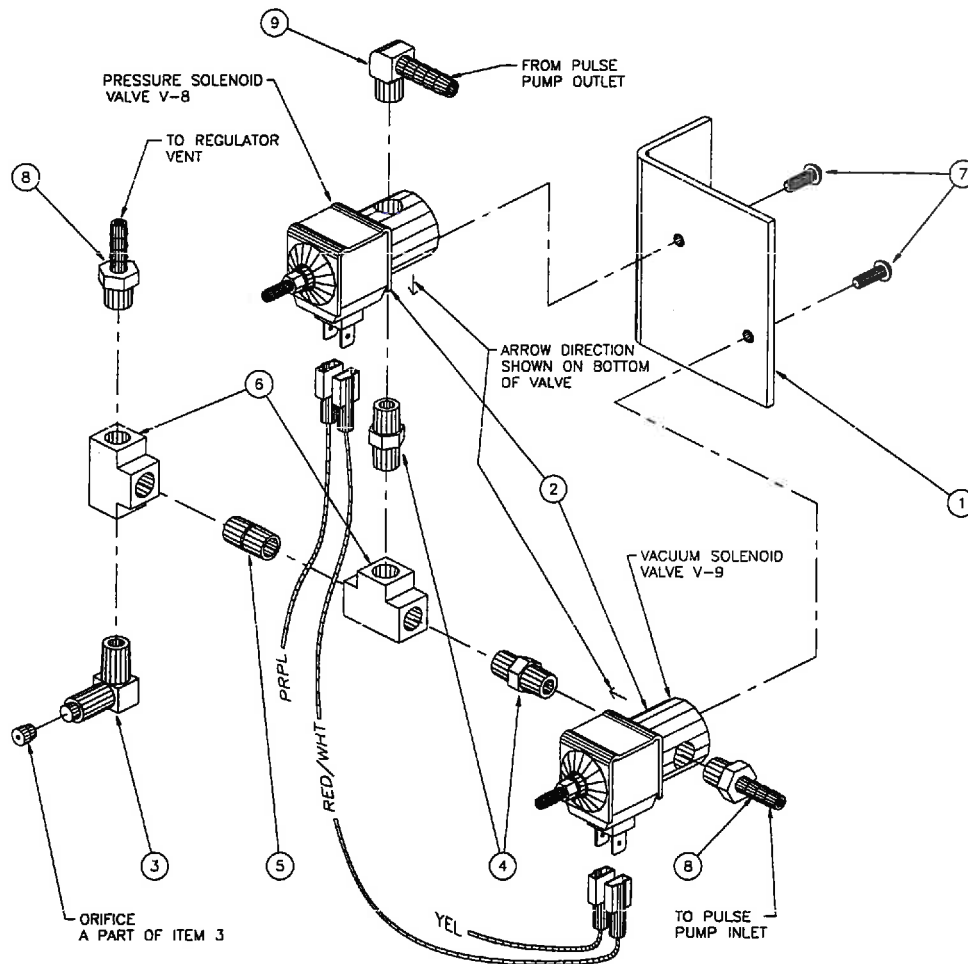
C3474



ITEM	PART NO	DESCRIPTION	QTY
1	041-176	Cover, Starter Solenoid	1
2	-----	Briggs & Stratton Starter Solenoid	1
3	157-022	Switch, Relay	1
4	157-115	Switch, 16 amp Mini Rocker with Terminal	2
5	084-006	Lamp, Red Pilot - Round	2
6	052-272	Cup, Gravity Feed Oil Blower Lubrication Port	1
7	052-096	Insert, #F23	1
8	174-005	Washer, 3/8 Flat	1
9	143-074	Screw, 1/4 - 20 x 1/2" HXWSHD Self Tapping	2
10	143-126	Screw, 10 - 24 x 1/2" s/s HHC	1
11	174-017	Washer, 1/4" Lock	2
12	174-014	Washer, #10 s/s Lock	1
13	094-008	Nut, 1/4 - 20 Hex	2
14	033-049	Clamp, Indicator Light	2
15	081-075	Label Set (Pump-In/Out)	1
16	081-075	Label Set (Lube)	1

Figure 3-21: ECD Solenoid Assembly

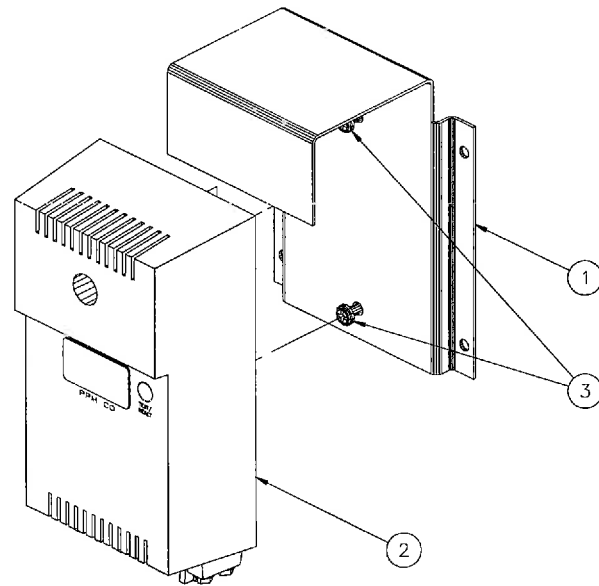
C2994, Rev B



ITEM	PART NO	DESCRIPTION	QTY
1	015-283	Bracket, ECD Solenoid Mount	1
2	169-029	Valve, Solenoid	2
3	-----	ECD Contrld Orifice Hsg (Part of Kit 078-350)	1
4	052-069	Nipple, 1/8" Brass Hex	2
5	052-057	Nipple, 1/8" Brass Close	1
6	052-092	Tee, 1/8" Brass	2
7	143-050	Screw, 8-32 x 1/2" Round Hd Mach.	2
8	052-097	Insert, #24	2
9	052-253	Elbow, 1/8" Male x 1/4" Barb	1

Figure 3-23: Carbon Monoxide Detector Assembly

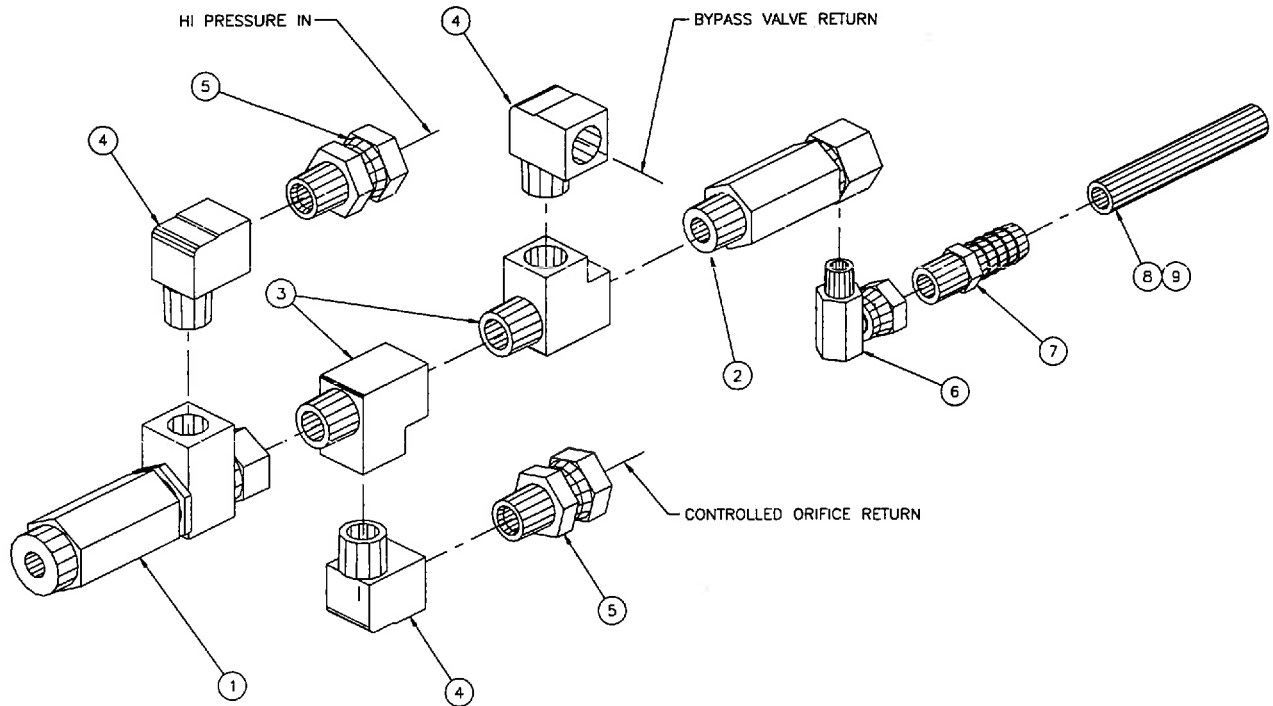
B3516



ITEM	PART NO	DESCRIPTION	QTY
1	015-289	Bracket, Carbon Monoxide Det. Support	1
2	149-032	Sensor, Carbon Monoxide Detector 12v	1
3	143-050	Screw, 8-32 x 1/2" Round Hd Mach.	2

Figure 1-23: **By-Pass Valve Manifold Assembly**

C3204, Rev A



ITEM	PART NO	DESCRIPTION	QTY
1	169-101	Valve, By-Pass	1
2	169-011	Valve, 185 High Temp Control Valve	1
3	052-023	Tee, 3/8" Male Street - Brass	2
4	052-086	Elbow, 3/8" Brass Street	3
5	052-019	6M-6UFS	2
6	052-004	2MA-4UFS	1
7	052-117	Insert, #48	1
8	068-018	Hose, 1/2" Rubber	90"
9	068-018	Hose, 1/2" Rubber	52"

Spare Parts

CM 302

Section 3-37

Down-time on the unit can be very expensive, because your truck-mounted unit is capable of generating several hundred dollars per day. In order to minimize such down-time, it is strongly recommended by the manufacturer that you purchase and keep in your truck the parts listed below.

Parts Orders

To expedite your parts needs, please call your sales representative. In most instances, he either stocks or has access to parts through a regional service center. If further assistance is needed, contact the factory and coordinate your needs. If this becomes necessary, always indicate the method of shipment you desire, i.e. UPS, Blue Label, Air Freight, Air Express, etc.

HydraMaster Parts Dept. Phone (425) 775-7276
HydraMaster Parts Dept. Toll Free Fax 1-800-426-4225

Parts List (078-090)

PART NO	DESCRIPTION	QTY
010-060	Belt, #9305 - Pump Drive	1
049-014	Filter, Vanguard Oil	2
049-007	Filter, S/S Vacuum Pump	1
049-016	Filter, 1/4" Replacement Y	1
049-023	Screen, Garden Hose	1
049-012	Filter, Vanguard Air	1
049-030	Filter Bag, 92 + Truck Mount	2
052-050	Quick Connect, 440 Male	3
052-051	Quick Connect, 440 Female	2

PART NO	DESCRIPTION	QTY
052-052	Quick Connect, 660 Male	1
052-053	Quick Connect, 660 Female	1
057-043	Gasket, Recovery Tank	1
074-003	Gauge, Hi PSI (0-1000)	1
074-013	Meter, Chemical Flow	1
078-015	Kit, Chem Flowmeter	1
078-101	Kit, Seal & Spring Hi PSI	1
106-016	Plug, Vanguard Spark	2
131-037	Wrap, Exhaust Insulation	1
157-0012	Switch, Tethered Float Hvy Duty Liquid Level	1
157-115	Mini-Rocker with Terminal	1
157-022	Switch, Relay	2
169-022	Valve, 1 ½" Full Port	1
169-062	Valve, ¼ Anti-Siphon	1
169-120	Valve, Chemical System	1
152-008	Sleeve, #6 Drive Coupler	1
078-139	Kit, Valve - Triplex Pumps	1
078-141	Kit, Triplex Pump Seal	1

How to Order Parts

CM 302

Section 3-39

To obtain a proper diagnosis of your malfunction, and to order warranty replacement parts, it is important that you proceed in the following manner:

WARRANTY PARTS ORDERS

1. Call HydraMaster/CleanMaster Service Department at (425) 775-7275.
2. Give the Service representative the following information:
 - A. Your Company Name and Address
 - B. Equipment Model
 - C. Date of Purchase
 - D. Hours on the Unit
 - E. Unit Serial Number
 - F. Name of Person Authorized to Order Parts
 - G. Sales Representative from which Unit was Purchased
 - H. Description of Malfunction
 - I. High Pressure Gauge Readings with the Wand Turned On and Off
3. If warranty replacement parts are needed, please specify method of shipment desired. HydraMaster/CleanMaster will pay for ground UPS. If you require replacement parts overnight they will be sent freight collect, via: Air Freight, Air Mail, or Air Express.
4. Do not give malfunctioning parts to a HydraMaster/CleanMaster sales or service representative. **All parts must be returned directly to HydraMaster/CleanMaster, freight prepaid.**

PARTS ORDERS

To expedite your parts needs, please call your sales representative. In most instances, they either stock or have access to parts through a regional service center. If further assistance is needed, contact the factory and coordinate your needs. If this becomes necessary, always indicate the method of shipment you desire, i.e. UPS, Blue Label, Air Freight, Air Express, etc.

HydraMaster/CleanMaster Parts Dept. Phone (425) 775-7276
HydraMaster/CleanMaster Parts Dept. Toll-Free Fax 1-800-426-4225

HydraMaster/CleanMaster has a \$40 minimum on parts orders. Orders below the minimum will be charged a \$15 expediting fee.

ONE FINAL NOTE

Any questions you have regarding the warranty program should be directed to the Service Department personnel at HydraMaster/CleanMaster Corporation.

We shall always endeavor to be fair in our evaluation of your warranty claim, and shall provide you with a complete analysis of our findings.

HydraMaster/CleanMaster warranty covers only defective materials and/or workmanship for the periods listed. **Labor and/or diagnostic reimbursement is specifically excluded.**

Accessories

CM 302

Section 3-41

Genuine HydraMaster Accessories & Detergents

This section of your Owners Manual is devoted to Accessories and Detergents which we have found to be helpful and useful. *These products can enhance your cleaning and reduce your labor costs!*

HydraMaster Machine accessories are the most innovative collection available in the cleaning industry. Our patented **RX-20 Rotary Extractors** have changed the shape of steam cleaning. Our hoses and tanks are of the finest quality construction.

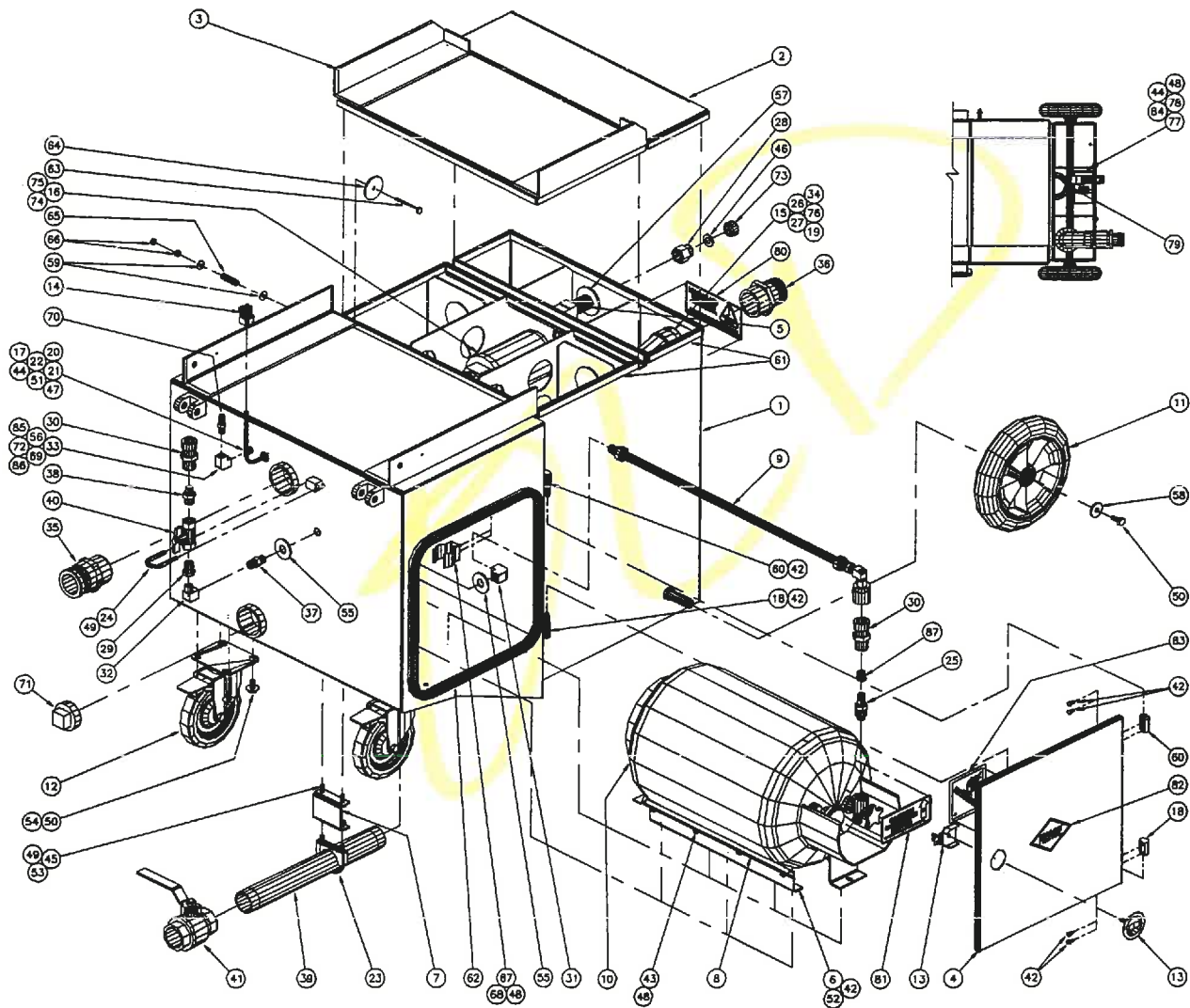
SafeClean Detergents have been specially prepared, not only to give you exceptional cleaning, but also to optimize your truckmount's operation and reliability. *Most detergents don't work well under the high heat, high pressure conditions of truckmount use.* **SafeClean** will maintain your machines's water pump and water heating systems at peak efficiency and help ensure fewer breakdowns.

***For more information, or to order Genuine
HydraMaster Accessories and Detergents
Call your nearest authorized HydraMaster Distributor.***

PART NO	DESCRIPTION	QTY
052-052	Quick Connect, 660 Male	1
052-053	Quick Connect, 660 Female	1
057-043	Gasket, Recovery Tank	1
074-003	Gauge, Hi PSI (0-1000)	1
074-013	Meter, Chemical Flow	1
078-015	Kit, Chem Flowmeter	1
078-101	Kit, Seal & Spring Hi PSI	1
106-016	Plug, Vanguard Spark	2
131-037	Wrap, Exhaust Insulation	1
157-001	Switch, Tethered Mercury	1
157-115	Mini-Rocker with Terminal	1
157-022	Switch, Relay	2
169-022	Valve, 1 1/2" Full Port	1
169-062	Valve, 1/4 Anti-Siphon	1
169-120	Valve, Chemical System	1
152-008	Sleeve, #6 Drive Coupler	1
078-140	Kit, Hypro Seal	1

Figure 3-11: Cart and Recovery Tank Assembly

D3061, Rev C



Cart and Recovery Tank Assembly Parts List

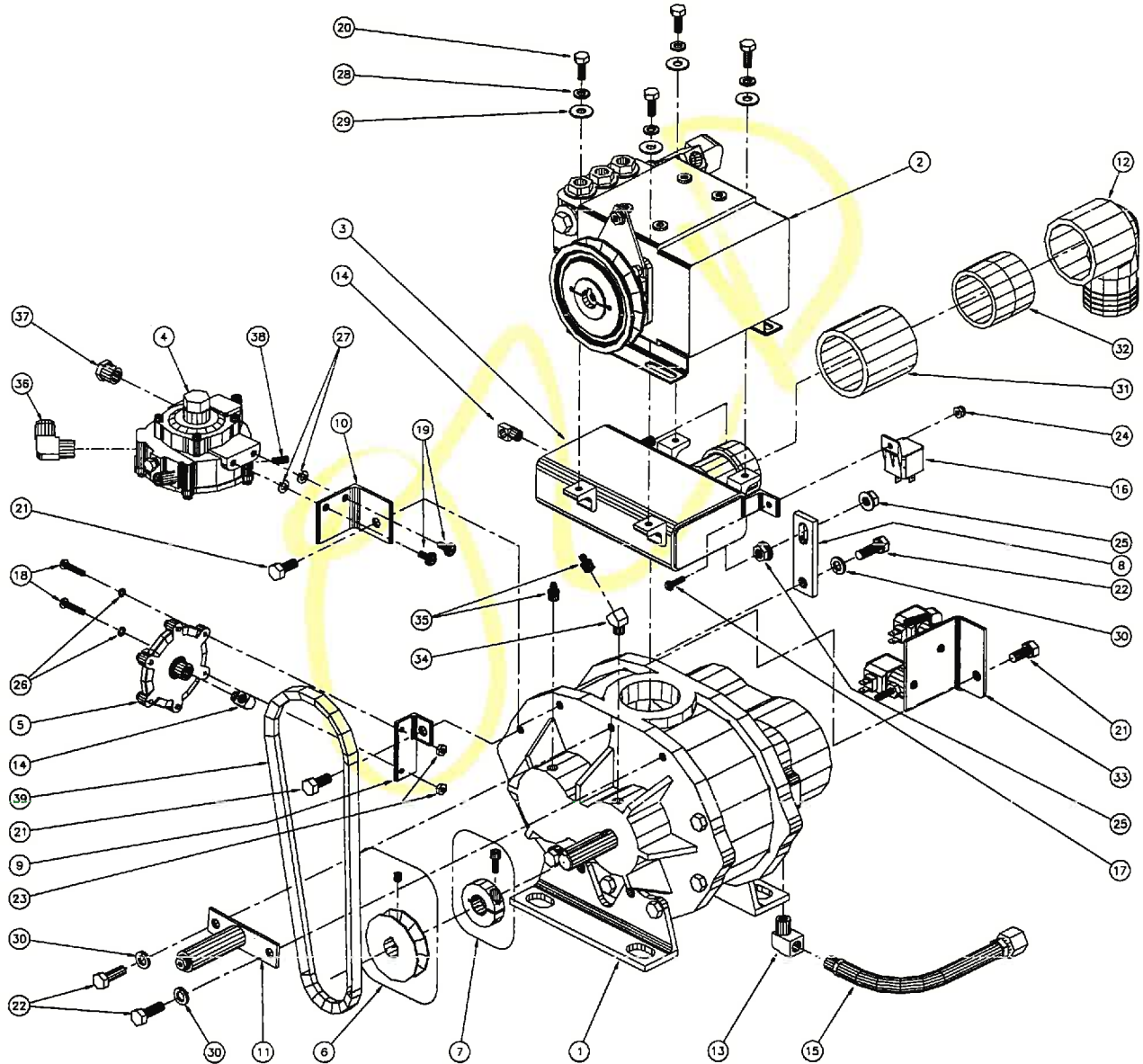
ITEM	PART NO	DESCRIPTION	QTY
1	159-047	Tank and Cart - CM 302	1
2	041-201	Cover, CM 302 Front Recovery Tank	1
3	041-197	Cover, CM 302 Rear Recovery Tank	1
4	041-199	Cover, CM 302 Side Access	1
5	Figure 3-14	APO Assembly	1
6	015-268	Bracket, CM 302 Propane Tank	2
7	015-269	Bracket, CM 302 Waste Wtr Drain Pipe Hanger	1
8	114-001	Rail, CM 302 Propane Tank Guide	2
9	068-391	Hose, Propane - Tank/Cart to Propane Sol.	1
10	159-012	Propane Tank, 30 lb CM 302 Horizontal	1
11	177-026	Wheel, 10 x 2 - 1/8 Smooth Tread Balloon Tire	2
12	177-025	Caster, CM 302 with Brake	2
13	086-014	Latch, Access Door	1
14	037-050	Connector, 4 Pole Male - Water Tight	1
15	049-030	Filter Bag, 92+ Truckmount	1
16	049-007	Filter, s/s Vacuum Pump - Blower	1
17	060-007	Grommet, 3/8" Rubber	1
18	067-017	Hinge Set, Left - Recovery Tank	2
19	125-014	Pipe, 2" Sch. 40, PVC x 20 Ft Long.	1
20	108-050	Protector, Electric Cord Lock Bulk Head Fitting	1
21	157-001	Switch, Tethered Mercury Float - 35 Deg.	1
22	033-021	Clamp, 1/4 Nylon Hose	1
23	033-061	Clamp, 1 7/8" Muffler	1
24	143-091	U-Bolt, 5/16" x 1" Diameter	1
25	052-494	Nipple, POL x 1/4" M Propane	1
26	052-242	Adapter, 2" MPT x 2" M - Slip ABS	1
27	052-404	Adapter, 3" F Slip x 2" F Slip	1
28	052-413	Bushing, 3/4" M Garden x 3/4" FPT - Brass	1
29	052-064	Bushing, 1/2 M x 3/8 F Brass	1
30	052-046	Propane Quick Connect, Male	2
31	052-142	Elbow, 3/8" F x F Brass	1
32	052-086	Elbow, 3/8" Brass Street	1
33	052-088	Elbow, 1/4" Brass Female	1
34	052-241	Elbow, 2" F Slip x F Slip PVC 90 Deg.	1
35	052-499	Coupler, Male CAM x 2" MPT	1

ITEM	PART NO	DESCRIPTION	QTY
36	052-221	Insert, 2" NPT x 2" Plastic Barb	1
37	052-074	Nipple, 3/8" Brass Hex	1
38	052-075	Nipple, 3/8" x 1/2" Brass Hex	1
39	052-493	Nipple, 1 1/2" x 15" Steel	1
40	169-032	Valve, 1/2" Propane Shut-Off	1
41	169-022	Valve, 1 1/2" Full Port Brass Dump	1
42	143-166	Screw, 10-24 x 3/8" s/s HHC	14
43	143-060	Screw, 10-24 x 3/8" Flat Hd Machine	8
44	143-062	Screw, 10-24 x 3/4" s/s PANHDMS Phillips	3
45	143-012	Screw, 5/16-18 x 3/4" HHC s/s	2
46	057-055	Gasket, Garden Hose	1
47	094-027	Nut, 10-24 s/s Hex	1
48	094-034	Nut, 10-24 s/s Nylock Hex	12
49	094-012	Nut, 5/16-18 s/s Hex	4
50	143-017	Screw, 3/8-16 x 3/4" HHC	10
51	174-001	Washer, #10 s/s Flat	1
52	174-014	Washer, #10 s/s Lock	6
53	174-018	Washer, 5/16" s/s Lock	2
54	174-005	Washer, 3/8" Flat	8
55	174-008	Washer, 5/8" Flat	1
56	174-040	Washer, 9/16 ID Flat	2
57	174-050	Washer, 1" s/s Flat	1
58	174-013	Washer, 3/8" Fender	2
59	174-003	Washer, 1/4" s/s Flat	2
60	067-018	Hinge Set, Right - Recovery Tank	1
61	131-028	Gasket, Trimlok Recovery Tank Gasket Mat.	10 Ft
62	131-041	Trimlok, Side Bulb	6 Ft
63	143-009	Screw, 1/4-20 x 2 1/2" HHC s/s	1
64	105-005	Plate, Vacuum Relief	1
65	155-002	Spring, s/s Vacuum Relief Valve	1
66	094-010	Nut, 1/4-20 s/s Hex	2
67	033-039	Clamp, 1 1/2" Spring - Wand Holder	1
68	143-126	Screw, 10-24 x 1/2" s/s HHC	2
69	052-085	Elbow, 1/4" Brass Street	1
70	052-435	Quick Connect, 1/4" M x 1/4" NPT - Service Master	1
71	106-018	Plug, 2" Plastic	1

ITEM	PART NO	DESCRIPTION	QTY
72	068-394	Hose, 3/8" x 18" Rubber with 1/4" Ends	1
73	027-014	Cap, Brass Garden Hose	1
74	052-228	Nipple, 2" Close PVC SCH 80	1
75	052-205	Coupler, 2" Aluminum	1
76	143-118	Screw, #8 x 1/2" HXWSHD SM	1
77	157-013	Switch, Ball Float without Cover	1
78	041-001	Cover, New Style Vac Tank Stop Switch	1
79	162-005	Tie Wrap, 12" Nylon	1
80	081-086	Label, "Breathing Hazard"	1
81	081-085	Label, "Do Not Overfill..."	1
82	081-077	Label, "Propane Symbol"	1
83	081-078	Label, Red "Flammable Gas"	1
84	015-342	Bracket, Recovery Tank Float Switch	1
85	052-102	Insert, #46	1
86	033-004	Clamp, Size 6 Mini Hose	1
87	052-061	Bushing, 3/8 M x 1/4 F Brass	1

Figure 3-9: Blower and Pump Assembly

D3148, Rev A

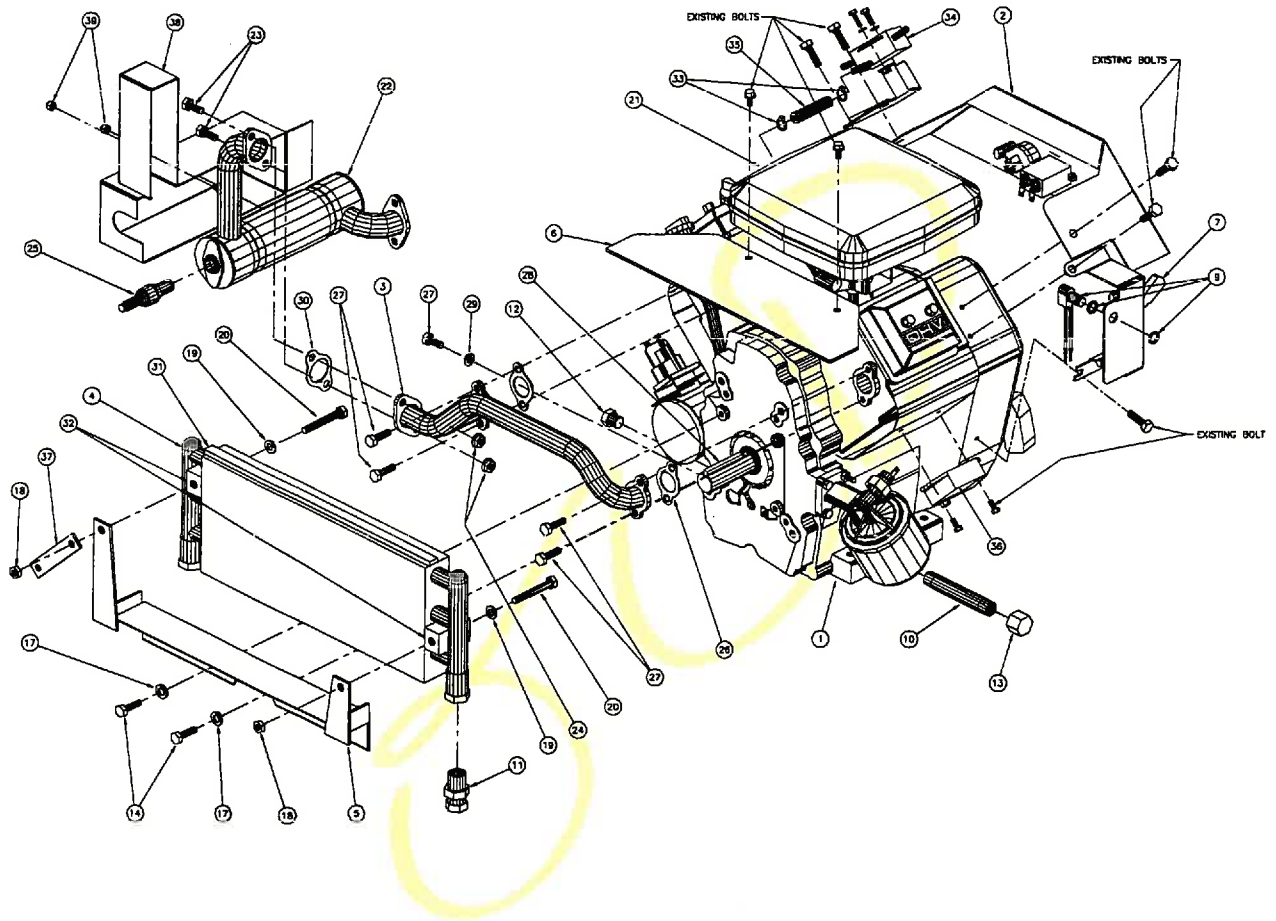


Blower and Pump Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	111-020	Blower, 3.2 Roots	1
2	Figure 3-7	Pump Assembly	1
3	015-266	Bracket, Pump Mnt Collector Box - Triplex Pmp	1
4	135-005	Regulator, Engine Propane B&S 14 HP	1
5	157-018	Switch, Micro - Vacuum Solenoid	1
6	109-004	Pulley, 2 3/4" x 3/4" - Pump Drive	1
7	020-011	Collar, Blower Shaft - Single Screw Type	1
8	015-267	Bracket, Mount Straps - Pump Mnt with Triplex	1
9	015-280	Bracket, CM 302 Vacuum Switch Mount	1
10	015-279	Bracket, CM 302 Propane Regulator Mount	1
11	154-052	Spacer, Lower Belt Guard	1
12	052-222	Elbow, 2" Comb - Insert x FPT	1
13	052-085	Elbow, 1/4" Brass Street	1
14	052-084	Elbow, 1/8" Brass Street	2
15	068-221	Hose, 3/8" x 24" Pump Drain	1
16	157-022	Switch, Relay	1
17	143-126	Screw, 10-24 x 1/2" s/s HHC	1
18	143-224	Screw, 5mm x .8mm x 25mm Slot Head	2
19	143-317	Screw, 1/4-20 x 1/2" Pan Hd, Zinc Plated, Phil.	2
20	143-012	Screw, 5/16 - 18 x 3/4" HHC s/s	4
21	143-017	Screw, 3/8 - 16 x 3/4" HHC	3
22	143-019	Screw, 3/8-16 x 1 1/4" HHC, Grade 5 Zinc	3
23	094-067	Nut, 5mm x .8mm	2
24	094-034	Nut, 10-24 s/s Nylock	1
25	094-016	Nut, 3/8 - 16 Whiz	2
26	174-014	Washer, #10 s/s Lock	2
27	174-017	Washer, 1/4" Lock	2
28	174-018	Washer, 5/16" s/s Lock	4
29	174-004	Washer, 5/16 Flat	4
30	174-021	Washer, 3/8 Lock	3
31	052-205	Coupler, 2" Aluminum	1
32	052-228	Nipple, 2" Close PVC SCH 80	1
33	Figure 3-21	ECD Solenoid Assembly	1
34	052-078	Elbow, 1/8" Brass 45 Street	1
35	-----	Grease Fitting (Included with 111-020)	2
36	052-495	Elbow, 1/2" Flare x 3/8" MPT 90 Deg.	1
37	052-061	Bushing, 3/8 M x 1/4 F Brass	1
38	-----	Insert, 1/4" Hose (Part of Kit 078-350)	1
39	010-060	Belt, #9305 - Pump Drive	1

Figure 3-8: Engine Assembly

D3088, Rev C

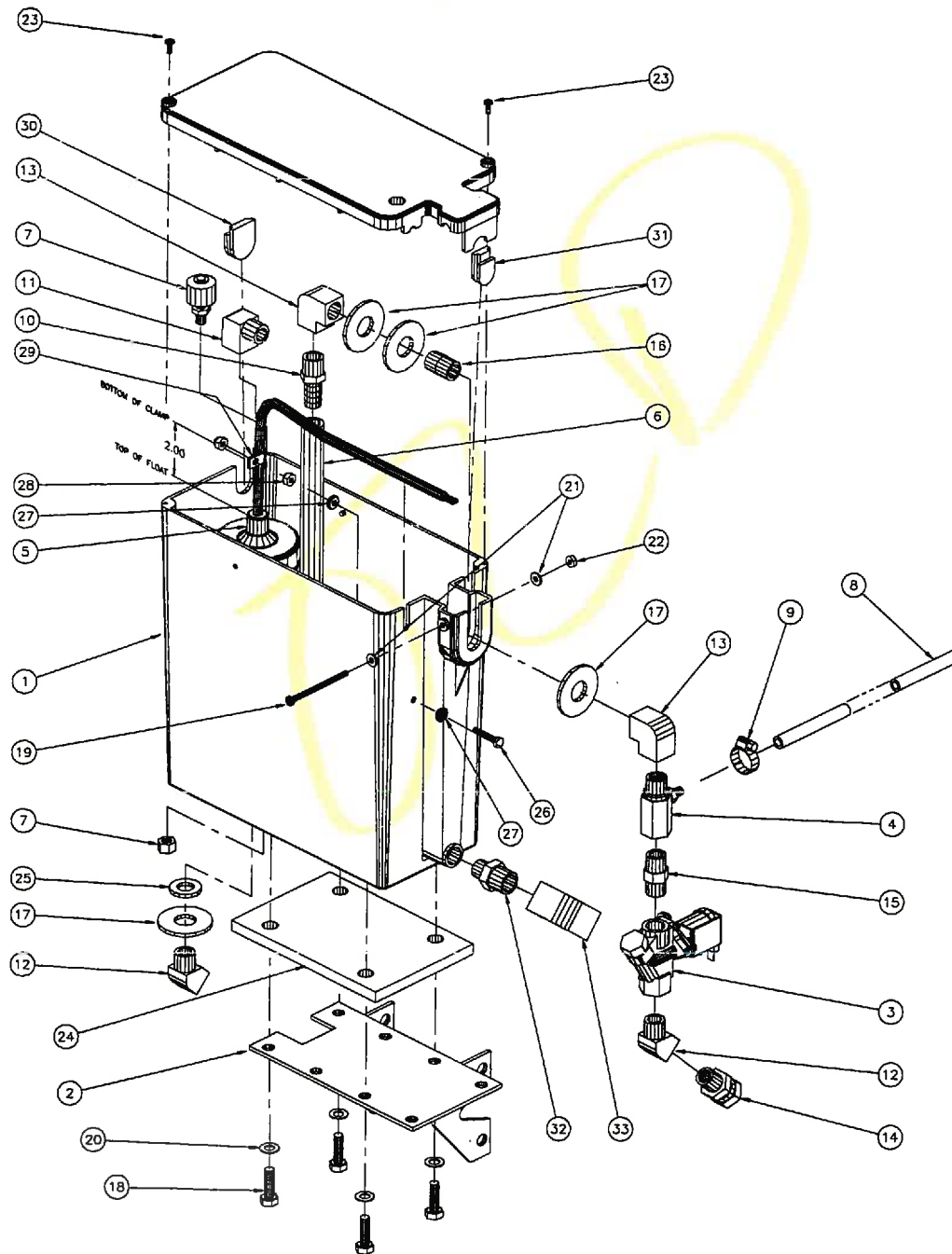


Engine Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	047-010	Engine, B & S 14HP Propane Vanguard	1
2	Figure 3-13	Dash Assembly	1
3	090-034	Manifold, CM 302 Exhaust Mod.	1
4	113-002	Radiator	1
5	015-242	Bracket, Lower Radiator Mount	1
6	041-202	Cover, Secondary Silencer - 8" Tank Hd	1
7	-----	Throttle Box Modification	1
9	157-009	Switch, Momentary, Normally Closed	1
10	052-408	Nipple, 3/8" x 4" Brass	1
11	052-032	8M-6UFS	1
12	106-003	Plug, 3/8" Brass	1
13	027-008	Cap, 3/8" Brass Pipe	1
14	143-090	Screw, 5/16-24 x 1" HHCS	2
17	174-018	Washer, 5/16" s/s Lock	2
18	094-035	Nut, 5/16-18 s/s Nylock Half	2
19	174-049	Washer, 5/16" s/s Flat	2
20	143-092	Screw, 5/16" x 2 1/4" HHCS s/s	2
21	Figure 3-15	Propane Conversion Assembly	1
22	090-038	Manifold, Catalytic Conv. Assembly	1
23	143-012	Screw, 5/16-18 x 3/4" HHC s/s	2
24	094-023	Nut, 5/16 - 18 Whiz	2
25	149-031	Sensor, Non-Heated Oxygen	1
26	057-010	Gasket, Exhaust Manifold - Vanguard	2
27	143-185	Screw, 8mm x 20mm, Grade 8.8 HHCS	5
28	077-006	Key, Briggs 16 HP Engine	1
29	174-018	Washer, 5/16" s/s Lock	1
30	057-016	Gasket, P-220 Exhaust Manifold	1
31	057-026	Gasket, 1/2" x 18 1/8" x 1/4" Kawasaki Brow Seal	1
32	012-003	Block, Rubber - Radiator Mount Pad	2
33	162-001	Tie Wrap, 4" Nylon	2
34	111-015	Pump, Mod. Fuel Pulse for ECD	1
35	068-019	Hose, 1/4" Rubber Vacuum	1
36	-----	Voltage Regulator Modification	1
37	015-288	Bracket, Upper Catalytic Guard	1
38	108-035	Protector, Catalytic Converter Heat Shield	1
39	094-090	Nut, 10-24 Acorn - Chrome	2

Figure 3-10: Mix Tank Assembly

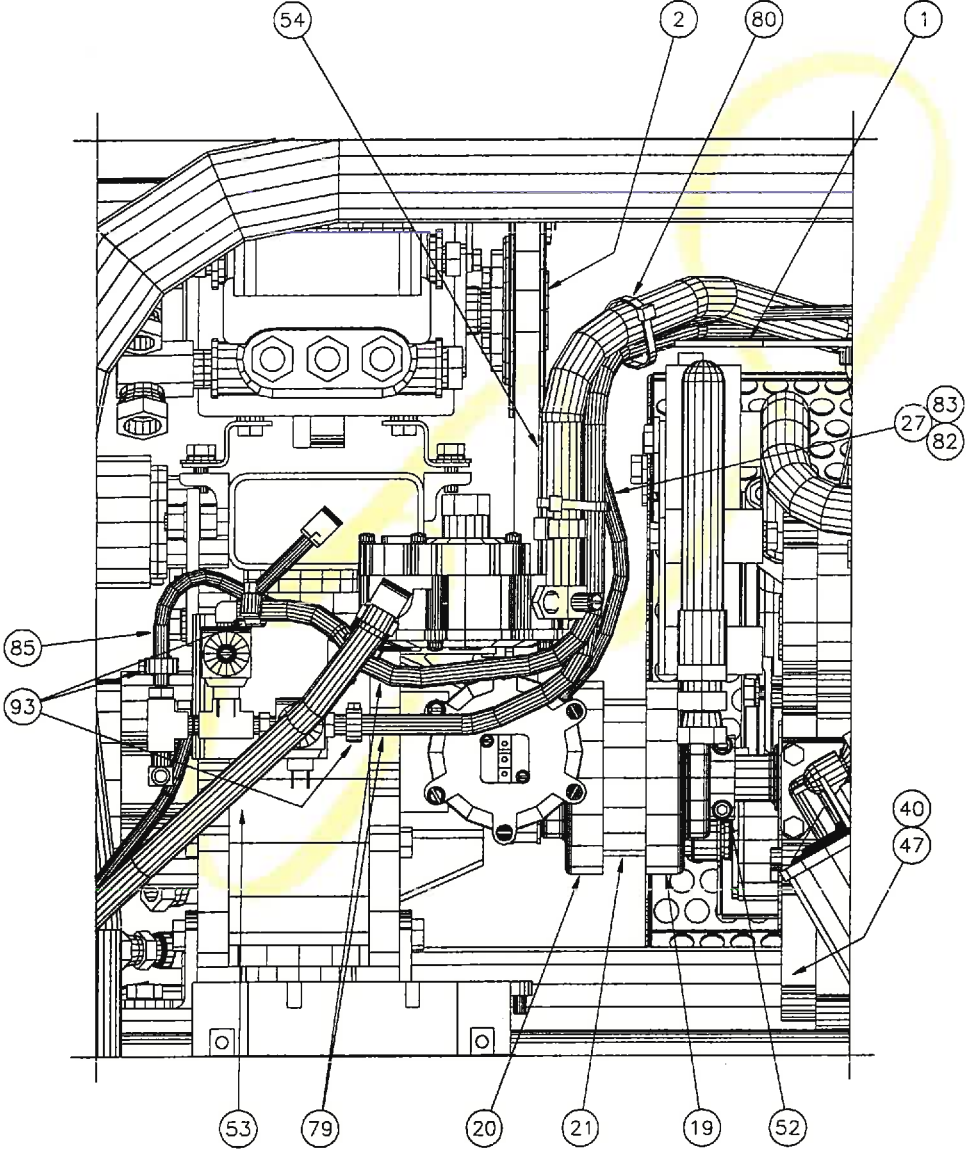
D2795, Rev G



Mix Tank Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	159-042	Tank, SF Mix - Mod.	1
2	015-244	Bracket, Mix Tank	1
3	169-120	Valve, Chemical System Solenoid - 12 v	1
4	181-008	Venturi, Low PSI Injector	1
5	157-001	Switch, Tethered Mercury Float - 25°	1
6	068-327	Hose, ½" Clear Braid	1
7	157-004	Switch, Mini Liquid Level Reed Kill	1
8	068-015	Hose, ¼" Rubber	1
9	033-004	Clamp, Size 6 Mini Hose	1
10	052-105	Insert, #68	1
11	052-086	Elbow, ⅜" Brass Street	1
12	052-083	Elbow, ⅜" Brass 45 Street	2
13	052-142	Elbow, ⅜" F x F Brass	2
14	052-019	6 M - 6 UFS	1
15	052-074	Nipple, ⅜" Brass Hex	1
16	052-077	Nipple, ⅜" Brass Close	1
17	174-034	Washer, .688 ID x 1.5 OD x .078 Thick s/s	4
18	143-143	Screw, ⅝ ¹⁶ - 18 x 1" HHC s/s	4
19	143-311	Screw, #8 - 32 x 2½" PANHMS	1
20	174-059	Washer, ⅝ ¹⁶ " s/s External Star	4
21	174-047	Washer, #8 Flat	2
22	094-059	Nut, #8 - 32 Nylock	1
23	143-314	Screw, #8 x ½" PNHD	2
24	057-028	Gasket, SF Mix Tank to Bracket Vibration Dmp.	1
25	057-055	Gasket, Garden Hose	1
26	143-134	Screw, 10-24 x 1" HHCS s/s	1
27	174-036	Washer, #10 s/s Flat - Rubber Back	2
28	094-034	Nut, 10-24 s/s Nylock	2
29	033-021	Clamp, ¼ Nylon Hose	1
30	106-039	Plug, Mix Tank 0.75"	1
31	106-038	Plug, Mix Tank 0.41"	1
32	052-075	Nipple, ⅜" x ½" Brass Hex	1
33	052-143	Elbow, ½" F x F Brass	1

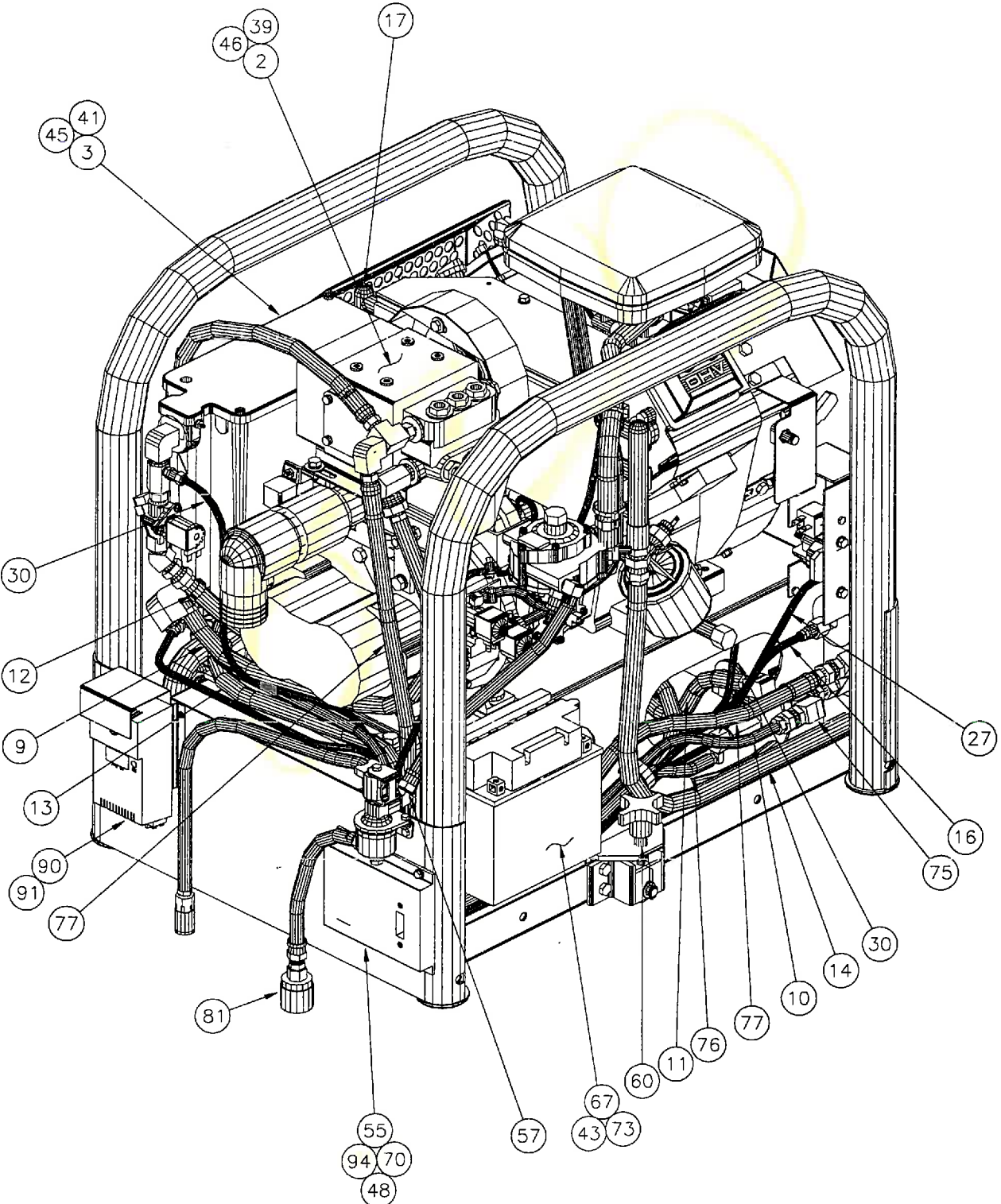
Figure 3-4
D3060, Rev B



ITEM	PART NO	DESCRIPTION	QTY
72	094-027	Nut, 10 - 24 s/s Hex	1
73	174-001	Washer, #10 s/s Flat	3
74	143-160	Screw, ⁵ / ₁₆ - 18 x 1" HHCS Grade 8	8
75	Figure 5-2	By-Pass Valve Assembly	1
76	-----	Dump Hose Assembly	1
77	068-295	Hose, ³ / ₈ " x 46" Throb	1
78	174-028	Washer, ⁷ / ₈ " ID Flat s/s x 1 ½" OD x .09 Thk	1
79	068-026	Hose, ¼" Rubber Fuel Line	3 Ft
80	162-002	Tie Wrap, 6" Nylon	2
81	068-391	Hose, Tank/Cart to Propane Solenoid	1
82	052-138	Insert, #22 (¹ / ₈ " NPT x ¹ / ₈ " Barb)	1
83	052-137	Insert, #12 (¹ / ₁₆ " NPT x ¹ / ₈ " Barb)	1
84	174-013	Washer, ³ / ₈ Fender	2
85	068-030	Hose, ⁵ / ₃₂ " Rubber Vacuum	6"
86	041-194	Cover, Right Front Heat Exchanger	1
87	Figure 3-20	Starter Solenoid Cover Assembly	1
88	143-128	Screw, 10 - 24 x ⁵ / ₈ " Btn Hd Cap	4
89	068-298	Hose, ½" x 18" Yellow with ³ / ₈ " Ends	1
90	Figure 3-22	Carbon Monoxide Detector Assembly	1
91	143-050	Screw, 8 - 32 x ½" Round Head Mach.	4
92	143-148	Screw, ⁵ / ₁₆ -18 x ½" HHCS s/s	2
93	033-003	Clamp, Size 4 Mini Hose	6
94	174-036	Washer, #10 s/s Flat - Rubber Back	8

Figure 3-5

D3060, Rev A

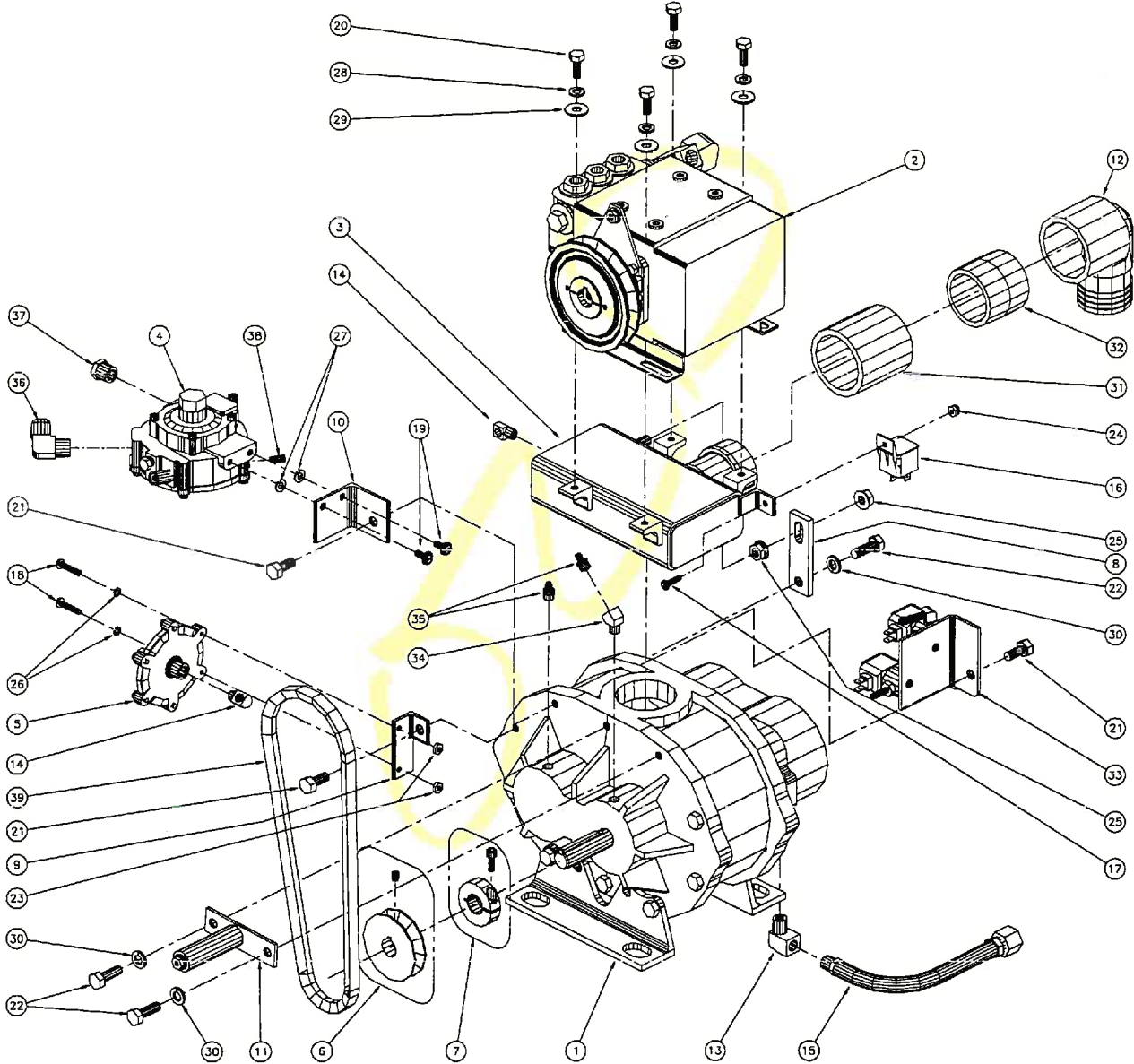


Machine Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	Figure 3-8	Engine Assembly	1
2	Figure 3-9	Blower and Pump Assembly	1
3	Figure 3-10	Mix Tank Assembly	1
4	Figure 3-17	Lower Heat Exchanger Assembly	1
5	Figure 3-18	Dual Heat Exchanger Assembly	1
6	055-019	Frame	1
7	108-041	Protector, Belt Guard	1
8	068-266	Hose, 3/8" x 25" Throb with 3/8" Ends	1
9	068-411	Hose, 3/4" x 25 1/2" Pump Pickup with 1/2" Ends	1
10	068-074	Hose, 3/8" x 62" Teflon	1
11	068-297	Hose, 1/2" x 8" Red with 3/8" Ends	1
12	068-262	Hose, 1/2" x 24" Red with 3/8" End, 1/2" Thr. End	1
13	068-264	Hose, 1/2" x 69" Red with 3/8" Ends	1
14	068-265	Hose, 1/2" x 23" Black with 3/8" Ends	1
15	068-267	Hose, 3/8" x 9" Teflon	1
16	068-175	Hose, Sol. Valve to Rotary Union	1
17	-----	Hose Assembly, Radiator Fill	1
18	093-027	Silencer, 2" Compact - Quiet	1
19	039-017	Coupler, #6 x 1"	1
20	039-014	Coupler, #6 x 3/4"	1
21	152-008	Sleeve, #6 Drive Coupler	1
22	074-003	Gauge, High PSI (0-1000)	1
23	074-013	Meter, Chemical Flow	1
24	169-064	Valve, 3/8" Full Port Ball	1
25	052-086	Elbow, 3/8" Brass Street	1
26	068-260	Hose, 1 1/4" x 32 1/2" s/s Exhaust Flex	1
27	068-030	Hose, 5/32" Rubber/Vacuum	1
28	033-027	Clamp, 1 3/8" Muffler	2
29	015-236	Bracket, Air Duct Mount	2
30	068-015	Hose, 1/4" Rubber	5 Ft
31	052-052	Quick Connect, 660 Male with Viton - Standard	1
32	052-050	Quick Connect, 440 Male with Viton Standard	1
33	052-013	4M-6UFS	1
34	105-012	Plate, Machine Serial ID	1
35	052-097	Insert, #24	2

Figure 3-9: Blower and Pump Assembly

D3148



Blower and Pump Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	111-020	Blower, 3.2 Roots	1
2	Figure 3-7	Pump Assembly	1
3	015-266	Bracket, Pump Mnt Collector Box - Triplex Pmp	1
4	135-005	Regulator, Engine Propane B&S 14 HP	1
5	157-018	Switch, Micro - Vacuum Solenoid	1
6	109-004	Pulley, 2 3/4" x 3/4" - Pump Drive	1
7	020-011	Collar, Blower Shaft - Single Screw Type	1
8	015-267	Bracket, Mount Straps - Pump Mnt with Triplex	1
9	015-280	Bracket, CM 302 Vacuum Switch Mount	1
10	015-279	Bracket, CM 302 Propane Regulator Mount	1
11	154-052	Spacer, Lower Belt Guard	1
12	052-222	Elbow, 2" Comb - Insert x FPT	1
13	052-085	Elbow, 1/4" Brass Street	1
14	052-084	Elbow, 1/8" Brass Street	2
15	068-221	Hose, 3/8" x 24" Pump Drain	1
16	157-022	Switch, Relay	1
17	143-126	Screw, 10-24 x 1/2" s/s HHC	1
18	143-224	Screw, 5mm x .8mm x 25mm Slot Head	2
19	143-317	Screw, 1/4-20 x 1/2" Pan Hd, Zinc Plated, Phil.	2
20	143-012	Screw, 5/16 - 18 x 3/4" HHC s/s	4
21	143-017	Screw, 3/8 - 16 x 3/4" HHC	3
22	143-019	Screw, 3/8-16 x 1 1/4" HHC, Grade 5 Zinc	3
23	094-067	Nut, 5mm x .8mm	2
24	094-034	Nut, 10-24 s/s Nylock	1
25	094-016	Nut, 3/8 - 16 Whiz	2
26	174-014	Washer, #10 s/s Lock	2
27	174-017	Washer, 1/4" Lock	2
28	174-018	Washer, 5/16" s/s Lock	4
29	174-004	Washer, 5/16 Flat	4
30	174-021	Washer, 3/8 Lock	3
31	052-205	Coupler, 2" Aluminum	1
32	052-228	Nipple, 2" Close PVC SCH 80	1
33	Figure 3-21	ECD Solenoid Assembly	1
34	052-078	Elbow, 1/8" Brass 45 Street	1
35	-----	Grease Fitting (Included with 111-020)	2
36	052-495	Elbow, 1/2" Flare x 3/8" MPT 90 Deg.	1
37	052-061	Bushing, 3/8 M x 1/4 F Brass	1
38	-----	Insert, Straight Thread - 1/4" Hose (See Item 4)	1
39	010-060	Belt, #9305 - Pump Drive	1

Figure 3-10: Mix Tank Assembly

D2795, Rev E

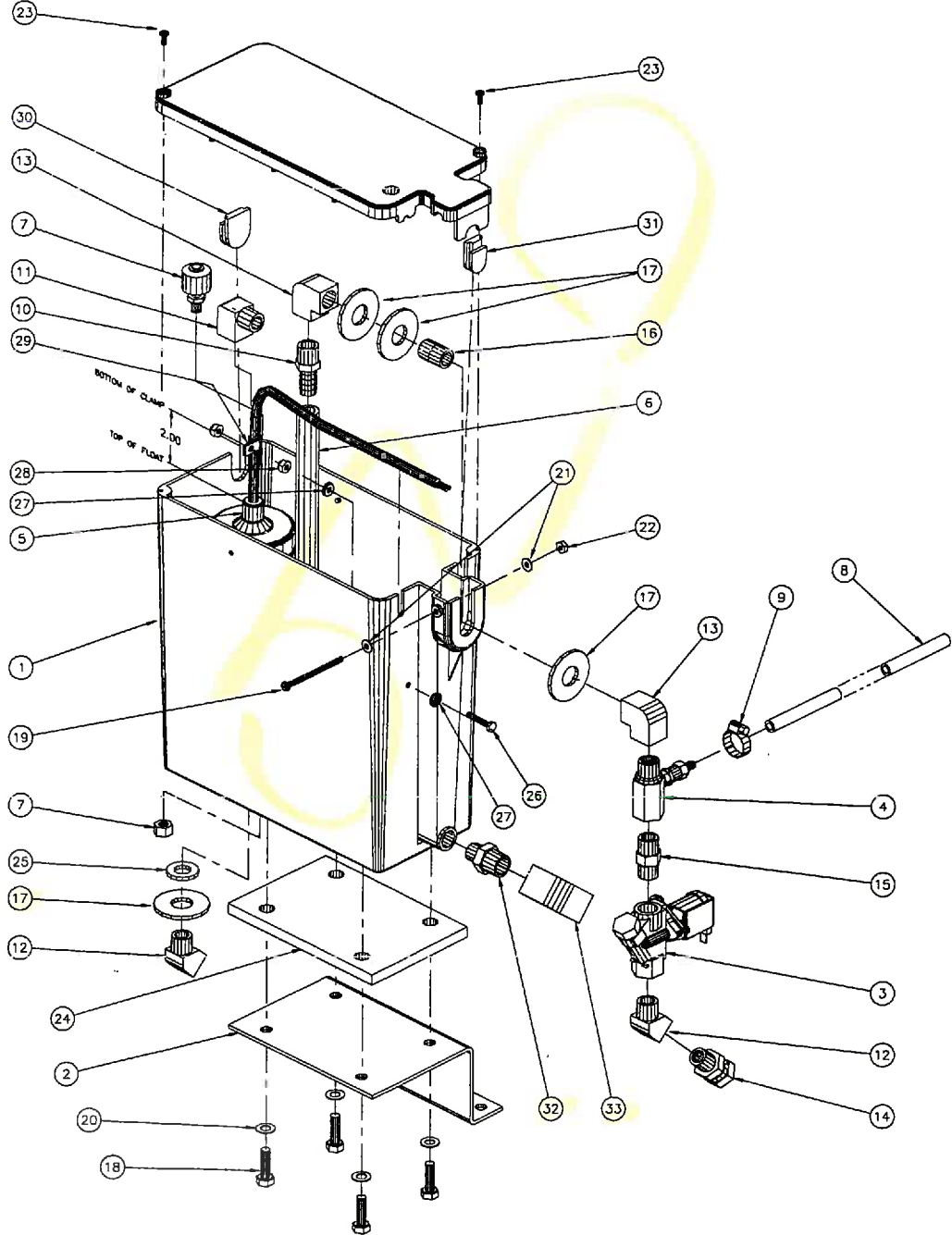
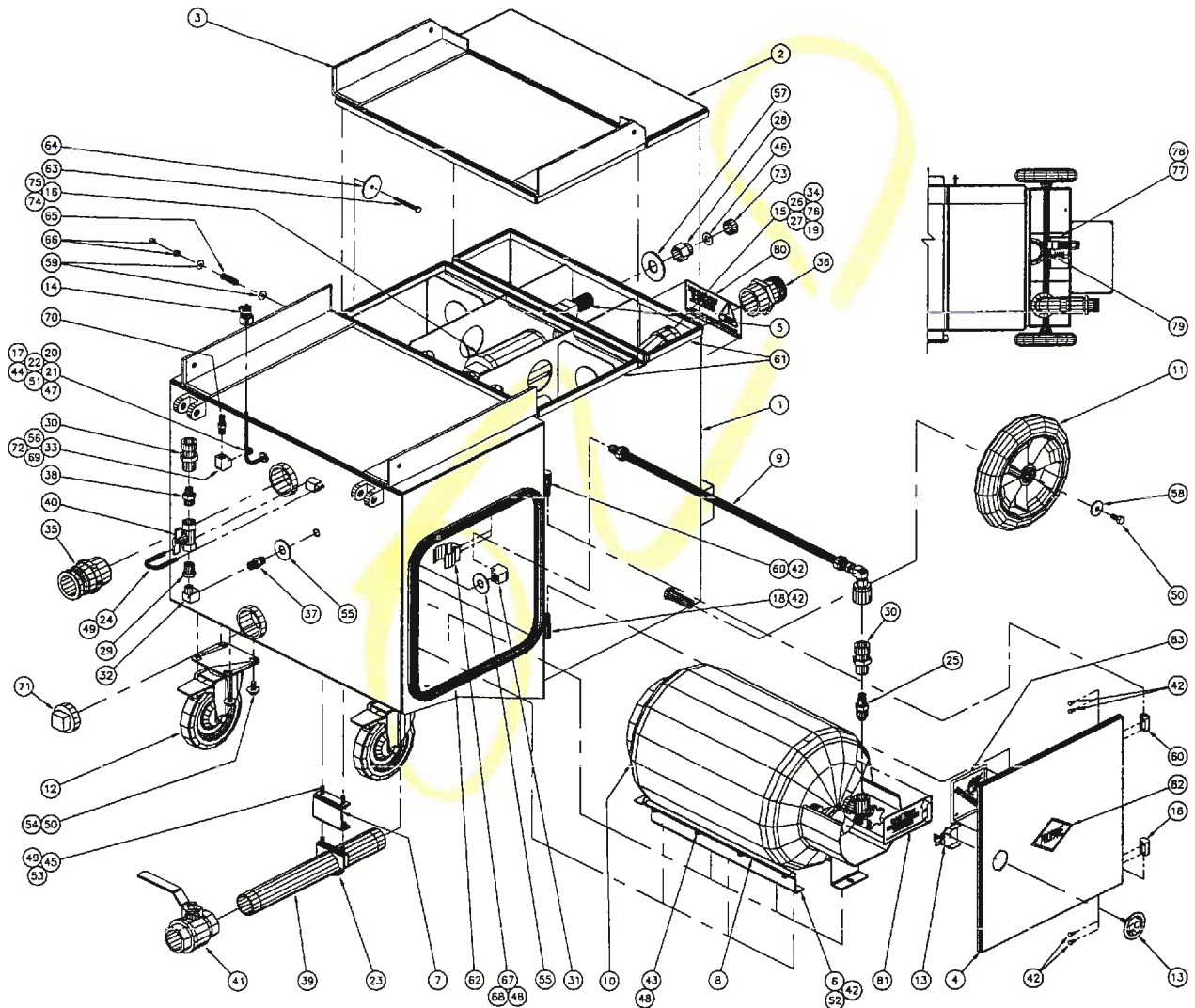


Figure 3-11: Cart and Recovery Tank Assembly

D3061



Cart and Recovery Tank Assembly Parts List

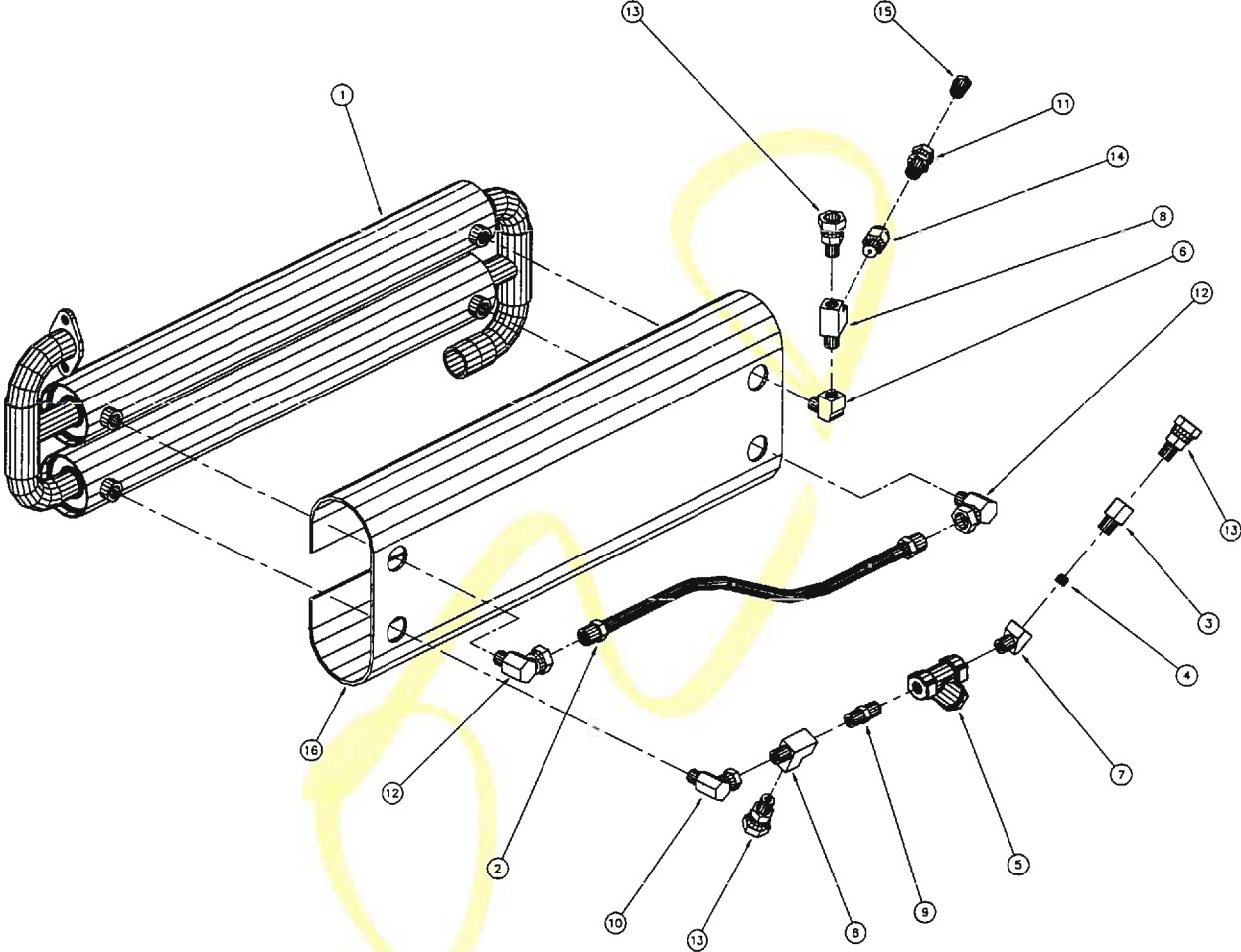
ITEM	PART NO	DESCRIPTION	QTY
1	159-047	Tank and Cart - CM 302	1
2	041-201	Cover, CM 302 Front Recovery Tank	1
3	041-197	Cover, CM 302 Rear Recovery Tank	1
4	041-199	Cover, CM 302 Side Access	1
5	Figure 3-14	APO Assembly	1
6	015-268	Bracket, CM 302 Propane Tank	2
7	015-269	Bracket, CM 302 Waste Wtr Drain Pipe Hanger	1
8	114-001	Rail, CM 302 Propane Tank Guide	2
9	068-391	Hose, Propane - Tank/Cart to Propane Sol.	1
10	159-012	Propane Tank, 30 lb CM 302 Horizontal	1
11	177-026	Wheel, 10 x 2 - 1/8 Smooth Tread Balloon Tire	2
12	177-025	Caster, CM 302 with Brake	2
13	086-014	Latch, Access Door	1
14	037-050	Connector, 4 Pole Male - Water Tight	1
15	049-030	Filter Bag, 92+ Truckmount	1
16	049-007	Filter, s/s Vacuum Pump - Blower	1
17	060-008	Grommet, 5/16" ID Rubber - Mix Tank	1
18	067-017	Hinge Set, Left - Recovery Tank	2
19	125-014	Pipe, 2" Sch. 40, PVC x 20 Ft Long.	1
20	108-050	Protector, Electric Cord Lock Bulk Head Fitting	1
21	157-001	Switch, Tethered Mercury Float - 35 Deg.	1
22	033-021	Clamp, 1/4 Nylon Hose	1
23	033-061	Clamp, 1 7/8" Muffler	1
24	143-091	U-Bolt, 5/16" x 1" Diameter	1
25	052-494	Nipple, POL x 1/4" M Propane	1
26	052-242	Adapter, 2" MPT x 2" M - Slip ABS	1
27	052-404	Adapter, 3" F Slip x 2" F Slip	1
28	052-413	Bushing, 3/4" M Garden x 3/4" FPT - Brass	1
29	052-064	Bushing, 1/2 M x 3/8 F Brass	1
30	052-046	Propane Quick Connect, Male	2
31	052-142	Elbow, 3/8" F x F Brass	1
32	052-086	Elbow, 3/8" Brass Street	1
33	052-088	Elbow, 1/4" Brass Female	1
34	052-241	Elbow, 2" F Slip x F Slip PVC 90 Deg.	1
35	052-499	Coupler, Male CAM x 2" MPT	1

ITEM	PART NO	DESCRIPTION	QTY
36	052-221	Insert, 2" NPT x 2" Plastic Barb	1
37	052-074	Nipple, 3/8 Brass Hex	1
38	052-075	Nipple, 3/8" x 1/2" Brass Hex	1
39	052-493	Nipple, 1 1/2" x 15" Steel	1
40	169-032	Valve, 1/2" Propane Shut-Off	1
41	169-022	Valve, 1 1/2" Full Port Brass Dump	1
42	143-166	Screw, 10-24 x 3/8" s/s HHC	14
43	143-060	Screw, 10-24 x 3/8" Flat Hd Machine	8
44	143-062	Screw, 10-24 x 3/4" s/s PANHDMS Phillips	1
45	143-012	Screw, 5/16-18 x 3/4" HHC s/s	2
46	057-055	Gasket, Garden Hose	1
47	094-027	Nut, 10-24 s/s Hex	1
48	094-034	Nut, 10-24 s/s Nylock Hex	10
49	094-012	Nut, 5/16-18 s/s Hex	4
50	143-017	Screw, 3/8-16 x 3/4" HHC	10
51	174-001	Washer, #10 s/s Flat	1
52	174-014	Washer, #10 s/s Lock	6
53	174-018	Washer, 5/16" s/s Lock	2
54	174-005	Washer, 3/8 Flat	8
55	174-008	Washer, 5/8 Flat	1
56	174-040	Washer, 9/16 ID Flat	2
57	174-050	Washer, 1" SAE Flat	1
58	174-013	Washer, 3/8 Fender	2
59	174-003	Washer, 1/4" s/s Flat	2
60	067-018	Hinge Set, Right - Recovery Tank	1
61	131-028	Gasket, Trimlok Recovery Tank Gasket Mat.	10 Ft
62	131-041	Trimlok, Side Bulb	6 Ft
63	143-009	Screw, 1/4-20 x 2 1/2" HHC s/s	1
64	105-005	Plate, Vacuum Relief	1
65	155-002	Spring, s/s Vacuum Relief Valve	1
66	094-010	Nut, 1/4-20 s/s Hex	2
67	033-039	Clamp, 1 1/2" Spring - Wand Holder	1
68	143-126	Screw, 10-24 x 1/2" s/s HHC	2
69	052-085	Elbow, 1/4" Brass Street	1
70	052-435	Quick Connect, 1/4 M x 1/4" NPT - Service Master	1
71	106-018	Plug, 2" Plastic	1

ITEM	PART NO	DESCRIPTION	QTY
72	068-394	Hose, 3/8" x 18" Rubber with 1/4" Ends	1
73	027-014	Cap, Brass Garden Hose	1
74	052-228	Nipple, 2" Close PVC SCH 80	1
75	052-205	Coupler, 2" Aluminum	1
76	143-118	Screw, #8 x 1/2" HXWSHD SM	1
77	157-013	Switch, Ball Float without Cover	1
78	041-001	Cover, New Style Vac Tank Stop Switch	1
79	162-002	Tie Wrap, 6" Nylon	1
80	081-086	Label, "Breathing Hazard"	1
81	081-085	Label, "Do Not Overfill..."	1
82	081-077	Label, "Propane Symbol"	1
83	081-078	Label, Red "Flammable Gas"	1

Figure 3-18: Dual Heat Exchanger Assembly

D3090

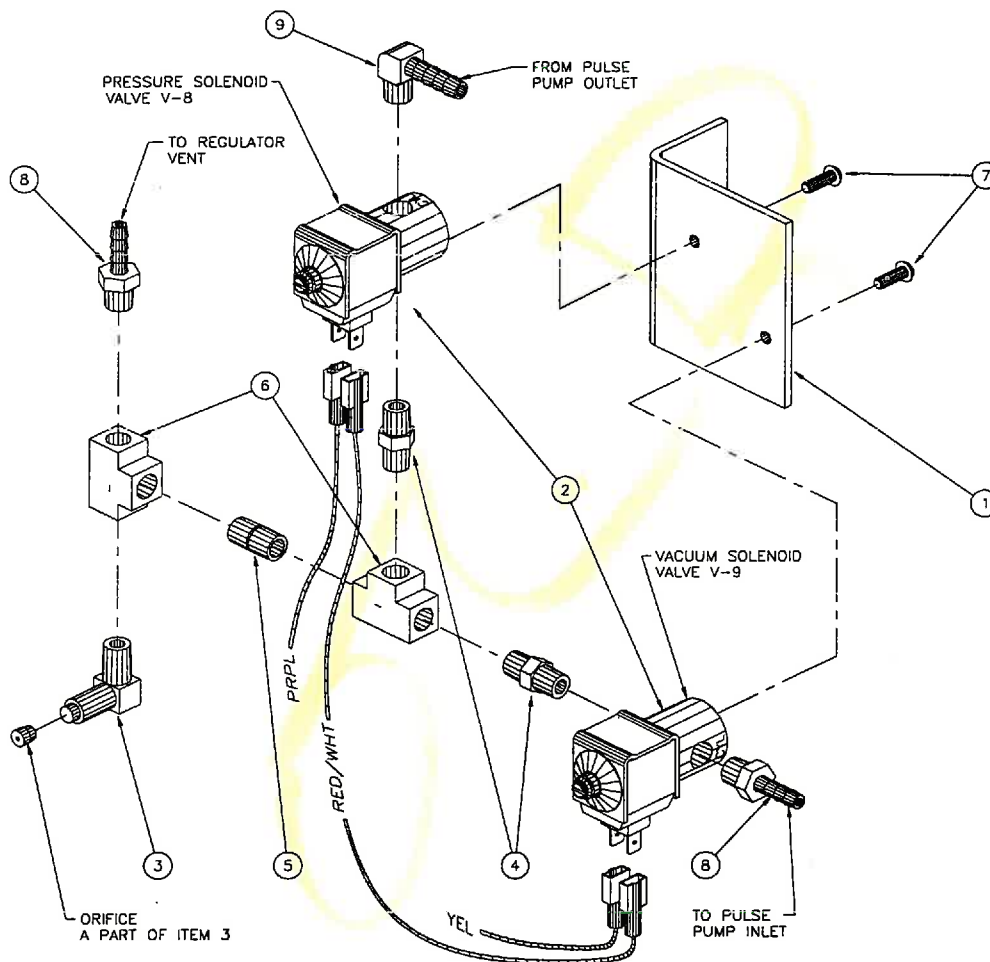


Dual Heat Exchanger Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	038-026	Heat Exchanger, s/s	1
2	068-078	Hose, 3/8" x 18" Teflon	1
3	052-423	Bushing, Mod. Set Screw Orifice Housing	1
4	180-002	Orifice, Set Screw - .039"	1
5	049-033	Filter, 1/4" Inline V	1
6	052-085	Elbow, 1/4" Brass Street	1
7	052-082	Elbow, 1/4" Brass 45 Street	1
8	052-090	Tee, 1/4" Male Branch M-F-F	2
9	052-071	Nipple, 1/4" Brass Hex	1
10	052-006	4MA-4UFS	1
11	052-005	4M-4UFS	1
12	052-014	4MA-6UFS	2
13	052-013	4M-6UFS	3
14	135-052	Regulator, High PSI Snubber	1
15	052-059	Bushing, 1/4 M x 1/8 F Brass	1
16	108-023	Protective Insulation Blanket	1

Figure 3-21: ECD Solenoid Assembly

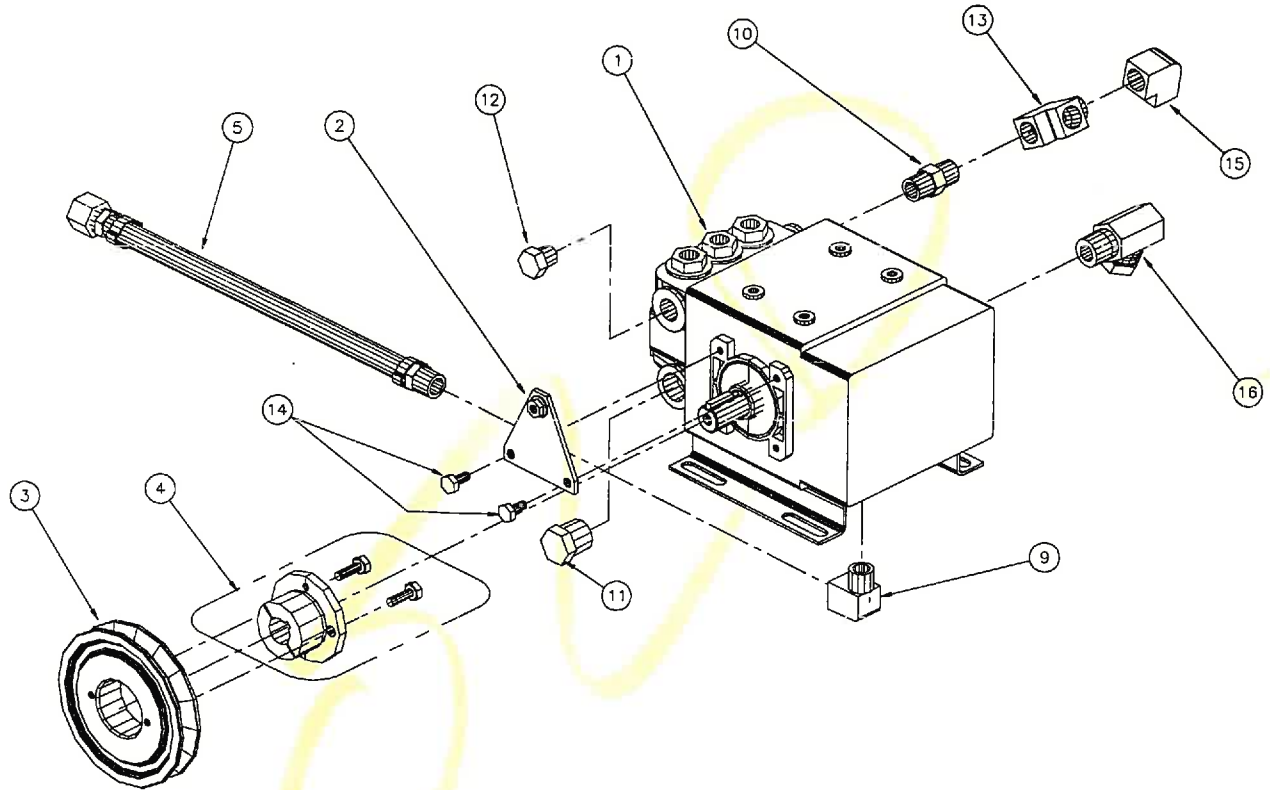
C2994, Rev A



ITEM	PART NO	DESCRIPTION	QTY
1	015-283	Bracket, ECD Solenoid Mount	1
2	169-029	Valve, Solenoid	2
3	-----	ECD Check Valve (Part of Kit 078-350)	1
4	052-069	Nipple, 1/8" Brass Hex	2
5	052-057	Nipple, 1/8" Brass Close	1
6	052-092	Tee, 1/8" Brass	2
7	143-050	Screw, 8-32 x 1/2" Round Hd Mach.	2
8	052-097	Insert, #24	2
9	052-253	Elbow, 1/8" Male x 1/4" Barb	1

Figure 3-7: Pump Assembly

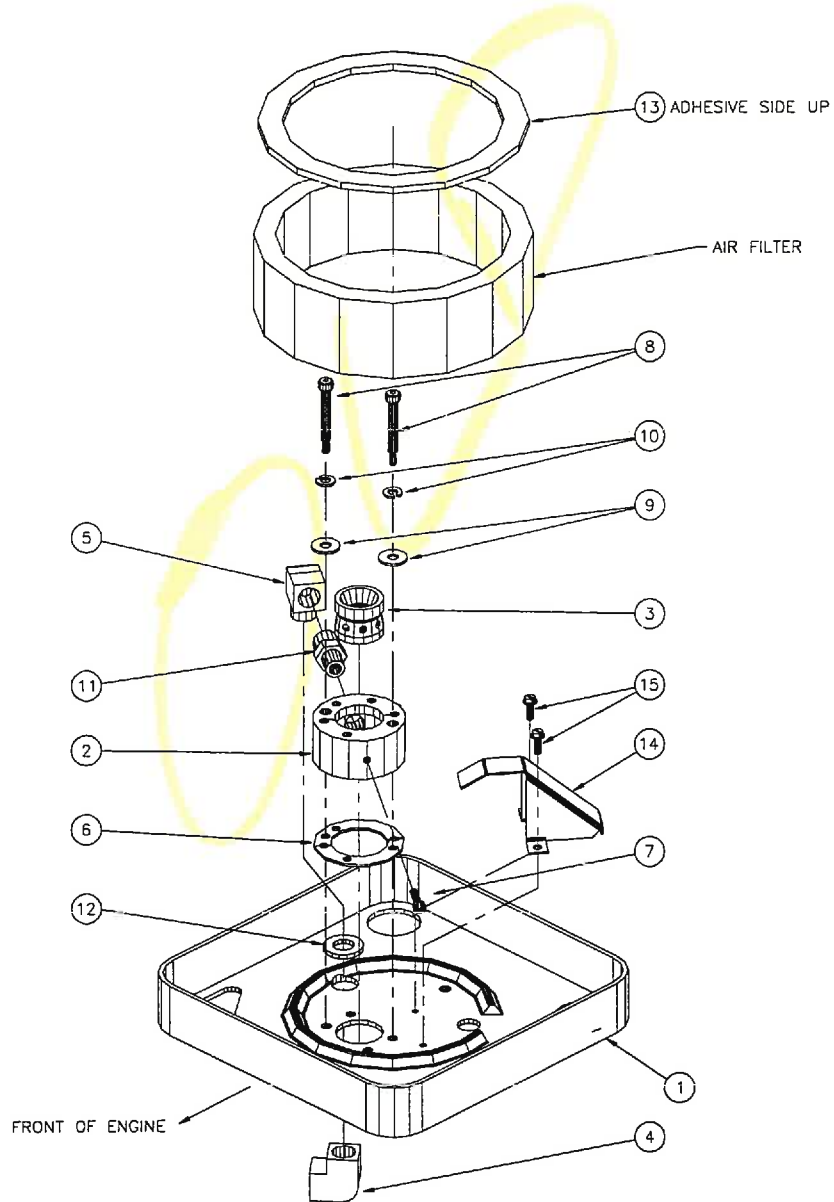
C3239, Rev A



ITEM	PART NO	DESCRIPTION	QTY
1	111-041	Pump, Triplex 3.5 GPM	1
2	154-057	Spacer, Upper Belt Guard - Triplex Pump	1
3	109-020	Pulley, AK46H Pump	1
4	020-021	Bushing, H x 3/4" Hub	1
5	068-219	Hose, Pump Drain	1
9	052-086	Elbow, 3/8" Brass Street	1
10	052-074	Nipple, 3/8" Brass Hex	1
11	106-004	Plug, 1/2" Brass	1
12	106-003	Plug, 3/8" Brass	1
13	052-023	Tee, 3/8" Male Branch - Brass	1
14	143-221	Screw, 6M - 1 x 13mm HHCS	2
15	052-142	Elbow, 3/8" F x F Brass	1
16	052-036	8MA-8UFS	1

Figure 3-15: Propane Conversion Assembly

C3156



Propane Conversion Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	042-060	Housing, Engine Air Filter	1
2	001-031	Adapter Set, Propane Carb. Inlet	1
3	181-010	Venturi, Beam Propane	1
4	052-142	Elbow, 3/8" F x F Brass	1
5	052-086	Elbow, 3/8" Brass Street	1
6	-----	Gasket (Part of Kit 001-030)	1
7	-----	Screw, #10-24 x 3/4" (Part of Kit 001-030)	1
8	143-222	Screw, 6mm x 40mm Socket Head	2
9	174-003	Washer, 1/4" s/s Flat	1
10	174-017	Washer, 1/4" Lock	2
11	052-073	Nipple, 1/4" x 3/8" Brass Hex	1
12	057-055	Gasket, Garden Hose	1
13	057-029	Gasket, Air Filter Cover	1
14	015-329	Bracket, Breather Tube	1
15	143-118	Screw, #8 x 1/2" HXWSHD SM	2

Spare Parts

CM 302
Section 3-36

Down-time on the unit can be very expensive, because your truck-mounted unit is capable of generating several hundred dollars per day. In order to minimize such down-time, it is strongly recommended by the manufacturer that you purchase and keep in your truck the parts listed below.

Parts Orders

To expedite your parts needs, please call your sales representative. In most instances, he either stocks or has access to parts through a regional service center. If further assistance is needed, contact the factory and coordinate your needs. If this becomes necessary, always indicate the method of shipment you desire, i.e. UPS, Blue Label, Air Freight, Air Express, etc.

HydraMaster Parts Dept. Phone (206) 775-7276
HydraMaster Parts Dept. Toll Free Fax 1-800-426-4225

Parts List (078-090)

PART NO	DESCRIPTION	QTY
010-060	Belt, #9305 - Pump Drive	1
049-014	Filter, Vanguard Oil	2
049-007	Filter, S/S Vacuum Pump	1
049-016	Filter, 1/4" Replacement Y	1
049-023	Screen, Garden Hose	1
049-012	Filter, Vanguard Air	1
049-030	Filter Bag, 92+ Truck Mount	2
052-050	Quick Connect, 440 Male	3
052-051	Quick Connect, 440 Female	2

PART NO	DESCRIPTION	QTY
052-052	Quick Connect, 660 Male	1
052-053	Quick Connect, 660 Female	1
057-043	Gasket, Recovery Tank	1
074-003	Gauge, Hi PSI (0-1000)	1
074-013	Meter, Chemical Flow	1
078-015	Kit, Chem Flowmeter	1
078-101	Kit, Seal & Spring Hi PSI	1
106-016	Plug, Vanguard Spark	2
131-037	Wrap, Exhaust Insulation	1
157-001	Switch, Tethered Mercury	1
157-115	Mini-Rocker with Terminal	1
157-022	Switch, Relay	2
169-022	Valve, 1 1/2" Full Port	1
169-062	Valve, 1/4 Anti-Siphon	1
169-120	Valve, Chemical System	1
152-008	Sleeve, #6 Drive Coupler	1
078-140	Kit, Hypro Seal	1

How to Order Parts

CM 302

Section 3-38

To obtain a proper diagnosis of your malfunction, and to order warranty replacement parts, it is important that you proceed in the following manner:

WARRANTY PARTS ORDERS

1. Call HydraMaster/CleanMaster Service Department at (206) 775-7275.
2. Give the Service representative the following information:
 - A. Your Company Name and Address
 - B. Equipment Model
 - C. Date of Purchase
 - D. Hours on the Unit
 - E. Unit Serial Number
 - F. Name of Person Authorized to Order Parts
 - G. Sales Representative from which Unit was Purchased
 - H. Description of Malfunction
 - I. High Pressure Gauge Readings with the Wand Turned On and Off
3. If warranty replacement parts are needed, please specify method of shipment desired. HydraMaster/CleanMaster will pay for ground UPS. If you require replacement parts overnight they will be sent freight collect, via: Air Freight, Air Mail, or Air Express.
4. Do not give malfunctioning parts to a HydraMaster/CleanMaster sales or service representative. **All parts must be returned directly to HydraMaster/CleanMaster, freight prepaid.**

PARTS ORDERS

To expedite your parts needs, please call your sales representative. In most instances, they either stock or have access to parts through a regional service center. If further assistance is needed, contact the factory and coordinate your needs. If this becomes necessary, always indicate the method of shipment you desire, i.e. UPS, Blue Label, Air Freight, Air Express, etc.

HydraMaster/CleanMaster Parts Dept. Phone (206) 775-7276
HydraMaster/CleanMaster Parts Dept. Toll-Free Fax 1-800-426-4225

HydraMaster/CleanMaster has a \$40 minimum on parts orders. Orders below the minimum will be charged a \$15 expediting fee.

ONE FINAL NOTE

Any questions you have regarding the warranty program should be directed to the Service Department personnel at HydraMaster/CleanMaster Corporation.

We shall always endeavor to be fair in our evaluation of your warranty claim, and shall provide you with a complete analysis of our findings.

HydraMaster/CleanMaster warranty covers only defective materials and/or workmanship for the periods listed. **Labor and/or diagnostic reimbursement is specifically excluded.**

Accessories

CM 302

Section 3-40

Genuine HydraMaster Accessories & Detergents

This section of your Owners Manual is devoted to Accessories and Detergents which we have found to be helpful and useful. *These products can enhance your cleaning and reduce your labor costs!*

HydraMaster Machine accessories are the most innovative collection available in the cleaning industry. Our patented **RX-20 Rotary Extractors** have changed the shape of steam cleaning. Our hoses and tanks are of the finest quality construction.

SafeClean Detergents have been specially prepared, not only to give you exceptional cleaning, but also to optimize your truckmount's operation and reliability. *Most detergents don't work well under the high heat, high pressure conditions of truckmount use.* **SafeClean** will maintain your machines's water pump and water heating systems at peak efficiency and help ensure fewer breakdowns.

*For more information, or to order Genuine
HydraMaster Accessories and Detergents
Call your nearest authorized HydraMaster Distributor.*

Machine Parts

CM 302
Section 3-1

Figure 3-1: Final Machine Assembly

D3059

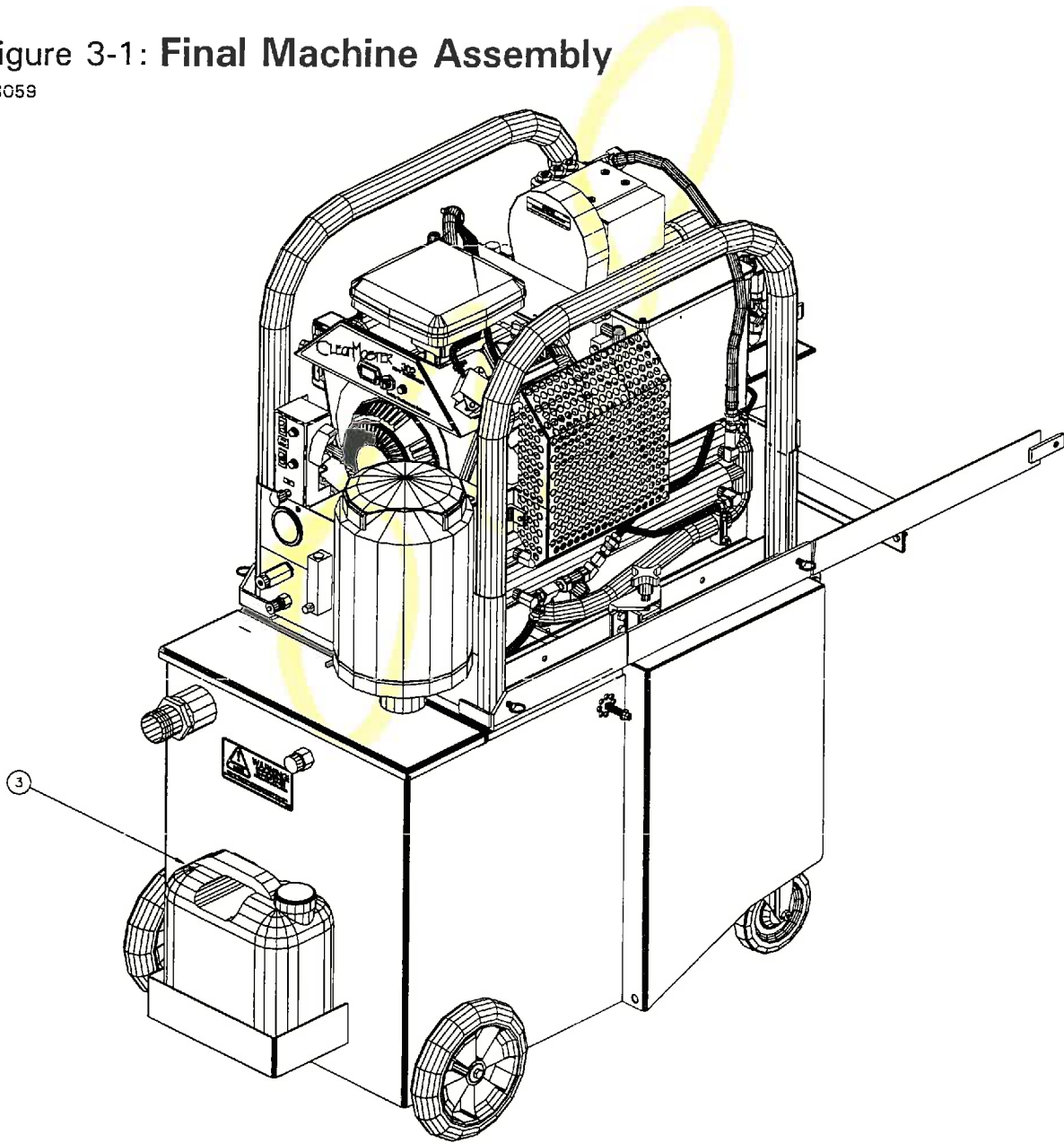
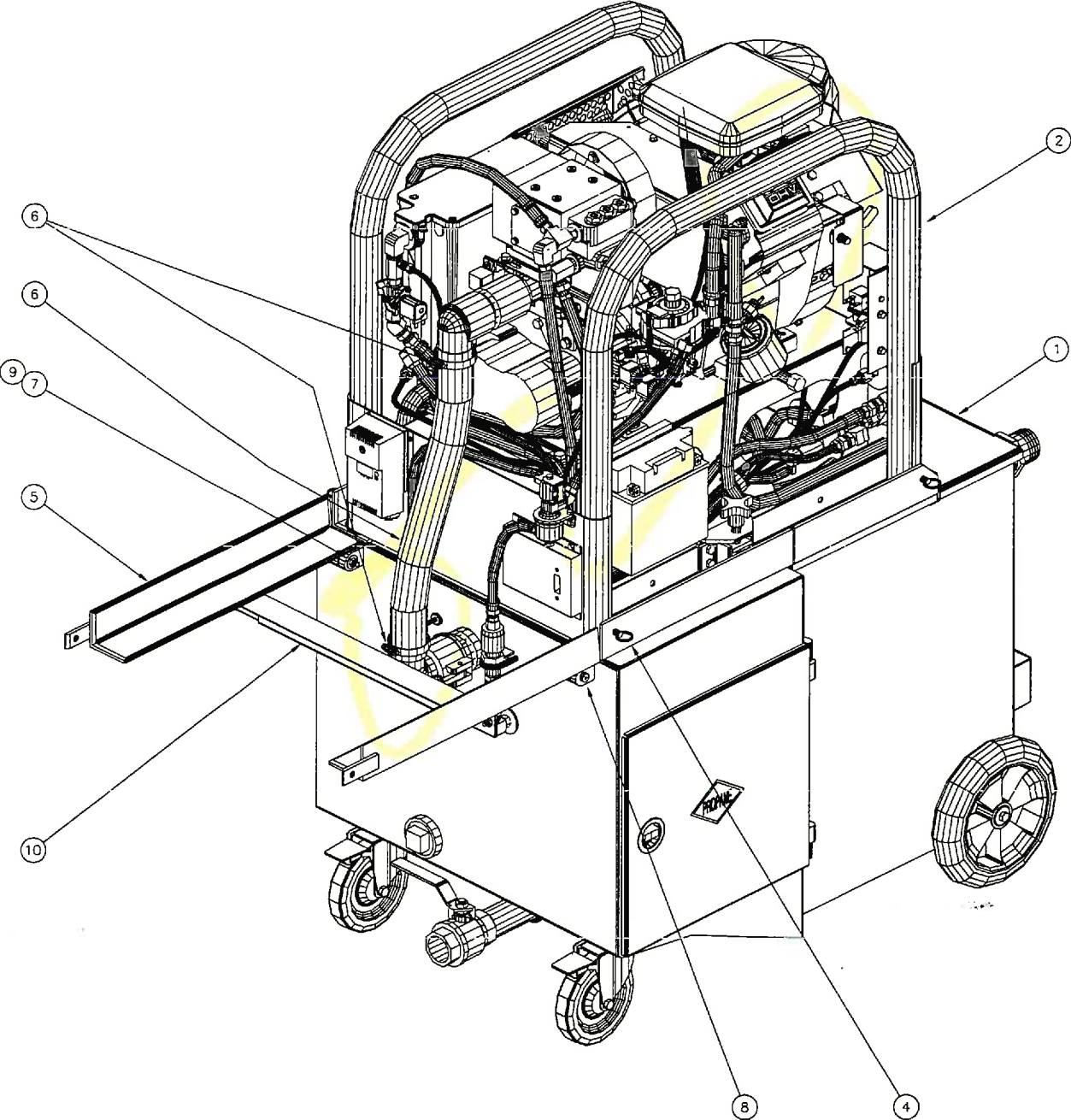


Figure 3-2



Final Machine Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	Figure 3-11	Cart and Recovery Tank Assembly	1
2	Figures 3-3 to 6	Machine Assembly (Power Unit with Silencer)	1
3	159-022	Jug, 2½ Gallon Chemical	1
4	103-029	Pin, CM302 Machine to Cart	4
5	015-290	Bracket, Rail to Truckmount	1
6	068-276	Hose, 2" x 36" Air Vent	1
7	094-035	Nut, ⁵ / ₁₆ - 18 s/s Nylock Half	2
8	143-163	Bolt, ³ / ₈ " x 2" Shoulder with ⁵ / ₁₆ " Threads s/s	2
9	174-049	Washer, ⁵ / ₁₆ " s/s Flat	2
10	131-028	Gasket, Trimlok Recovery Tank Material	2 Ft
11	033-010	Clamp, Size 32 Hose	2

Figure 3-3: Machine Assembly

D3060

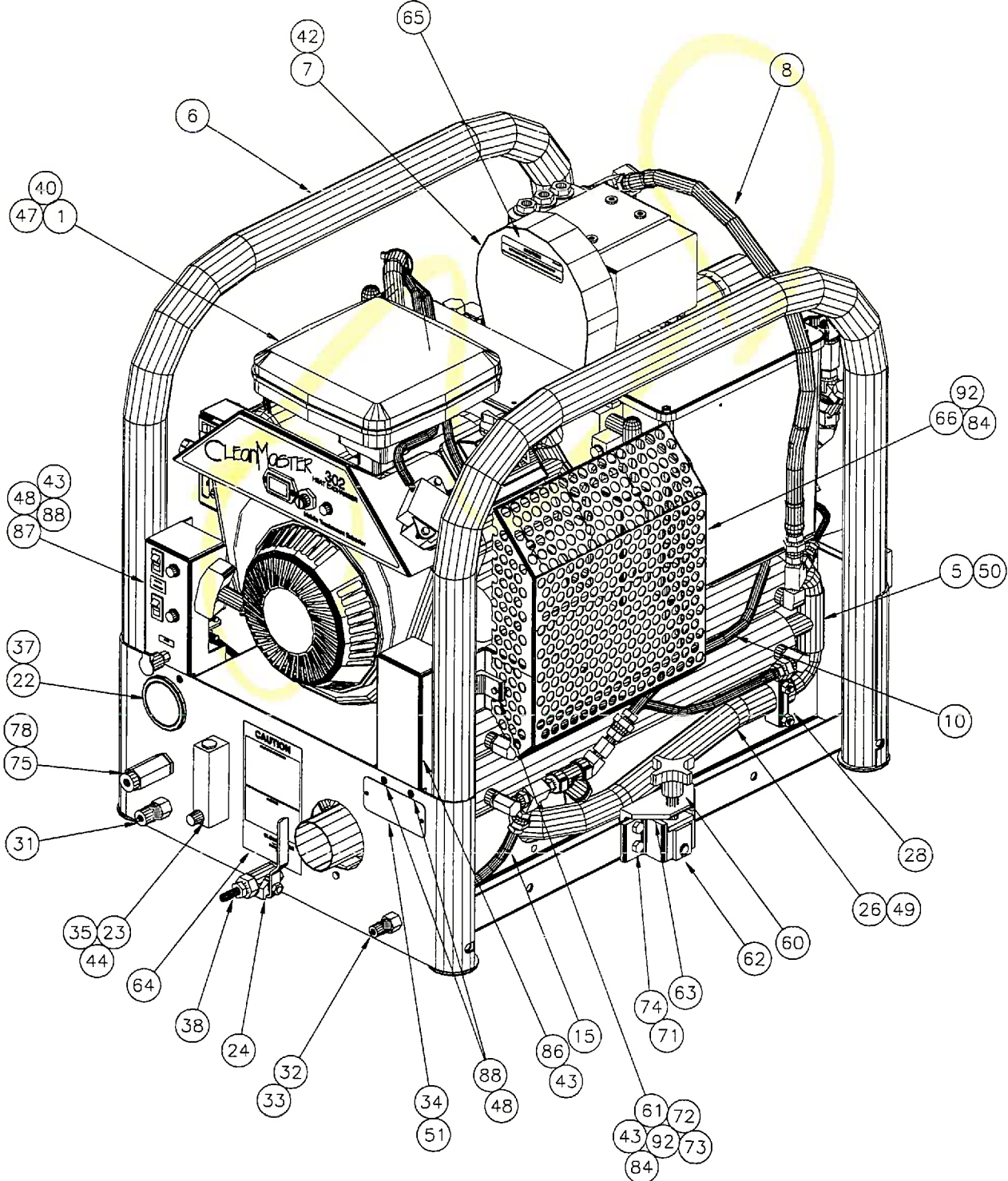


Figure 3-4

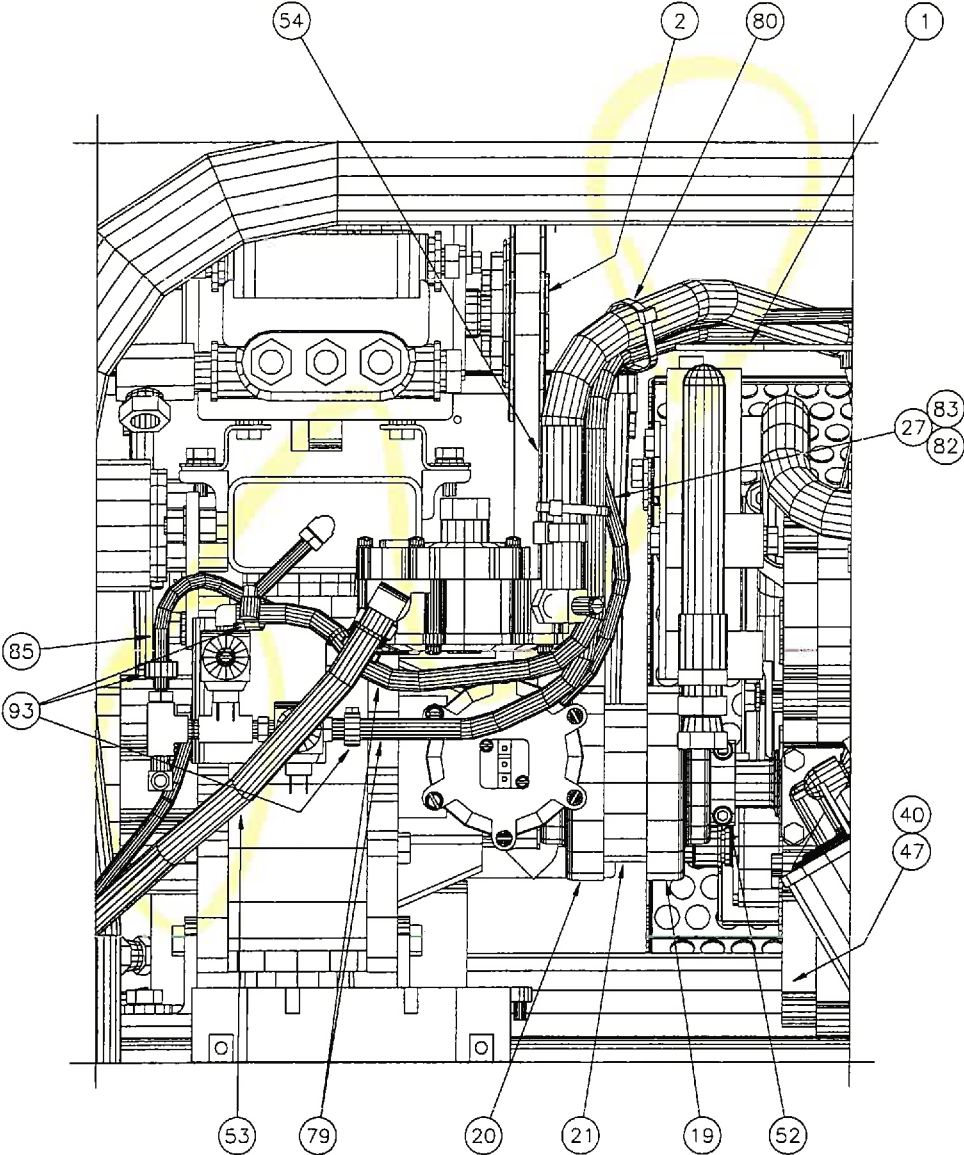


Figure 3-5

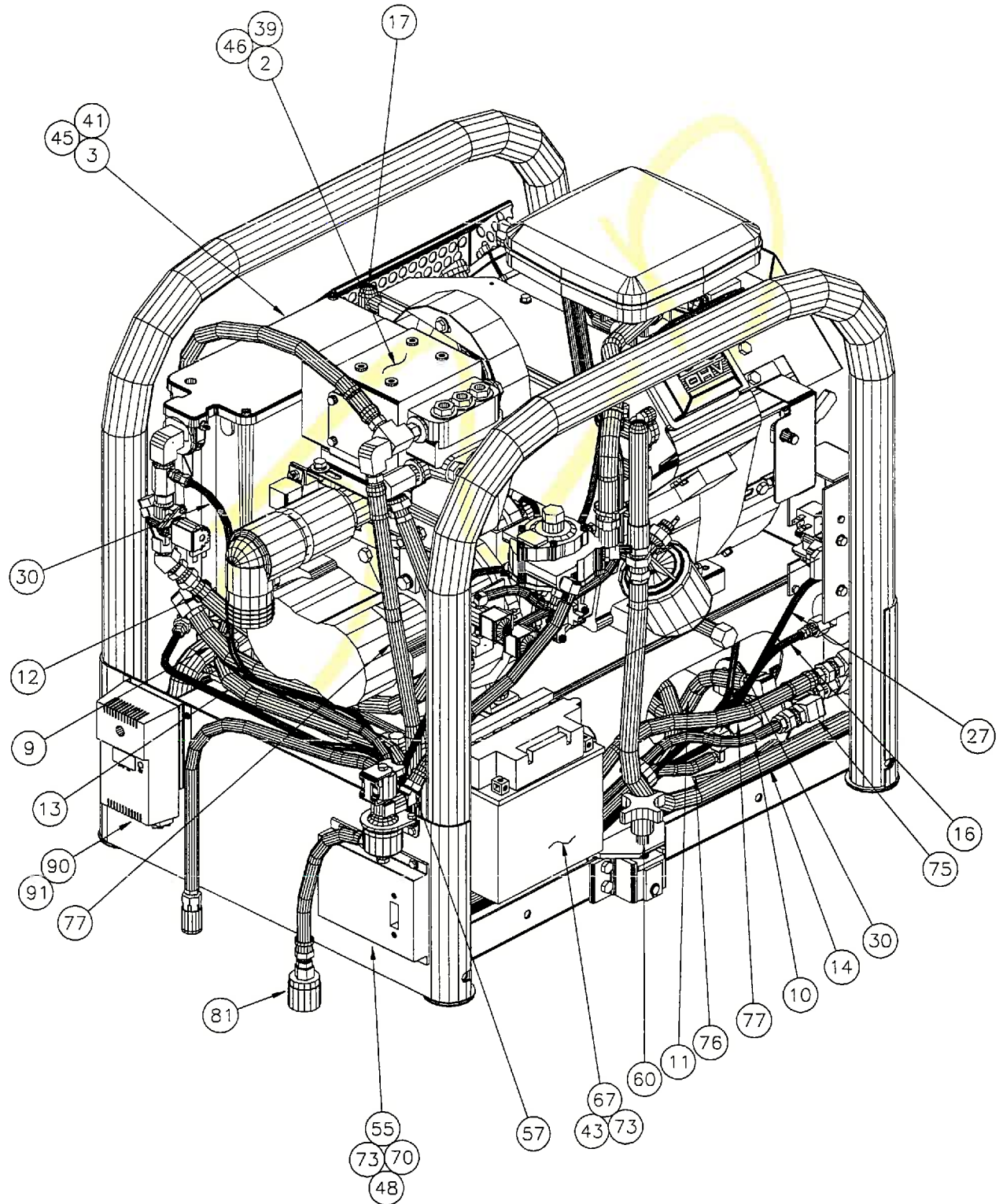
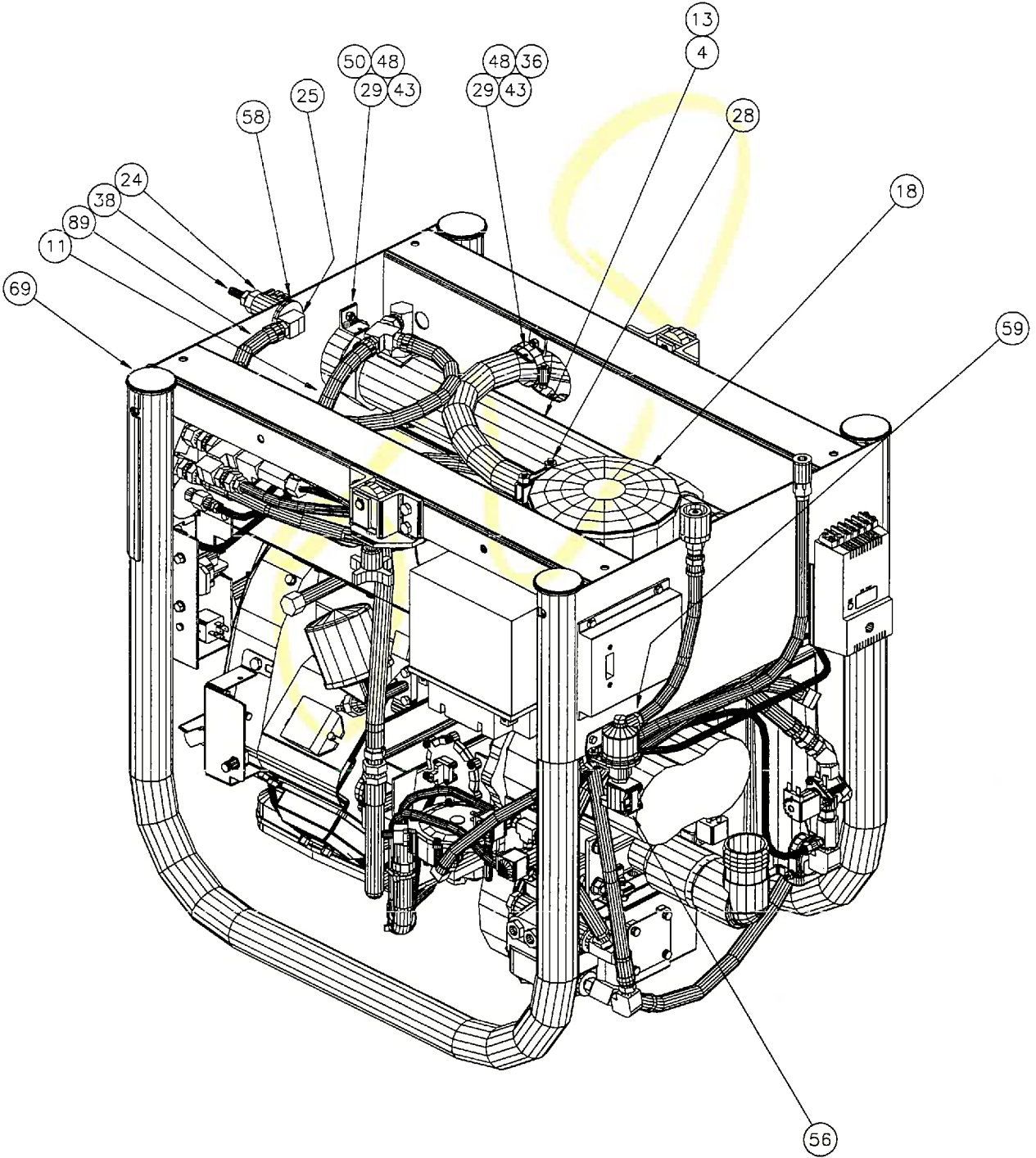


Figure 3-6



Machine Assembly Parts List

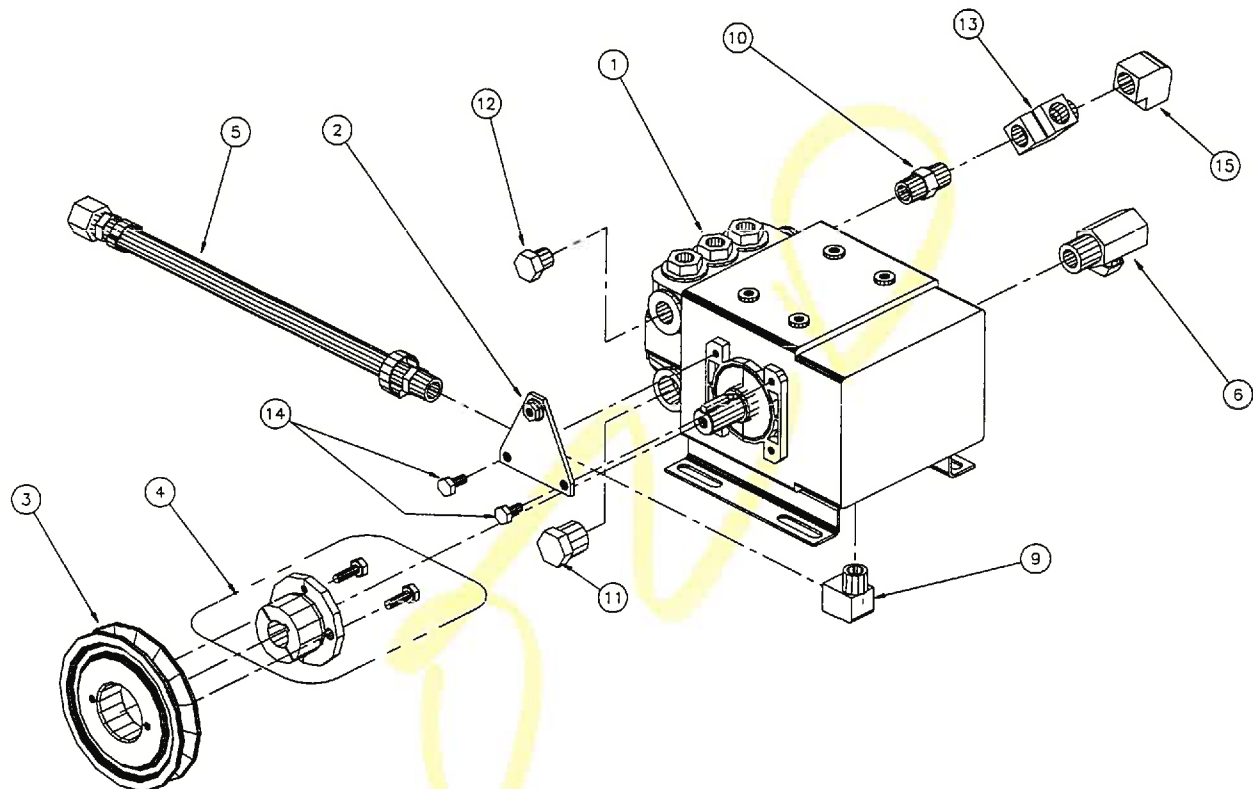
ITEM	PART NO	DESCRIPTION	QTY
1	Figure 3-8	Engine Assembly	1
2	Figure 3-9	Blower and Pump Assembly	1
3	Figure 3-10	Mix Tank Assembly	1
4	Figure 3-17	Lower Heat Exchanger Assembly	1
5	Figure 3-18	Dual Heat Exchanger Assembly	1
6	055-019	Frame	1
7	108-041	Protector, Belt Guard	1
8	068-266	Hose, $\frac{3}{8}$ " x 25" Throb with $\frac{3}{8}$ " Ends	1
9	068-268	Hose, $\frac{1}{2}$ " x 25 $\frac{1}{2}$ " Red with $\frac{3}{8}$ " Ends	1
10		Hose, $\frac{3}{8}$ " x 62" Teflon	1
11	068-411	Hose, $\frac{1}{2}$ " x 8" Red with $\frac{3}{8}$ " Ends	1
12		Hose, $\frac{1}{2}$ " x 24" Red with $\frac{3}{8}$ " End, $\frac{1}{2}$ " Thr. End	1
13		Hose, $\frac{1}{2}$ " x 69" Red with $\frac{3}{8}$ " Ends	1
14		Hose, $\frac{1}{2}$ " x 23" Black with $\frac{3}{8}$ " Ends	1
15		Hose, $\frac{3}{8}$ " x 9" Teflon	1
16		Hose, Sol. Valve to Rotary Union	1
17	-----	Hose Assembly, Radiator Fill	1
18	093-027	Silencer, 2" Compact - Quiet	1
19	039-017	Coupler, #6 x 1"	1
20	039-014	Coupler, #6 x $\frac{3}{4}$ "	1
21	152-008	Sieve, #6 Drive Coupler	1
22	074-003	Gauge, High PSI (0-1000)	1
23	074-013	Meter, Chemical Flow	1
24	169-064	Valve, $\frac{3}{8}$ " Full Port Ball	1
25	052-086	Elbow, $\frac{3}{8}$ " Brass Street	1
26	068-260	Hose, 1 $\frac{1}{4}$ " x 32 $\frac{1}{2}$ " s/s Exhaust Flex	1
27	068-030	Hose, $\frac{5}{32}$ " Rubber/Vacuum	1
28	033-027	Clamp, 1 $\frac{3}{8}$ " Muffler	2
29	015-236	Bracket, Air Duct Mount	2
30	068-015	Hose, $\frac{1}{4}$ " Rubber	5 Ft
31	052-052	Quick Connect, 660 Male with Viton - Standard	1
32	052-050	Quick Connect, 440 Male with Viton Standard	1
33	052-013	4M-6UFS	1
34	105-012	Plate, Machine Serial ID	1
35	052-097	Insert, #24	2

ITEM	PART NO	DESCRIPTION	QTY
36	033-009	Clamp, Size 24 Hose	1
37	052-066	Coupler, 1/8 x 1/4 Female Brass	1
38	052-104	Insert, #66	1
39	143-027	Screw, 7/16 - 14 x 1 1/4" HHC	4
40	143-020	Screw, 3/8 - 16 x 1 1/2" HHC Grade 5 Zinc	4
41	143-012	Screw, 5/16 - 18 x 3/4" HHC s/s	2
42	143-141	Screw, 1/4 - 20 x 1/2" Whiz Lock	2
43	143-126	Screw, 10 - 24 x 1/2" s/s HHC	5
44	143-059	Screw, 10 - 32 x 3/8" HHC - Slotted	2
45	174-018	Washer, 5/16" s/s Lock	2
46	094-018	Nut, 7/16 - 14 Hex	4
47	094-015	Nut, 3/8 - 16 Two-Way Lock Zinc Plated Steel	4
48	094-034	Nut, 10 - 24 s/s Nylock	12
49	131-046	Ins. Sleeving, .054" x 1 1/2" Exh. Tube Wrap	3 Ft
50	033-012	Clamp, Size 44 Hose	3
51	140-015	Rivet, 1/8" x 1/4" Aluminum Pop	2
52	020-012	Collar, Engine Shaft - Double Screw Type	1
53	068-392	Hose, Prop. Solenoid to Propane Regulator	1
54	068-393	Hose, Propane Reg. To Carburetor Inlet	1
55	149-030	Sensor, Electronic Emission Control Device	1
56	169-030	Valve, Beam Filterlock Propane Shut-Off	1
57	052-491	Elbow, 3/8" Flare x 1/4" x 45 Degree MPT	1
58	174-008	Washer, 5/8 Flat	2
59	052-490	Nipple, 3/8" Flare x 1/4" MPT	1
60	061-021	Knob, Lifting Mechanism - Lift	2
61	015-287	Bracket, Lower Catalytic Guard	1
62	Figure 3-16	Jack Bearing Assembly	2
63	015-273	Bracket, Jack Screw - Lifting Mechanism	2
64	081-075	Label Set, CM 302 4-Piece	1
65	081-032	Label, Caution - Hot Surface and Rotating Equip.	1
66	108-051	Protector, Catalytic Housing Guard	1
67	013-010	Box, Battery	1
68	-----	Battery, 12 Volt (not included)	1
69	106-040	Plug, Frame End	4
70	143-132	Screw, 10 - 24 x 3/4" HHC s/s	4
71	094-023	Nut, 5/16 - 18 Whiz	8

ITEM	PART NO	DESCRIPTION	QTY
72	094-027	Nut, 10 - 24 s/s Hex	1
73	174-001	Washer, #10 s/s Flat	7
74	143-160	Screw, ⁵ / ₁₆ - 18 x 1" HHCS Grade 8	8
75	Figure 5-2	By-Pass Valve Assembly	1
76	-----	Dump Hose Assembly	1
77	068-295	Hose, ³ / ₈ " x 46" Throb	1
78	174-028	Washer, ⁷ / ₈ " ID Flat s/s x 1 ½" OD x .09 Thk	1
79	068-026	Hose, ¼" Rubber Fuel Line	3 Ft
80	162-002	Tie Wrap, 6" Nylon	2
81	068-391	Hose, Tank/Cart to Propane Solenoid	1
82	052-138	Insert, #22 (1/8" NPT x 1/8" Barb)	1
83	052-137	Insert, #12 (1/16" NPT x 1/8" Barb)	1
84	174-013	Washer, ³ / ₈ Fender	2
85	068-030	Hose, ⁵ / ₃₂ " Rubber Vacuum	6"
86	041-194	Cover, Right Front Heat Exchanger	1
87	Figure 3-20	Starter Solenoid Cover Assembly	1
88	143-128	Screw, 10 - 24 x ⁵ / ₈ " Btn Hd Cap	4
89	068-298	Hose, ½" x 18" Yellow with ³ / ₈ " Ends	1
90	Figure 3-22	Carbon Monoxide Detector Assembly	1
91	143-050	Screw, 8 - 32 x ½" Round Head Mach.	4
92	143-148	Screw, 5/16 - 18 x ½" HHCS s/s	2
93	033-003	Clamp, Size 4 Mini Hose	6

Figure 3-7: Pump Assembly

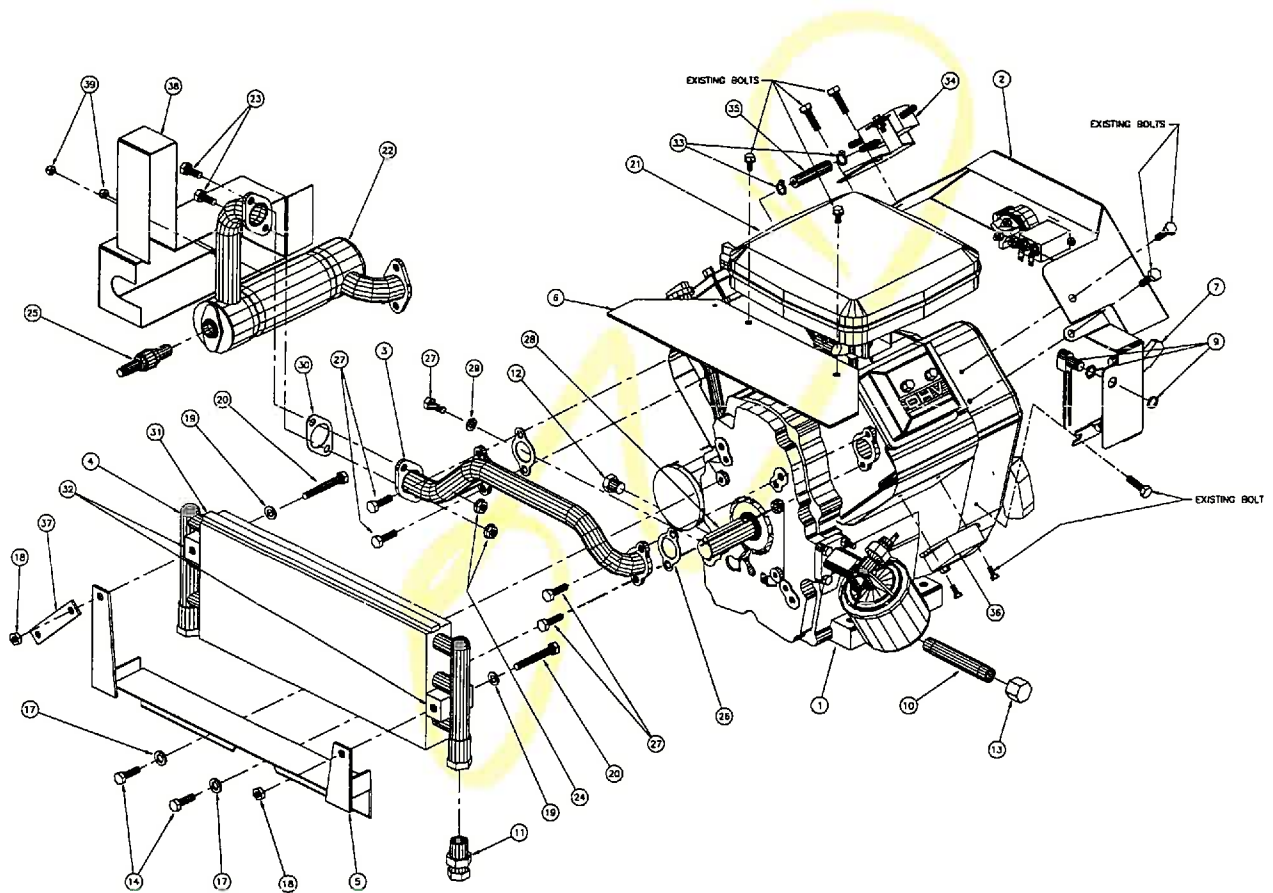
C3239



ITEM	PART NO	DESCRIPTION	QTY
1	111-041	Pump, Triplex 3.5 GPM	1
2	154-057	Spacer, Upper Belt Guard - Triplex Pump	1
3	109-020	Pulley, AK46H Pump	1
4	020-021	Bushing, H x 3/4" Hub	1
5	068-219	Hose, Pump Drain	1
6	052-033	8MA-6UFS	1
9	052-086	Elbow, 3/8" Brass Street	1
10	052-074	Nipple, 3/8 Brass Hex	1
11	106-004	Plug, 1/2" Brass	1
12	106-003	Plug, 3/8" Brass	1
13	052-023	Tee, 3/8" Male Branch - Brass	1
14	143-221	Screw, 6M - 1 x 13mm HHCS	2
15	052-142	Elbow, 3/8" F x F Brass	1

Figure 3-8: Engine Assembly

D3088, Rev B

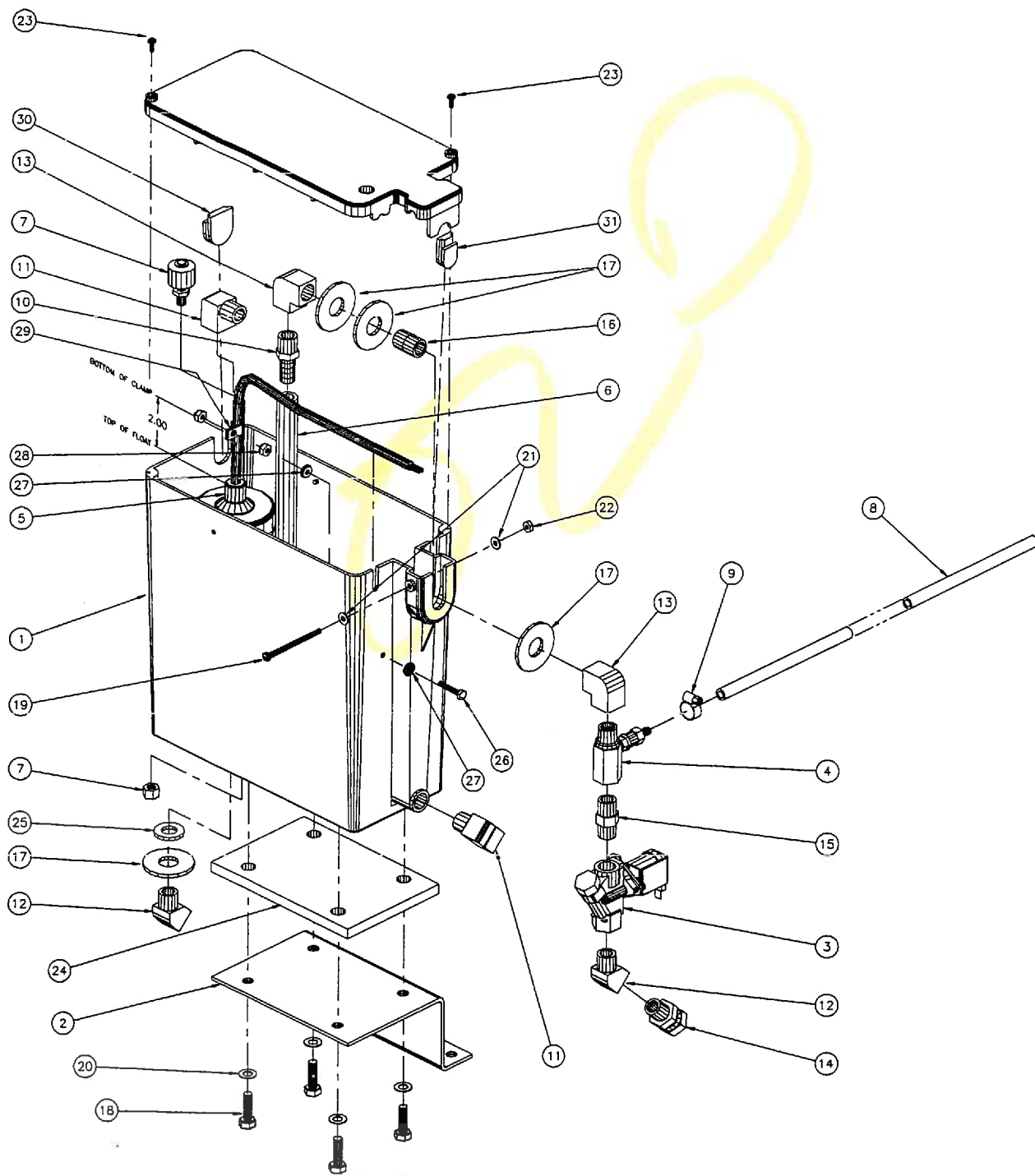


Engine Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	047-010	Engine, B & S 14HP Propane Vanguard	1
2	Figure 3-13	Dash Assembly	1
3	090-034	Manifold, CM 302 Exhaust Mod.	1
4	113-002	Radiator	1
5	015-242	Bracket, Lower Radiator Mount	1
6	041-202	Cover, Secondary Silencer - 8" Tank Hd	1
7	-----	Throttle Box Modification	1
9	157-009	Switch, Momentary, Normally Closed	1
10	052-408	Nipple, 3/8" x 4" Brass	1
11	052-032	8M-6UFS	1
12	106-003	Plug, 3/8" Brass	1
13	027-008	Cap, 3/8" Brass Pipe	1
14	143-090	Screw, 5/16-24 x 1" HHCS	2
17	174-018	Washer, 5/16" s/s Lock	2
18	094-035	Nut, 5/16-18 s/s Nylock Half	2
19	174-049	Washer, 5/16" s/s Flat	2
20	143-092	Screw, 5/16" x 2 1/4" HHCS s/s	2
21	Figure 3-15	Propane Conversion Assembly	1
22	090-038	Manifold, Catalytic Conv. Assembly	1
23	143-012	Screw, 5/16-18 x 3/4" HHC s/s	2
24	094-023	Nut, 5/16 - 18 Whiz	2
25	149-031	Sensor, Non-Heated Oxygen	1
26	057-010	Gasket, Exhaust Manifold - Vanguard	2
27	143-185	Screw, 8mm x 20mm, Grade 8.8 HHCS	5
28	077-006	Key, Briggs 16 HP Engine	1
29	174-018	Washer, 5/16" s/s Lock	1
30	057-016	Gasket, P-220 Exhaust Manifold	1
31	057-026	Gasket, 1/2" x 18 1/8" x 1/4" Kawasaki Brow Seal	1
32	012-003	Block, Rubber - Radiator Mount Pad	2
33	162-001	Tie Wrap, 4" Nylon	2
34	-----	Pump, Pulse (See item 1)	1
35	068-019	Hose, 1/4" Rubber Vacuum	1
36	-----	Voltage Regulator Modification	1
37	015-288	Bracket, Upper Catalytic Guard	1
38	108-035	Protector, Catalytic Converter Heat Shield	1
39	094-090	Nut, 10-24 Acorn - Chrome	2

Figure 3-10: Mix Tank Assembly

D2795, Rev C

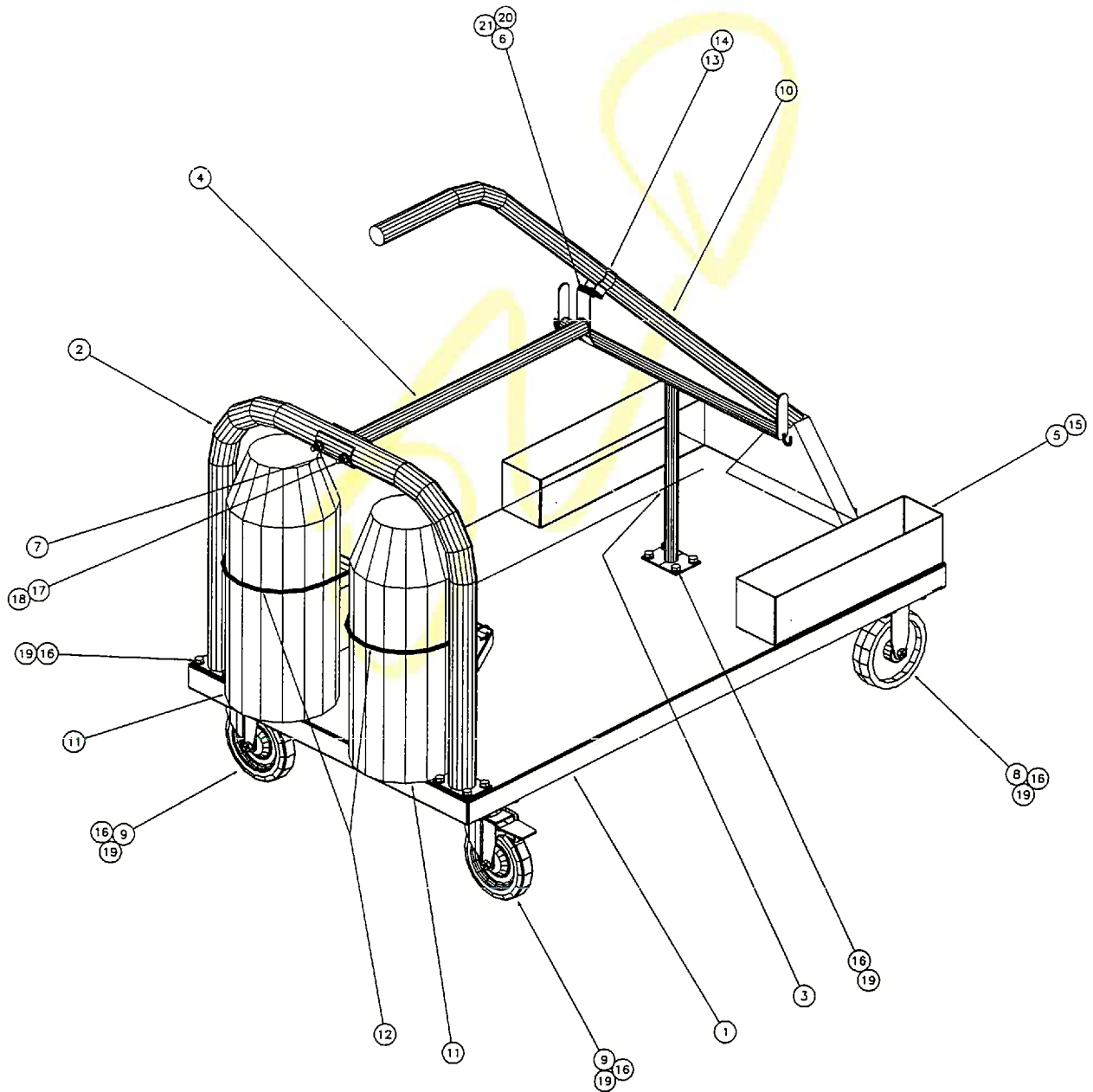


Mix Tank Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	159-042	Tank, SF Mix - Mod.	1
2	015-244	Bracket, Mix Tank	1
3	169-120	Valve, Chemical System Solenoid - 12 v	1
4	181-008	Venturi, Low PSI Injector	1
5	157-001	Switch, Tethered Mercury Float - 25°	1
6	068-327	Hose, ½" Clear Braid	1
7	157-004	Switch, Mini Liquid Level Reed Kill	1
8	068-015	Hose, ¼" Rubber	1
9	033-004	Clamp, Size 6 Mini Hose	1
10	052-105	Insert, #68	1
11	052-086	Elbow, ⅜" Brass Street	2
12	052-083	Elbow, ⅜" Brass 45 Street	2
13	052-142	Elbow, ⅜" F x F Brass	2
14	052-019	6 M - 6 UFS	1
15	052-074	Nipple, ⅜" Brass Hex	1
16	052-077	Nipple, ⅜" Brass Close	1
17	174-009	Washer, ⅝" Flat	3
18	143-143	Screw, ⅝ ¹⁶ - 18 x 1" HHC s/s	4
19	143-311	Screw, #8 - 32 x 2½" PANHMS	1
20	174-059	Washer, ⅝ ¹⁶ " s/s External Star	4
21	174-047	Washer, #8 Flat	2
22	094-059	Nut, #8 - 32 Nylock	1
23	143-314	Screw, #8 x ½" PNHD	2
24	057-028	Gasket, SF Mix Tank to Bracket Vibration Dmp.	1
25	057-055	Gasket, Garden Hose	1
26	143-134	Screw, 10-24 x 1" HHCS s/s	1
27	174-036	Washer, #10 s/s Flat - Rubber Back	2
28	094-034	Nut, 10-24 s/s Nylock	2
29	033-021	Clamp, ¼ Nylon Hose	1
30	106-039	Plug, Mix Tank 0.75"	1
31	106-038	Plug, Mix Tank 0.41"	1

Figure 3-12: Utility Cart Assembly

D3149



Utility Cart Assembly Parts List

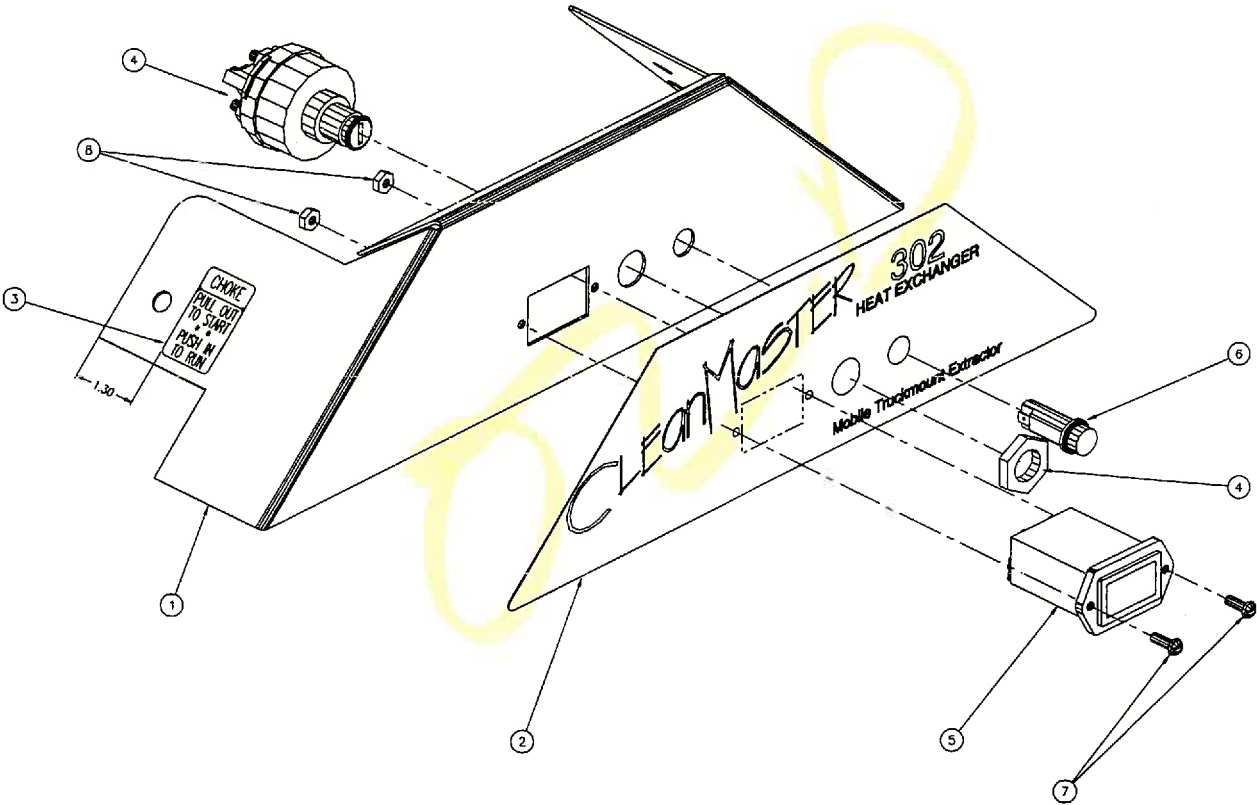
ITEM	PART NO	DESCRIPTION	QTY
1	163-061	Base, Utility Cart*	1
2	163-061	Handle, Utility Cart*	1
3	163-061	Bracket, Utility Cart Accessory Hose*	1
4	163-061	Bracket, Vacuum Hose*	1
5	163-061	Box, Accessory*	2
6	163-061	Bracket, Vacuum Hose Capture*	1
7	163-061	Bracket, Vacuum Hose Clamp*	1
8	177-024	Caster, Cart - Fixed	2
9	177-025	Caster, with Brake	2
10	-----	Wand♦	1
11	-----	Pump-Up Sprayer♦	2
12	-----	Bungee Cord, 8"♦	2
13	033-039	Clamp, 1 ½" Spring - Wand Holder	1
14	143-107	Screw, 10 - 24 x ⅜" Butt Soc. c/s Alloy, Gr. 8	2
15	143-126	Screw, 10 - 24 x ½" s/s HHC	4
16	143-017	Screw, ⅜ - 16 x ¼" HHC	28
17	143-023	Screw, ⅜ - 16 x 3" HHC	2
18	094-016	Nut, ⅜ - 16 Whiz	2
19	174-005	Washer, ⅜ Flat	28
20	094-075	Nut, ⅝" Wingnut	1
21	143-194	Screw, 4-40 x ¼" Socket Head Cap	1

* Parts make up welded accessory cart.

♦ Not included.

Figure 3-13: Dash Panel Assembly

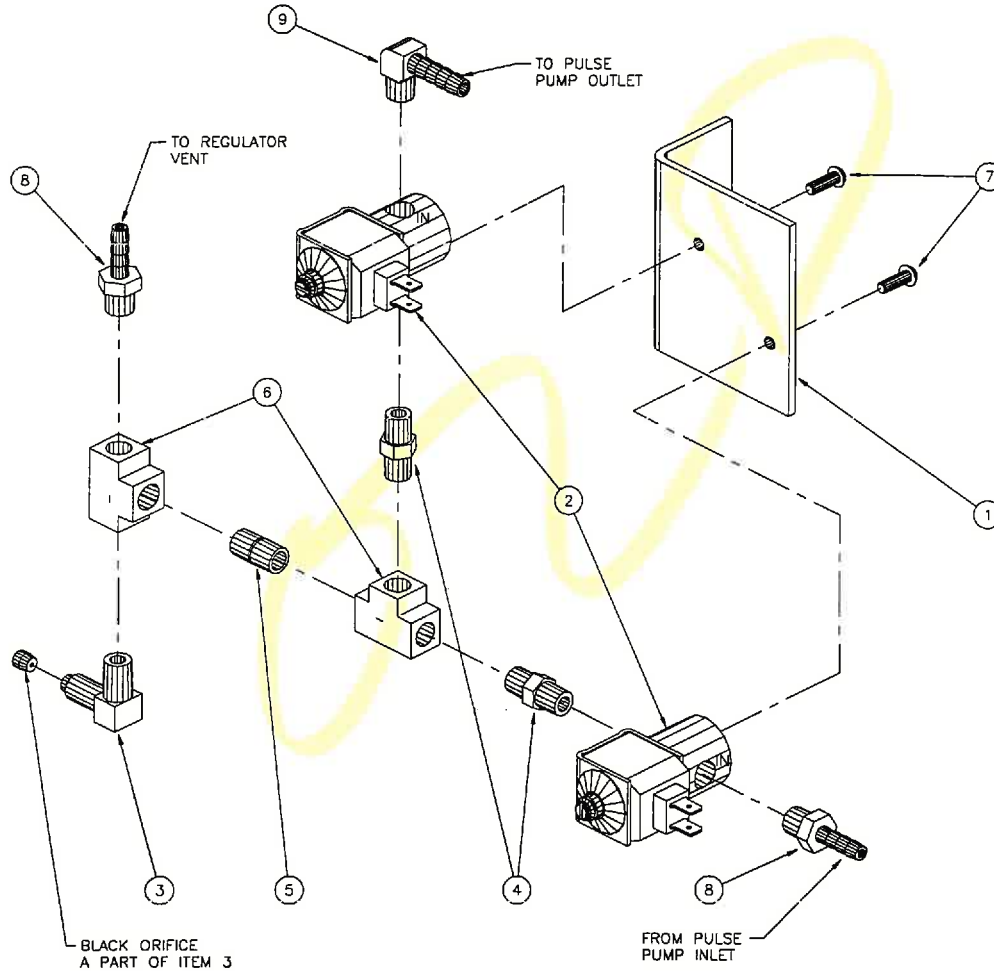
D3143



ITEM	PART NO	DESCRIPTION	QTY
1	100-046	Panel, CM 302 Dash	1
2	081-075	Label Set (Dash Label Shown)	1
3	081-073	Label, "Choke" Briggs & Stratton	1
4	157-008	Switch, Ignition	1
5	074-011	Meter, Retangular Hour	1
6	084-006	Lamp, Red Pilot - Round	1
7	143-050	Screw, 8-32 x 1/2" Round Head Mach.	2
8	094-002	Nut, 8-32 s/s Hex	2

Figure 3-21: ECD Solenoid Assembly

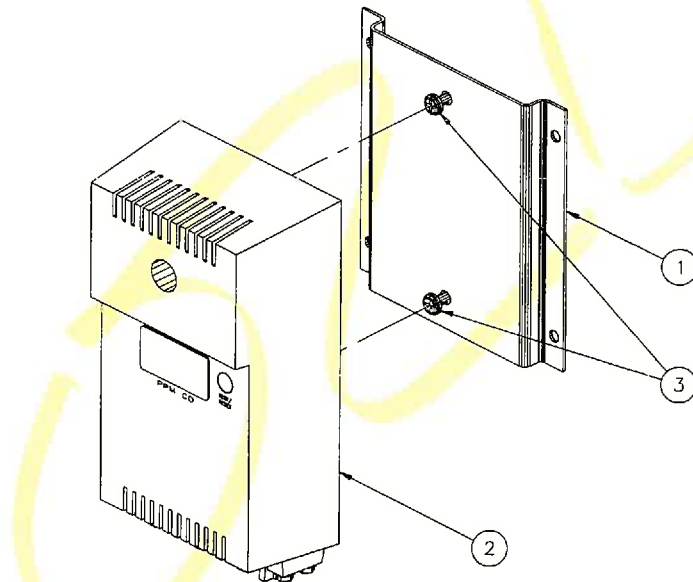
C2994



ITEM	PART NO	DESCRIPTION	QTY
1	015-283	Bracket, ECD Solenoid Mount	1
2	-----	ECD Solenoid (Part of Kit 149-030)	2
3	-----	ECD Check Valve (Part of Kit 149-030)	1
4	052-069	Nipple, 1/8" Brass Hex	2
5	052-057	Nipple, 1/8" Brass Close	1
6	052-092	Tee, 1/8" Brass	2
7	143-050	Screw, 8-32 x 1/2" Round Hd Mach.	2
8	052-097	Insert, #24	2
9	052-253	Elbow, 1/8" Male x 1/4" Barb	1

Figure 3-22: Carbon Monoxide Detector Assembly

B3516



ITEM	PART NO	DESCRIPTION	QTY
1	015-289	Bracket, Carbon Monoxide Det. Support	1
2	149-032	Sensor, Carbon Monoxide Detector 12v	1
3	143-050	Screw, 8-32 x ½" Round Hd Mach.	2

Freeze Guard

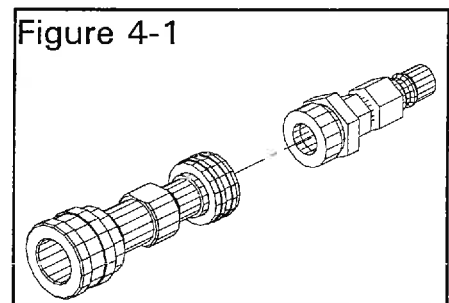
CM 302

Section 4-1

1. Start the machine.
2. Spray all of the water out of the system until the engine stops.
3. Add a half gallon of 50/50 antifreeze and water mix to the chemical mix tank and draw the antifreeze into the flow meter.

When using the recirculation kit (part no. 078-058), fill a third of the mix tank with a 50/50 antifreeze mix. Verify that the upper float is not lying horizontal, but floats below.

Attach the recirculation fitting provided in the kit to the garden hose quick connect (see illustration to right) and this combination to the front of the machine.



Attach one section of female/female solution hose to the outgoing solution fitting on the front of the machine and the other end to the garden hose and recirculation fitting combination that is attached to the front of the machine (or as many sections as you want, if you wish to freeze guard your hoses).

4. Start the machine. Allow it to run for 2 to 3 minutes.

With the recirculation kit, skip ahead to step 6.

5. Remove the quick connect fitting from the end of the garden hose. Attach the garden hose quick connect to the machine. Using a vacuum hose attached to the recovery tank, vacuum the water out of the garden hose quick connect.

6. Spray the antifreeze and water mix out of the machine and into a container to reclaim the solution. Run the machine until it stops.

NOTE 1: The reclaimed antifreeze solution may be used 3 times before being discarded.

NOTE 2: *To freeze guard hoses and wand,* perform the above step with all the hoses and wand attached.

The machine is now freeze guarded. Remember to flush antifreeze from the system prior to carpet cleaning.

Recovering antifreeze for re-use:

Before cleaning with the machine again, flush the remaining antifreeze solution from the system into a sealable container so that it may be used again. To do this spray water through the hoses and wand until all signs of antifreeze are gone.

◆ CAUTION ◆

One manufacturer of antifreeze cautions: "WHEN DISPOSING OF USED ANTIFREEZE COOLANT: Follow local laws and regulations. If required, dispose at facilities licensed to accept household hazardous waste. If permitted, dispose in sanitary sewer systems. Do not discard into storm sewers, septic systems, or onto the ground."

◆ WARNING ◆

This warning appears on the label of one brand of antifreeze: "HARMFUL OR FATAL IF SWALLOWED. Do not drink antifreeze coolant or solution. If swallowed, induce vomiting immediately. Call a physician. Contains Ethylene Glycol which caused birth defects in animal studies. Do not store in open or unlabeled containers.

KEEP OUT OF REACH OF CHILDREN AND ANIMALS."

Water System

CM 302

Section 5-1

This electro-mechanical system has been designed to be simple and trouble free.

WATER/CHEMICAL FLOW OPERATION

Incoming water flows first through the Solenoid Control Valve and the low pressure Chemical injector which are both mounted on the exterior of the mix tank. As the water passes through the Chemical injector, it is automatically proportioned with a predetermined quantity of detergent. The Mix Tank is equipped with a Water Level Float that responds to the level in the tank and will maintain the proper volume of solution to be reserved for the water pump.

The desired chemical injection ratio may be obtained by an adjustment of the Chemical Flowmeter during the fill cycle of the mix tank. Water must be flowing into the mix tank in order to adjust the chemical mix. The chemical will flow from the Chemical Jug to the Chemical Flowmeter, then to the Chemical injector where it is proportioned into the Mix Tank at the desired chemical setting.

NOTE: With this unique chemical system, the chemical flow is proportioned only during the filling cycles of the Mix Tank, not during the direct spraying of the wand. Therefore, it is possible that as your wand is spraying, you may have no chemical flow. Also, the converse is true in that you may not be spraying your wand, but if the mix tank is in a filling cycle, your Chemical Flowmeter may be active at the desired flow rate.

The chemical proportioning system will mix chemical with water at a 1 to 30 ratio when the Flowmeter is set at 5 GPH, or a 1 to 15 ratio when the Flowmeter is set at 10 GPH.

CHEMICAL SYSTEM MAINTENANCE

The chemical lines may need to be flushed with vinegar periodically to prevent abnormal chemical build-up. This flushing may be done by removing the clear plastic hose from the Chemical Jug and inserting it into a one quart container of vinegar. This should be done with the Chemical Flowmeter setting 10 GPH. Simply spray water from the wand until the quart of vinegar is exhausted. Then repeat the process with one quart of clear water to void all lines of vinegar.

Figure 5-1: **Water Flow Diagram**

D2760, Rev B

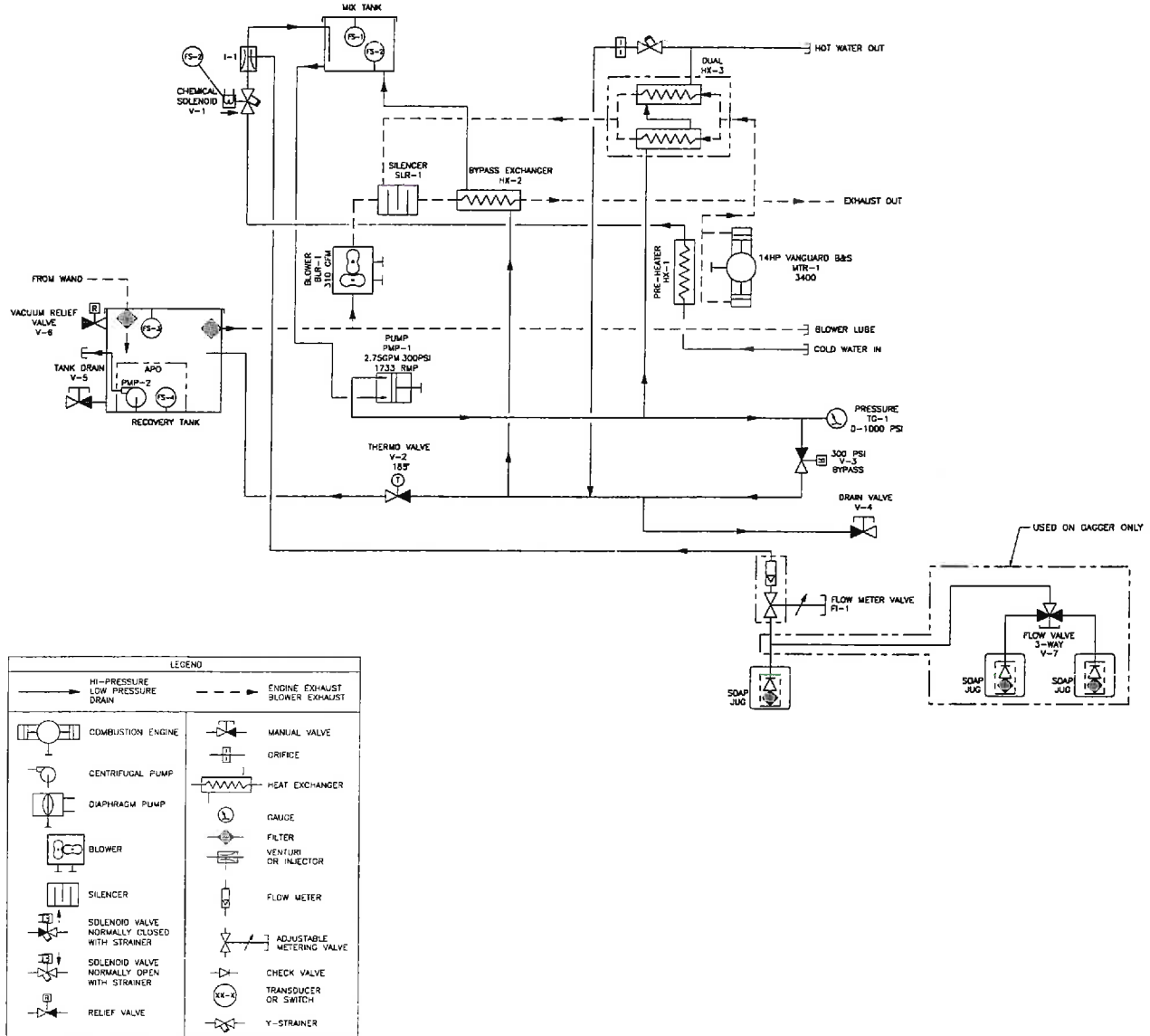
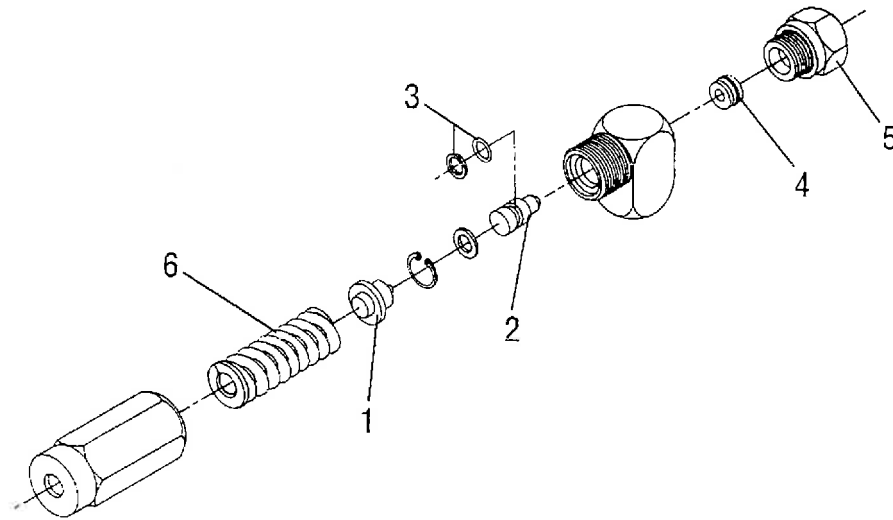


Figure 5-2: **By-Pass Valve Assembly**



169-101 Valve, By-Pass Truckmount

ITEM	PART NO	DESCRIPTION	QTY
1	105-101	Thrust Plate, By-pass Valve	1
2	105-102	Piston Plate, By-pass Valve	1
3	097-028	Seal Set for By-pass Valve	1
4	148-004	Seat and O-Ring, By-pass Valve	1
5	097-005	O-Ring, By-pass Valve Fitting	1
6	155-019	Spring, High PSI By-pass	1
Not Shown:			
	078-102	Kit, By-pass Repair (Complete, Incl. 078-101)	1
	078-101	Kit, Seal and Spring High PSI By-pass (Includes Items 3 and 6)	1

Troubleshooting

CM 302

Section 5-5

Water System

No	Problem / Possible Cause	Solution
1	There is a loss of water pressure.	
1.1	The <i>mix tank water supply hose</i> is missing. This will cause aeration and turbulence in the tank.	Look inside the mix tank and determine if a water inlet hose is present. If the hose is missing, order a new hose from your HydraMaster distributor and install it.
1.2	Foreign material is blocking the outlet hole for the pump in the bottom of the <i>mix tank</i> .	Inspect the outlet hole leading to the pump in the bottom of the mix tank. Remove any foreign material blocking the hole.
1.3	Foreign material is blocking the <i>water supply hose</i> leading to the pump from the mix tank.	Remove the water supply hose between the mix tank and the pump. Sight through the hose. Remove any foreign material from the hose. Reattach the hose.
1.4	The <i>water supply hose</i> from the mix tank to the pump is kinked or blocked.	Remove the hose and clean it. If it is kinked, order a replacement hose from your distributor.
1.5	The end of the <i>mix tank water supply hose</i> is pointed directly at the pump inlet hole in the bottom of the mix tank.	Inspect the mix tank and determine the orientation of the water hose. If it is pointing directly at the pump inlet hole in the bottom of the tank, reposition the hose to point towards the opposite side of the tank from the inlet.

No	Problem / Possible Cause	Solution
1.6	The <i>mix tank supply hose</i> is blocking the outlet hole leading to the pump in the bottom of the mix tank.	The water inlet hose may have to be shortened or lengthened to avoid blocking the outlet hole.
1.7	There is an air leak in the <i>water supply hose</i> from the mix tank to the pump.	Inspect the supply hose for worn or damaged areas. Also check for loose fittings. Replace the hose or fittings if necessary.
1.8	The <i>water supply hose</i> from the mix tank to the pump collapses when the machine is running hot.	Allow the machine to reach full water operating temperature (approximately 10 minutes). Inspect the water supply hose between the mix tank and the pump. If the hose appears to be collapsing, remove the hose and order a replacement hose from your distributor. Reinstall the new hose.
1.9	There is foreign material in the inlet or outlet valves of the <i>pump</i> .	Inspect the valves and remove any foreign material.
1.10	Too much water is flowing through or around the controlled <i>orifice</i> .	Inspect the threads and jet. If the jet is worn or the threads are stripped, replace the housing or jet. Seal the threads.
1.11	The <i>by-pass valve</i> is malfunctioning.	Remove the plunger and lube the "O" rings. Clean the walls of the by-pass valve with a bristle brush and de-scaler. NOTE: Use a water resistant high temperature lube.
1.12	The <i>glide seals and valves</i> in the pump are defective. NOTE: Do not operate the engine at low RPMs for long periods of time because damage may occur to the pump.	Repair the pump as necessary.

No	Problem / Possible Cause	Solution
2	The water temperature is too low.	
2.1	The <i>thermo valve</i> is stuck open and water is flowing continually past the valve.	This is a non-serviceable valve. Replace it.
2.2	The <i>orifice</i> (spray nozzle) in the cleaning tool is worn, defective, or the wrong size.	Replace or change the orifice size. This unit uses a 11004 T-jet.
2.3	The incoming <i>water supply</i> is extremely cold.	Keep the incoming water supply hoses away from ice and snow during winter months.
2.4	There is an <i>exhaust</i> leak.	Inspect the exhaust system for leaks. Tighten any loose clamps. Weld or replace any broken parts.
2.5	The <i>water pressure</i> is excessive.	Adjust the pressure regulator for less pressure.
2.6	There is <i>exhaust wrap</i> missing.	Replace any missing wrap.
2.7	The <i>engine</i> speed is low.	Reset the engine speed. Refer to the Engine Operation and Maintenance manual.
2.8	One of the <i>heat exchangers</i> has scale build-up.	De-scale the heat exchanger or remove it and take it to a radiator shop to be boiled out.
2.9	A <i>heat exchanger</i> is carbon-coated.	<p>a. For a stainless steel heat exchanger, clean it with oven cleaner or have it acid-dipped, "hot tanked".</p> <p>b. For a copper tube heat exchanger, carefully unplug the tubes by poking a small rod through them. Then take the heat exchanger to a radiator shop to be boiled out.</p>

No	Problem / Possible Cause	Solution
2.10	The <i>preheater</i> mounted behind the motor is scaled.	Remove the preheater. At a radiator shop, have it de-scaled. CAUTION: This unit has aluminum fins.

No	Problem / Possible Cause	Solution
3	The water temperature is excessive.	
3.1	The <i>filter</i> in front of the controlled orifice is clogged.	Inspect the filter. Clean it if necessary.
3.2	The controlled <i>orifice</i> is clogged.	Inspect the controlled orifice. Clean it if necessary.
3.3	The <i>thermo valve</i> is not opening and no water is flowing through the valve.	This is a non-serviceable valve. Replace it.
3.4	The <i>engine</i> speed is too low or too high.	Reset the engine speed. Refer to the Engine Operation and Maintenance manual.
3.5	The <i>water source</i> is hot.	Locate a cold water source. Connect to it.

No	Problem / Possible Cause	Solution
4	There is pressure on the gauge, but no water coming out of the wand.	
4.1	The <i>wand jet</i> is plugged.	Inspect and clean the jet.
4.2	The <i>quick connect</i> on one or more of the high pressure hoses is defective.	Remove and clean or replace the defective quick connect(s).
4.3	The <i>cleaning tool</i> has a clogged valve.	Remove the valve stem. Clean the valve. Replace the "O" rings and stem if they are bad.
4.4	The high pressure <i>quick connect</i> on the front of the machine is clogged.	Remove and clean or replace the quick connect.
4.5	The inner lining on a <i>hose</i> is constricted.	Remove the restriction or replace the hose.

No	Problem / Possible Cause	Solution
5	The water in the mix tank will not keep up with the wand.	
5.1	There is dirt in the <i>solenoid valve</i> along side of the mix tank.	Take the valve apart and clean it.
5.2	The <i>upper float</i> is bad.	Remove the wire on terminal 87a on the chemical relay. With a volt-OHM meter check for voltage between the end of the wire you removed and a ground. There should be no voltage reading on the meter with the float in the down position. Replace the float if necessary.
5.3	The <i>mix tank relay</i> is bad.	With the upper float in the mix tank in the up position, there should be no voltage reading on terminal 87a on the chemical relay. With the float in the down position, there should be +12 volts on terminal 87a. Replace the relay if it is defective.
5.4	The <i>water supply</i> is improperly adjusted.	The water supply should be two (2) gallons per minute or more.
5.5	The <i>water inlet supply hose filter</i> is clogged or the hose is kinked.	Remove the obstructions.

No	Problem / Possible Cause	Solution
6	There is water coming out of the exhaust.	
6.1	There are small amounts of water usually seen at start up.	This is <i>normal!</i> There is no solution! The water is condensation.
6.2	One of the <i>heat exchangers</i> is damaged from frozen water.	Determine which heat exchanger is bad. Replace it if it is necessary.
6.3	The <i>recovery tank</i> is full.	Empty the tank.
6.4	There is excessive foam in the recovery tank.	Apply a powdered or liquid defoamer to counter act this reaction to the excessive chemical in the carpet.

No	Problem / Possible Cause	Solution
7	The mix tank overflows.	
7.1	The <i>upper float in the mix tank</i> is malfunctioning.	Remove the wire on terminal 87a on the chemical relay. With a volt-OHM meter check for voltage between the end of the wire you removed and a ground. There should be no voltage reading on the meter with the float in the down position. Replace the float if necessary.
7.2	There is dirt in the <i>solenoid valve</i> next to the mix tank.	Remove one of the wires from the solenoid valve and turn the key on. If the water continues to flow, then take the solenoid apart and remove the foreign matter. Replace the solenoid valve if necessary.
7.3	The <i>chemical relay</i> is bad.	With the upper float in the mix tank in the up position, there should be no voltage reading on terminal 87a on the chemical relay. With the float in the down position, there should be + 12 volts on terminal 87a. Replace the relay if it is defective.

Chemical System

No	Problem / Possible Cause	Solution
1	There is a loss of, or erratic, chemical flow.	
1.1	The anti-siphon <i>foot valve</i> is clogged or missing causing the solution to reverse from the mix tank to the chemical jug.	Inspect the anti-siphon screen and remove any debris. Rinse it out in warm water or a vinegar solution.
1.2	The <i>flowmeter</i> is cracked allowing air intake which causes a loss of chemical suction.	Check for hairline cracks in the flowmeter. Fittings in the back of the meter can be tightened too much causing a crack. Freezing can also cause cracks. Replace the flowmeter if necessary.
1.3	There <i>water pressure</i> to the machine is too low causing a loss of chemical suction. The volume of water entering the mix tank is not be enough to siphon the chemical.	Unscrew the spring from the foot valve if you are in a low water pressure area. After removing the spring, the chemical hose must sit vertically in the jug enabling the ball in the foot valve to seat by gravity. (This is only a temporary fix.) Also check the incoming garden hose filter.
1.4	The <i>chemical feed hose</i> is cracked or split causing a loss of chemical suction.	If given the opportunity, the chemical venturi will suck air rather than water. Check for air leaks in the upper and lower hoses. Replace any defective hoses.
1.5	The <i>proportioning venturi</i> is closed causing a loss of chemical suction.	Remove the venturi and soak it in warm water or a vinegar solution. Adjust the side port for proper suction.
1.6	The <i>mix tank supply hose</i> is internally collapsed causing reduced flow of inlet water or reversed flow of solution from mix tank to chemical jug.	Replace the hose.

Pump Maintenance

CM 302

Section 6-1

DAILY

Check the oil level and the condition of the oil. The oil level should be up to the center of the sight glass on the back of the pump.

Use a 30 weight, non-detergent oil.

◆ CAUTION ◆

If the oil becomes discolored and contaminated, one of the oil seals may be damaged. Refer to the Service Section.

Do not operate the pump if the crankcase has been contaminated with water.

◆ CAUTION ◆

Do not leave contaminated oil in the pump housing or leave the housing empty. Remove contaminated oil as soon as it is discovered and replace it with clean oil.

PERIODICALLY

Change the oil after the first 100 hours of operation, and every 400 operating hours thereafter. When changing, remove the drain plug on the oil drain center located on the frame so all oil and accumulated sediment will drain out.

◆ CAUTION ◆

Do not turn the drive shaft while the oil reservoir is empty.

◆ CAUTION ◆

Protect the pump from freezing.

Service

CM 302

Section 6-3

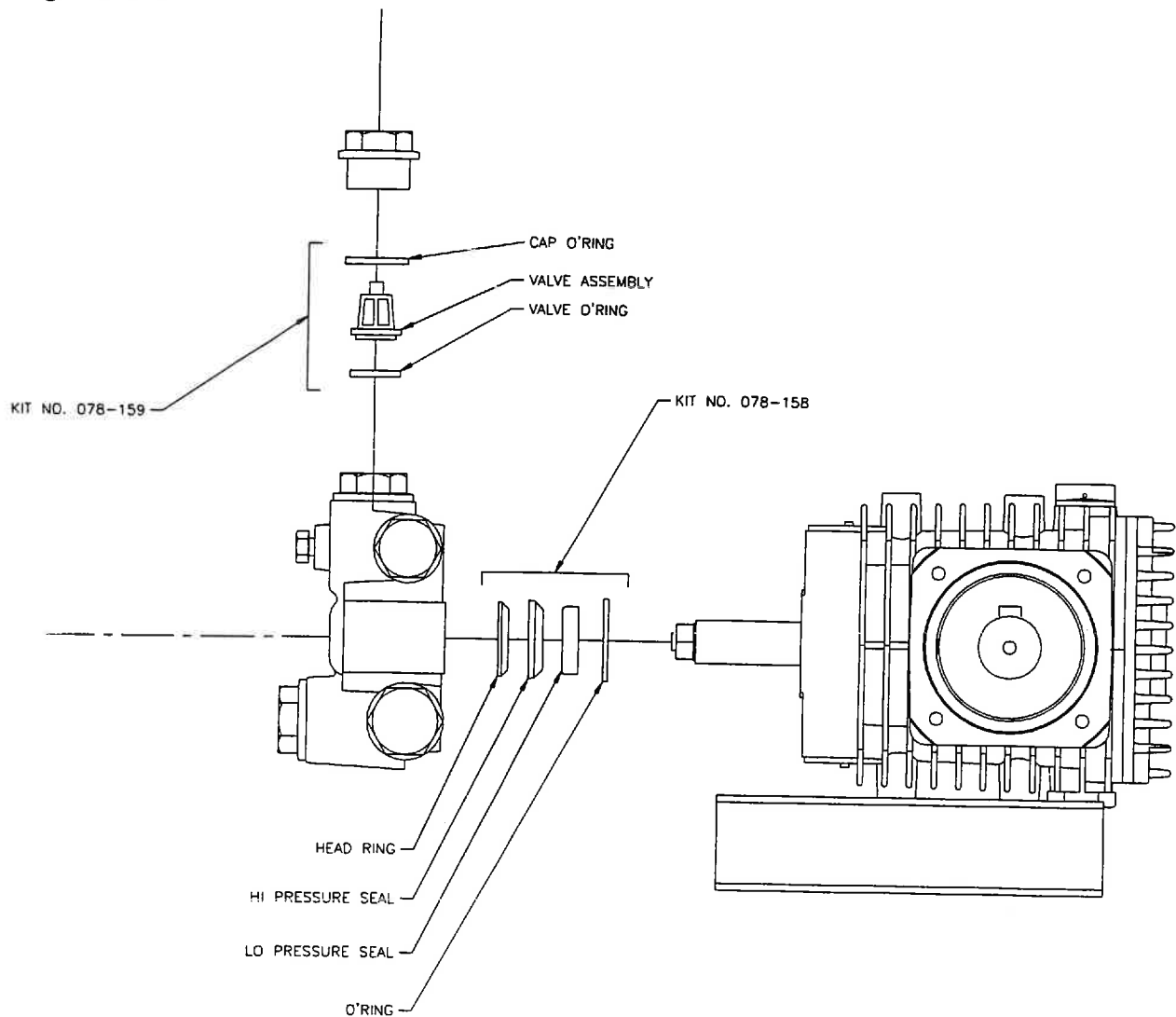
The next few pages explain how to disassemble and inspect all easily-serviceable parts of the pump.

◆ CAUTION ◆

Do not disassemble the hydraulic end unless you are a skilled mechanic. For assistance, contact HydraMaster (425-775-7275) or the distributor in your area.

1. Servicing the Valves (See Figure 6-1)
 - A. Remove the hex valve plugs (top—discharge, bottom—inlet).
 - B. Unthread the valve plug and examine the o-ring under the plug for cuts or distortion. Replace it if it is worn. Lubricate new o-rings before installing.
 - C. Grasp the valve retainer by the tab at the top with needle-nose pliers, then remove the o-ring at the bottom of the valve chamber.
 - D. Inspect all valve parts for pitting, gouges, or wear. If wear is excessive, replace valve assembly.
 - E. Reinstall valve assemblies:
 1. Using a clean towel, clean the valve chamber.
 2. Install the o-ring into the high pressure manifold.
 3. Install the valve assemblies into the high pressure manifold (the metal side of the valve faces the manifold).
 4. Replace the o-ring on the hex valve plug.
 5. Torque the plug to 30 foot pounds.

Figure 6-1



2. Removing the High Pressure Manifold

- A. Using an M6 allen wrench, remove all eight of the socket head bolts.
- B. Rotate the crankshaft by hand to start separation of the manifold head from the crankcase.
- C. Insert two flat-head screwdrivers on opposite sides to further separate the manifold from the crankcase.

◆ CAUTION ◆

To avoid damage to either plunger or seal, keep the manifold properly aligned with the ceramic plungers when removing it.

- D. Remove the seal retainer from the manifold and inspect for wear.
 - E. Examine the ceramic plunger for cracks or scoring (refer to *Servicing the Plungers* for replacement).
3. Servicing the Low Pressure Seals and High Pressure Seals (See Figure 6-1)
- A. Remove the low pressure seal from the seal retainer using a 90 degree pick tool.
 - B. Remove the high pressure seal from the manifold.
 - C. Inspect the low pressure seal and high pressure seal for wear and replace if necessary.
 - D. Reinstall the low pressure seal:
 - 1. Install the low pressure seal into the seal retainers with the garter spring down.
 - E. Reinstall the high pressure seal:
 - 1. Lubricate the seal chamber in the manifold.
 - 2. Carefully square the high pressure seal into position by hand with the grooved side down (metal back facing out).
 - 3. Examine the seal retainer's o-ring and replace if worn. Lubricate the new o-ring before installing.
 - 4. Next, press the seal retainers into the manifold until completely seated.
4. Servicing the Plungers
- A. Using a hex tool, loosen the plunger retainer about three to four turns. Push the plunger back to separate it from the retainer and finish unthreading the plunger retainer by hand.

- B. Unthread the plunger retainer with sealing washer.
 - C. Remove the ceramic plunger, keyhole washer and barrier slinger from the plunger rod.
 - D. Reinstall the ceramic plungers:
 - 1. Examine the sealing washer on the plunger retainer and replace it if it is cut or worn. Lubricate the new sealing washer for ease of installation and to avoid damage.
 - 2. Apply Loctite 242™ to the threads of the plunger retainer and press it into the ceramic plunger. Thread hand tight, then torque the bolt to 4.4 foot pounds.
 - 3. Install the seal retainer with holes to the top and bottom, and forward.
5. Reinstall High Pressure Manifold
- A. Slip the seal retainer over the ceramic plungers with the holes to the top and bottom and forward.
 - B. Turn the shaft by hand to line up the plungers so that the end plungers are parallel.
 - C. Lightly lubricate the plungers and carefully slide the manifold head onto the plungers while supporting it from the underside to avoid damaging the plungers.
 - D. Reinstall the socket head bolts and torque to 4.4 foot pounds.
6. Servicing the Crankcase
- A. While manifold, plungers, and seal retainers are removed, examine the crankcase seals for wear.
 - B. Rotate the crankshaft oil seal externally for drying, cracking or leaking.
 - C. Consult your HydraMaster distributor if crankcase servicing is necessary.

Pump Troubleshooting

CM 302

Section 6-7

Cavitation

Inadequate fluid supply because of:

- Inlet line collapsed or clogged
- Air leak in inlet line
- Worn or damaged inlet hose

Fluid too hot for inlet suction piping system.

Air entrained in fluid piping system.

Aeration and turbulence in supply tank.

Inlet suction vacuum too high.

High pressure seals worn.

Symptoms of Cavitation:

- Excessive pump valve noise (chattering)
- Premature failure of spring or retainer
- Volume or pressure drop
- Rough-running pump.

Drop in Volume or Pressure

Air leak in suction piping.

Clogged suction line.

Pressure gauge inoperative or not registering accurate.

Suction line inlet above fluid level in tank.

Inadequate fluid supply.

Pump not operating at proper RPM.

Worn pump valve parts.

Foreign material in inlet or outlet valves.

Worn low pressure seals.

Cavitation.

Belt slippage.

Water Pulsations

- Foreign object lodged in pump valve.
- Air in suction line.
- Valve spring broken.
- Cavitation.
- Aeration or turbulence in supply tank.
- Stuck inlet or discharge valve.

Valve Wear

- Normal wear.

Loss of Oil

- External seepage.
- Frozen pump.
- Worn crankshaft seal.
- Oil drain piping or fill cap loose.

Premature Failure of Valves or Seals

- Excessive cavitation.
- Foreign object in the pump.
- Pump running too fast.
- Valve or seal material incompatible with fluid being pumped.
- Excessive inlet pressure.
- Scored plungers.
- Running pump dry for excessive periods of time.
- Excessive temperatures of fluid being pumped.

Installation, Operation, Repair and Parts Manual

9/94

Description

Hypro's triplex plunger pumps are designed for high pressure washing applications in industrial cleaning areas.

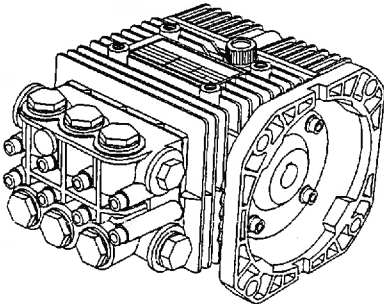
These pumps are constructed of anodized aluminum die cast bodies with a choice of aluminum or brass heads. Internal components are made of corrosion resistant stainless steel valves and ceramic plungers. All pumps come standard with large oil bath crankcases.

Hypro's triplex plunger pumps feature 1/2" NPT female inlet ports and 3/8" NPT female outlet ports. A combination unloader with chemical injector can be added to the 2250 Series pumps that include a garden hose adapter and filter.

The pumps are electric motor and gas engine driven. Each model of pump is designed and developed to work at the performance indicated on the pump's nameplate. The flows depend on:

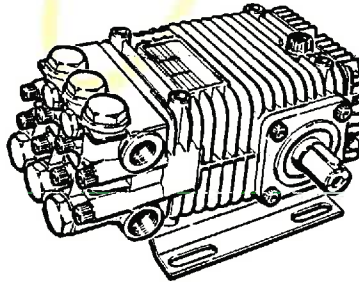
- 1) the diameter of the plungers,
- 2) the stroke of the plungers,
- 3) the number of plungers,
- 4) the number of revolutions per minute (rpm).

The pressure generated by the pump depends upon the nozzle used. **The pressure and rpm must remain within the maximum values indicated.**



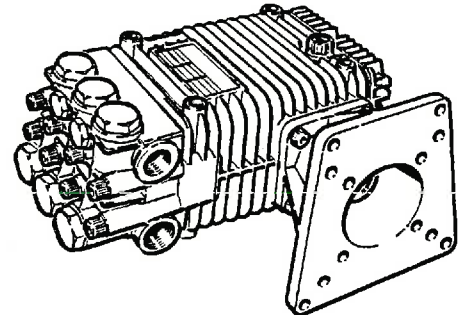
2250 "Kwik-Mount" Series
Triplex Plunger Pump

Max. Flow Rate: 2.1 to 3 gpm
 Max. Pressure: 1000 to 2000 psi
 RPM: 1750, 3400 and 3450 rpm
 Shaft: 5/8" Dia. (Hollow)
 3/4" Dia. (Hollow)



2333B thru 2337B
Powerline Series
Triplex Plunger Pump

Max. Flow Rate: 3.5 to 4.5 gpm
 Max. Pressure: 2200 to 3000 psi
 RPM: 1750 rpm
 Shaft: 24 mm Solid Shaft and Base



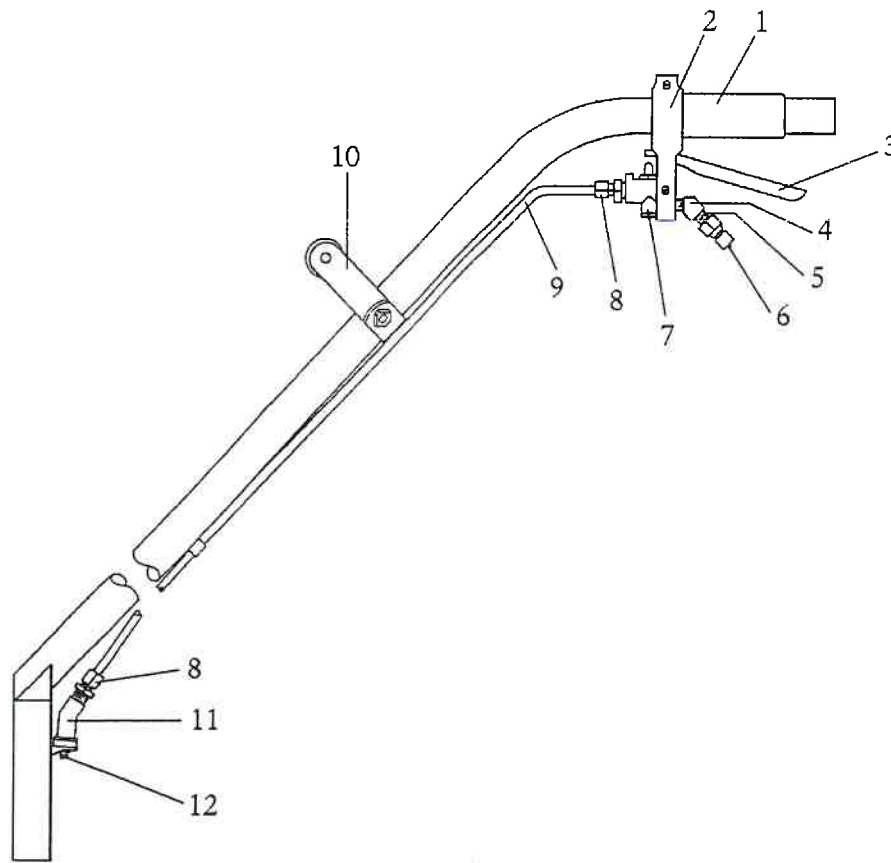
2362B-C thru 2363B-CU
"Kwik-Mount" Series
Triplex Plunger Pump

Max. Flow Rate: 4 gpm
 Max. Pressure: 3000 psi
 RPM: 3400 rpm
 Shaft: 1" Dia. (Hollow)

For mounting dimensions, request Hypro's individual spec sheets for each pump.

Cleaning Wand

CM 302
Section 7-1



Wand Parts List

ITEM	PART NO.	DESCRIPTION	QTY
1	061-007	Handle Grip	1
2	015-203	Bracket, Low Pressure Wand Valve Holder	1
3	167-018	Trigger, Wand Low PSI	1
4	052-082	Elbow, ¼" Brass 45 Street	1
5	052-072	Nipple, ¼ Brass Close	1
6	052-050	Quick Connect, 440 Male with Viton	1
7	169-074	Valve, High PSI Brass	1
8	052-152	Compression, ¼" Male HydraHoe Fitting	2
9	168-001	Tube, HydraHoe Solution ¼" OD s/s	1
10	061-024	Handle Kit, Wand - Pressure Guide (see below)	1
11	052-450	Elbow, For Jet Assembly Wands	1
12	076-004	Jet, #11004 ¼" VV s/s	1

Handle Assembly (Item #10):

094-035	Nut, 5/16-18 s/s Nylock Half	2
143-012	Bolt, 5/16-18 x ¾" HHC s/s	2
061-006	Handle, Pressure Guide	1

Vacuum System

CM 302

Section 8-1

The vacuum pump in this machine is commonly referred to as a “positive displacement lobe-type blower.” The performance and life of this unit is greatly dependent on the care and proper maintenance it receives.

Because of the close tolerances between the lobes and housing of the vacuum blower, solid objects entering the inlet will damage the internal lobes, gears, bearings or drive system.

To prevent this, a stainless steel filter screen has been placed at the vacuum inlet inside the vacuum recovery tank. This stainless steel screen is finger tight and should be removed for cleaning weekly.

◆ CAUTION ◆

When the machine is being run for test purposes and the vacuum inlet on top of the machine is open, caution should be used.

To protect the vacuum blower from overloading and damaging itself, there is a vacuum relief system installed on the vacuum tank. When the vacuum tank inlet is completely sealed off, a maximum of 12 HG will be attained. At the end of each day, an oil based lubricant should be sprayed into the blower lubrication port before shutting down the machine. If you fail to lubricate the vacuum blower daily, rust deposits and moisture will decrease the life of the vacuum blower.

◆ CAUTION ◆

Foam passing through the blower could lead to serious problems. Therefore, it is important to keep the vacuum tank foam free.

Read the vacuum blower manual carefully for proper oil change and grease application. The maintenance log may differ slightly from the manual, but the truckmounted carpet cleaning machine application is very demanding of the vacuum blower and therefore it should be maintained more regularly.

◆ CAUTION ◆

The vacuum tank is protected from overflowing by a vacuum tank float kill switch. The switch is not activated by foam, only by liquid.

VACUUM TANK FILTER BAGS

HydraMaster filter bags are designed to trap lint and dirt that would normally collect at the bottom of your vacuum tank. The use of these bags, if emptied at the end of each job, will eliminate the build-up of much of the debris in the tank. The drawstring top of these bags is designed to be slipped around the incoming dirty water inlet in the vacuum tank.

UNCONTESTED WARRANTY

The Roots Division of Dresser Industries, Inc. states in their February 1993 Roots Blower specification sheet, "Roots is the leader in blower warranties - the first to introduce an uncontested warranty that guarantees repair or replacement of any Universal RAI-J™ that malfunctions for any reason. We'll protect you or your customer for a full 18 months from date of original start-up or 24 months from date of shipment, whichever occurs first."

Blower Troubleshooting

CM 302

Section 8-3

No	Problem / Possible Cause	Solution
1	There is no vacuum or a loss of vacuum.	
1.1	The <i>stainless steel filter</i> is clogged.	Clean or replace the filter.
1.2	The <i>filter bag</i> is clogged.	Clean or replace the filter bag.
1.3	The <i>vacuum tank dump valve</i> is "open" or defective.	If water drips from the valve when the machine is not running, the valve will cause a vacuum loss when the machine is running. Replace it if it is defective.
1.4	The <i>vacuum hose</i> is plugged.	Remove the obstruction by reversing the vacuum hose.
1.5	There is a restriction in the <i>cleaning tool</i> .	Remove the obstruction.
1.6	The <i>vacuum tank seal</i> is defective.	Replace the seal.
1.7	The <i>hose</i> from the blower to the recovery tank is kinked or has collapsed inside.	Replace or reshape the hose. NOTE: A special reinforced hose is required for replacement.
1.8	There is a hole in the <i>recovery tank</i> .	Inspect the tank for leaks using smoke and weld the tank if it is required.
1.9	There is a hole in the <i>vacuum hose</i> .	Repair or replace the hose.
1.10	The <i>vacuum release</i> is loose.	Readjust the vacuum release.
1.11	The <i>engine speed</i> is too low.	Adjust the speed.

No	Problem / Possible Cause	Solution
1.12	The <i>vacuum blower's</i> end plates or lobes are worn.	Replace the worn components. NOTE: This must be accomplished by a qualified technician.
1.13	There are <i>vacuum leaks</i> around the top collector box.	A vacuum leak can usually be detected by spraying a mist of WD40 or blowing smoke towards the leak. The mist or smoke will be sucked into the leak. When you see the leak, repair it.

No	Problem / Possible Cause	Solution
2	The blower is noisy.	
2.1	There is an <i>exhaust</i> leak between the blower and the silencer.	Inspect the fittings to determine where the air leak is. Repair as necessary.
2.2	The <i>blower</i> is out of oil or the gears may be bad. NOTE: Permanent damage may result from a lack of lubrication.	Add oil. If the noise continues, replace the gears or blower. NOTE: Replacement of the gears must be accomplished by a qualified technician.
2.3	The <i>silencer</i> is bad.	Inspect it for an external hole. Repair or replace the silencer.
2.4	The <i>lobes</i> are hitting.	Replace the blower.
2.5	The <i>engine</i> is running at the wrong speed. This is noticeable because the blower noise increases with speed.	Adjust the engine to run at the proper speed.
2.6	The <i>bearings</i> are worn.	Remove and replace the bearings as required. NOTE: This process must be accomplished by a qualified technician.

No	Problem / Possible Cause	Solution
3	The blower will not turn.	
3.1	The <i>lobes</i> are locked up because of rust, burnt chemical foam, or a sugar-like substance has been vacuumed up from the carpet.	<p>a. Most <i>burnt foam</i> and <i>rust</i> can be removed by soaking the lobes with liquid wrench. After soaking the lobes, with the machine running, pour a half gallon of hot water into the top of the blower. Then spray WD40 or Pennz Lube into the top of the blower to displace the water.</p> <p>b. Any <i>sugar-like substances</i> can be removed by soaking the lobes with hot water.</p>
3.2	There is debris in the <i>blower</i> .	Remove the debris. A stainless steel filter is provided at the vacuum inlet in the vacuum tank to prevent this problem.
3.3	The blower has broken <i>gears</i> or shattered <i>lobes</i> .	Rebuild or replace the blower. NOTE: Rebuilding the blower must be accomplished by a qualified technician.

No	Problem / Possible Cause	Solution
4	The shaft turns, but the lobes do not.	
4.1	The <i>shaft</i> is broken inside the blower.	Replace the blower.

Engine Information

CM 302

Section 9-1

PROPANE EMISSION SYSTEM

The CM 302 carpet cleaning system is designed specifically for indoor operation. The CM 302 utilizes a four-layer safety system to ensure the lowest possible emissions. First, a propane engine is used which even by itself would meet all emissions standards. Second, a catalytic combustor has been incorporated to reduce the emission level even further. The third level of safety protection is an ECD unit (Emission Control Device). A fourth layer of safety is accomplished by utilizing a carbon monoxide sensor. This sensor continuously measures the air around the unit for carbon monoxide and will turn the unit off if OSHA limits are exceeded. This four-layer safety system is vital to indoor operation.

"THE MACHINE WITH A CONSCIENCE"

The CM 302 knows when it is not operating correctly. It is designed to meet the most stringent of standards. When the machine is manufactured and tuned properly the emission levels are very low. However as the machine operates the air cleaner becomes dirty and the spark plugs begin to deteriorate. This is normal but the result is incomplete combustion of the fuel. Incomplete combustion results in higher emission of toxic substances. Since the technician's safety is vital, toxic emissions must be maintained at their lowest possible levels. In order to accomplish this a unique emission control system combined with a catalytic combustor has been utilized. This unit continuously monitors the air-to-fuel ratio of the engine to maintain efficient combustion. If the emission level can not be maintained by the system the machine will be shut off and a warning light illuminated, signaling the technician as to the cause of the shut down.

WARRANTY

HydraMaster will warrant all fuel system parts for a period of 2 years. The engine is covered by Briggs & Stratton for a period of 2 years with this exception, "warranty does not apply to engine adjustment or repair required due to failure of the combustion chamber valves, valve seats, valve guides or burned starter motor windings which occur when operating an engine with LPG or NG" (Briggs & Stratton technical support, sheet number 1074, May 11, 1992). All other parts are covered by the standard HydraMaster "Golden Guarantee." Warranty repairs may be performed as usual with the exception of fuel system adjustments. The fuel system adjustments are set at the factory and any tampering with them will void the warranty.

The fuel system on the CM 302 machine consists of the following parts:

- Modified Briggs & Stratton Carburetor
- Modified Briggs & Stratton Carburetor Riser
- Beam Propane Regulator
- Beam Vacuum Switch
- Beam Solenoid Valve
- Manchester DOT Propane Cylinder
- ECD Unit with Oxygen Sensor
- Propane Quick Disconnect

Other emission related components are:

- Catalytic Combustor
- Spark Plugs
- Intake Manifold
- Air Filter
- Exhaust Manifold

ECD UNIT OPERATION

Your CM 302 carpet cleaning machine is equipped with an emission control device. This unit continually monitors the combustion efficiency of the engine and controls the fuel-to-air ratio to keep the engine running as efficiently as possible.

The ECD unit has an indicator light that allows you to see what the control device is doing. The light has five different conditions that indicate how the engine is operating. They are:

Fast Green Blink	Engine Cold (start up only)
Slow Green Blink	Normal Operation
Solid Red	Beyond Range (check wiring)
Clear (no color)	Fuel-to-Air Ratio Too Lean
Solid Green	Fuel-to-Air Ratio Too Rich

Under normal operation the fast green blink light will appear when the engine is first started until the engine is warm. Then the light will change to a slow green blink. If the red light should ever appear this indicates that the engine requires service. The engine will be shut down in two to five minutes and may not be started until the engine has been serviced.

NOTE: The solid red light or clear light may appear if the fuel tank is near empty. Check the propane tank fuel level or replace with a full tank and check the machine again. If the red, clear or solid green lights persist, have the machine serviced by a qualified technician.

Engine Troubleshooting

CM 302

Section 9-4

No	Problem / Possible Cause	Solution
1	The engine will not turn over:	
1.1	There is a loose <i>battery cable</i> or corroded <i>battery terminals</i> .	Clean and tighten the battery terminal connections.
1.2	The <i>battery</i> is dead.	Recharge or replace the battery.
1.3	There is a problem with the <i>fuse link</i> .	Check the link. If it is defective, replace it.
1.4	There is a problem with the <i>starter solenoid</i> .	With the ignition switch in the "Start" position, check the following on the solenoid. Check for +12 volts on: a. the small terminal with the yellow wire from the ignition switch, b. the large terminal with the cable from the battery, and c. the large terminal with the cable going to the starter. If the voltage is present on the first two checkpoints, but not on the large terminal going to the starter, replace the solenoid.
1.5	The <i>ignition switch</i> is defective.	Test the switch for entering voltage. If there is voltage entering but no voltage exiting at the yellow wire when the switch is fully engaged, then replace the switch.
1.6	The <i>vacuum blower</i> has seized.	Refer to The Blower, Chapter 10.

No	Problem / Possible Cause	Solution
1.7	The <i>starter motor</i> is defective.	Check to see if the engine will turn over manually. Check that the engine is grounded to the minus side of the battery. With the ignition key in the start position, check the starter motor for + 12 volts. If all of the above conditions are met and the starter will not turn, replace it.
1.8	There is an <i>engine</i> problem.	Refer to the engine operation and maintenance manual in your owner's manual or see the local Briggs & Stratton engine repair facility.
1.9	The <i>ground cable</i> underneath the motor has fallen or broken off.	Reattach the cable.

No	Problem / Possible Cause	Solution
2	The starter turns the engine over, however the engine will not start. (There is no spark[♦].)	♦ Check for spark at the spark plugs. If there is no spark, examine the troubleshooting guide below. However, if there is no fuel, see troubleshooting problem number 3 on the following page for possible fuel problems.
2.1	The <i>recovery tank</i> is full.	Empty the tank.
2.2	The <i>recovery tank float</i> is causing the engine to shut down.	Disconnect the float. If the unit starts, replace the defective float.
2.3	The <i>engine</i> is malfunctioning.	Refer to the Briggs & Stratton Engine Maintenance manual included in your owner's manual.
2.4	The <i>magnetron</i> is malfunctioning.	Check the magnetron. If it is adjusted properly, all the wires tight, and none of the wires are grounding out, then remove all the wires from the engine kill lug. If there is still no spark, replace it.
2.5	A <i>spark plug</i> is faulty.	Check for worn, fouled or improperly gapped spark plugs. Replace if necessary. CAUTION: Allow the engine to cool completely before attempting to remove the plugs.
2.6	The <i>engine stop relay</i> is malfunctioning.	Remove either end of the wire that runs from the relay to the engine kill lug. If the engine starts, replace the relay.
2.7	The <i>oil pressure switch</i> is causing the engine to shut down.	Check the engine oil level. If it is at the proper level, then disconnect the oil pressure switch. If the unit starts, then replace the switch.
2.8	The <i>lower float in the chemical mix tank</i> is defective.	Unplug the wire from terminal 86 on the kill relay. If there is water in the mix tank and the engine starts, replace the switch.

No	Problem / Possible Cause	Solution
2.9	The <i>ECD unit</i> is in shut down mode.	Remove the wires from the engine stop post. If the engine starts, replace one wire, then the other. If one of the wires stops the engine, determine the source. The ECD wire is white.

No	Problem / Possible Cause	Solution
3	The starter turns the engine over, however the engine will not start. (There is no fuel♦.)	♦ Check for spark at the spark plugs. If there is no spark, see troubleshooting problem number 2 on the previous page. However if there is a spark, examine the following troubleshooting guide for possible fuel problems.
3.1	The <i>propane tank valve</i> is closed.	Open the valve.
3.2	The <i>valve</i> on the outside of the tank and cart is closed.	Open the valve.
3.3	The <i>fuel filter</i> is clogged.	Inspect the filter and replace if necessary.
3.4	The <i>quick connect</i> in the fuel line is clogged.	Clean or replace the quick connect.
3.5	The <i>quick connects</i> are not tightened.	Tighten the quick connects.
3.6	The <i>fuel solenoid</i> is not opening.	While cranking, check for voltage.
3.7	The <i>fuel solenoid</i> is defective.	Replace the solenoid.

No	Problem / Possible Cause	Solution
4	The engine runs poorly or dies after running for awhile.	
4.1	The <i>air or gas filter</i> is clogged.	Inspect both filters and replace the clogged one.
4.2	There is a poor <i>battery ground</i> to the fuel pump.	Inspect the electrical grounds and repair any loose ground connections.
4.3	There is excessive <i>engine load</i> .	Clean and adjust the recovery tank relief valve. Adjust for 12 inches of lift under a full load.
4.4	The engine overheats from too much oil in the <i>crankcase</i> .	Check the oil level and correct if necessary.
4.5	The <i>engine</i> is malfunctioning.	Refer to the Engine Operation and Maintenance manual, or see local Briggs & Stratton dealer.
4.6	A clogged <i>heat exchanger</i> is causing back pressure.	This will cause the engine to run slow. Remove the stainless steel hose from the end of the stainless steel heat exchanger. if the engine runs good without the hose, then remove the copper heat exchanger under the machine and clean the debris.
4.7	The <i>ECD unit</i> has encountered a shut down situation.	See the ECD function.
4.8	The <i>PCV valve</i> is defective.	Remove and check the air cleaner for oil saturation. If it is saturated, replace the PCV valve and air filter.

Fuel System

CM 302

Section 10-1

HydraMaster, being a leader in the floor care industry, has taken every precaution possible in the design of this equipment to ensure the safety of the technician. Safety is our primary concern. Therefore, the fuel of choice for this equipment is Liquefied Petroleum Gas (LPG, or more commonly referred to as propane). Propane is one of the cleanest burning commercial fuels available. The compounds produced by the combustion of propane are carbon dioxide, carbon monoxide, and oxides of nitrogen. Even though these can be toxic compounds in high concentrations, in this equipment everything possible has been done to ensure that these compounds do not reach harmful levels.

Propane has many advantages over other liquid fuels. For instance:

- ▶ This fuel is readily available. Propane can be purchased in virtually any town in America.
- ▶ Propane cylinders are commercially available and offer a safe and convenient way to transport this fuel.
- ▶ Propane has been used successfully for many years by the floor care industry for indoor applications.
- ▶ There are well established safety standards for the indoor use of propane fuel.
- ▶ Propane is a very clean burning fuel, so it does not leave carbon deposits on interior engine components. This results in better engine life.
- ▶ Propane boils at -40 degrees F so it can not spill. It is enhanced with a strong odor that is perceptible well below the flammable level so leaks can easily be detected.

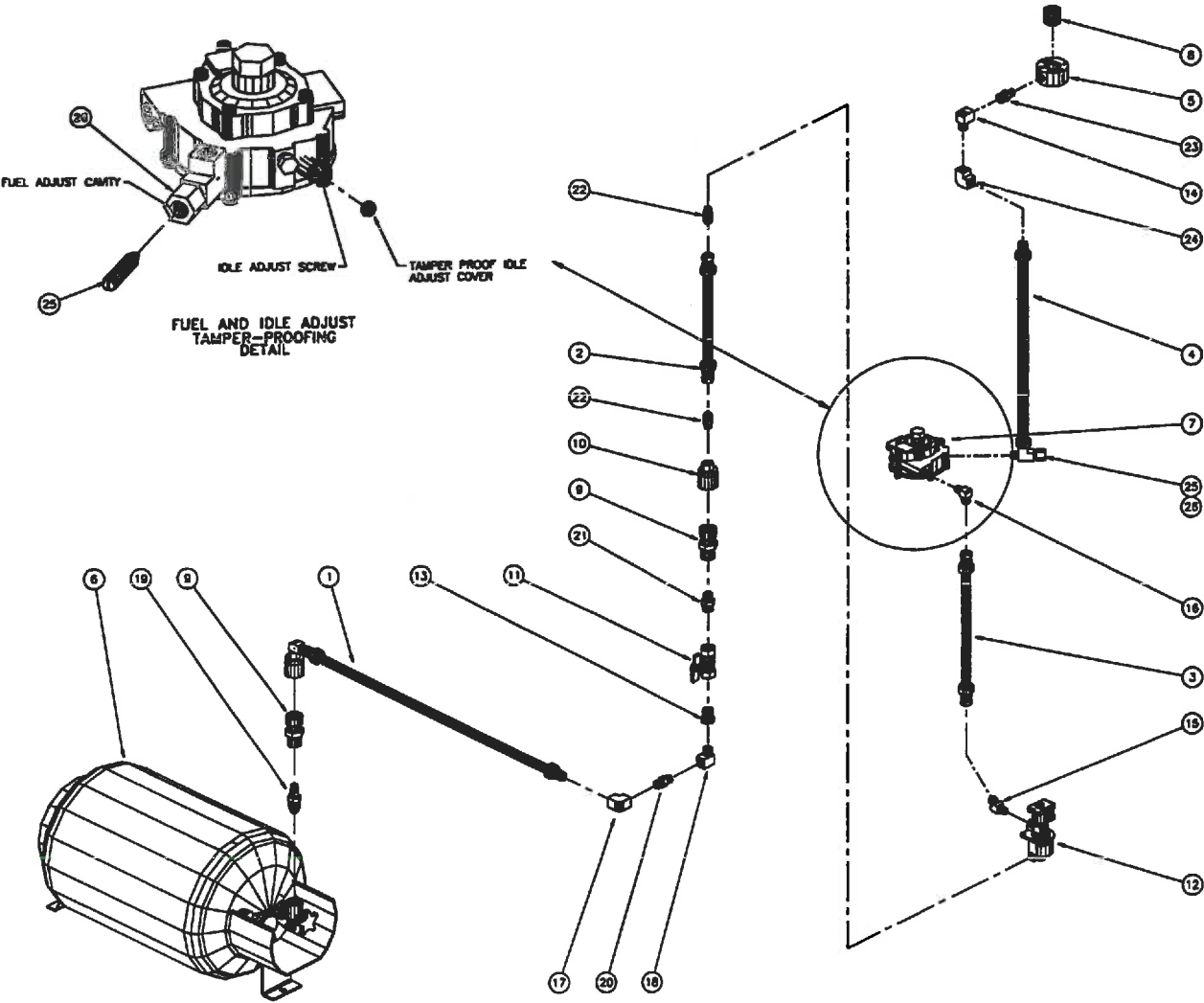
FUEL SYSTEM FLOW

The fuel system flow is as follows:

1. When the tank valve is opened pressurized propane vapor travels through a quick connect (item 9), a hose (item 1) which has a quick connect on it and to a shut-off valve (item 11).
2. When the valve (item 11) is opened, the propane vapor then travels through the quick connect fittings (items 9 and 10) to another shut-off valve (item 12).
3. When the engine is started, this valve (item 12) opens and allows propane vapor to reach the pressure regulator (item 7).
4. The pressure regulator reduces the propane pressure and regulates the flow of vapor to the engine.
5. The vapor then travels through the main metering valve on the hose shown as item 4.
6. The vapor then reaches the venturi (item 8) and is injected into the engine.

Figure 10-1: Propane Flow

D3270, Rev A



Propane Flow Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	-----	Hose Assembly, Propane Tank	1
2	068-391	Hose, Propane Tank and Cart to Propane Sol.	1
3	068-392	Hose, Propane Sol. to Propane Reg.	1
4	068-393	Hose, Propane Reg. to Carb. Inlet	1
5	001-031	Adapter Set, Propane Carburetor Inlet	1
6	159-012	Propane Tank, 30 lb. Horizontal "DOT" Appvd	1
7	135-005	Regulator, Engine Propane B & S 14 HP	1
8	181-010	Venturi, Beam Propane	1
9	052-046	Propane Quick Connect, Male	2
10	052-047	Propane Quick Connect, Female	1
11	169-032	Valve, ½" Propane Shut-Off	1
12	169-030	Valve, Beam Filterlock Propane Shut-Off	1
13	052-064	Bushing, ½ M x ⅜ F Brass	1
14	052-085	Elbow, ¼" Brass Street	1
15	052-491	Elbow, ⅜" Flare x ¼" 45 Degree MPT	1
16	052-492	Elbow, ⅜" Flare x ¼" 90 Degree NPT	1
17	052-142	Elbow, ⅜" F x F Brass	1
18	052-086	Elbow, ⅜" Brass Street	1
19	052-494	Nipple, POL x ¼" M Propane	1
20	052-074	Nipple, ⅜ Brass Hex	1
21	052-075	Nipple, ⅜" x ½" Brass Hex	1
22	052-490	Nipple, ⅜" Flare x ¼" MPT	2
23	052-073	Nipple, ¼" x ⅜" Brass Hex	1
24	052-142	Elbow, ⅜" F x F Brass	1
25	169-031	Valve Needle, Main Power Valve	1
26	042-032	Housing, Main Power Valve	1

T STAGE REGULATION

Reduced Freezing Problems - A two-stage regulator must be used on RV's. A two-stage regulator greatly reduces the possibility of freeze-ups because (1) larger orifice sizes can be used in the regulators and (2) heat can be transferred through the walls of two regulators instead of just one.

Improved Regulation - The second stage regulator receives a relatively uniform pressure from the first stage regulator. This helps the second stage regulator to maintain appliance pressure at a nearly constant 11" W.C. because it does not have to adjust to varying inlet pressures.

*BASIC FACTS ABOUT LP-GAS

PROPANE	
Pounds per gallon	4.20
Specific gravity of gas	1.50
Specific gravity of liquid	0.51
Cu. ft. gas per gallon liquid	36.38
Cu. ft. gas per pound	8.66
BTU per gallon	91,502
BTU per pound	21,548
Dew point in degrees F	-44
Vapor pressure at 0° F	31
Vapor pressure at 70° F	127
Vapor pressure at 100° F	196
Vapor pressure at 110° F	230

Butane is not readily available in the U.S. or Canada. Low pressures in cold climates are more likely to cause vaporization problems. Keep fuel levels above 50%.

Average LP-gas capacities (PROPANE)
(allow 20% for vapor space)

Lbs. of gas	BTU's
1 - 1.0 gal. DOT cylinder	107,740
1 - 2.5 gal. DOT cylinder	237,028
1 - 4.8 gal. DOT cylinder	430,960
1 - 7.2 gal. DOT cylinder	646,440
1 - 9.2 gal. DOT cylinder	861,920

Conversions:

Gallons to Liters (1 gallon = 3.785 liters)

F° to C° (F° = 9/5 C° + 32°)

11" Water Column = 6 1/4 ozs. per sq. in. pressure

27.7" Water Column = 1 pound per sq. in. pressure

To find out how long your LP-gas supply will last, simply total the BTU demand of all your gas appliances and the BTU capacity of your containers at 80% full. Divide container BTU capacity by total appliance demand.

*Data From NFPA Pamphlet #58-1989

NOTE: This pamphlet is not meant to be a complete guide to the use of propane cylinders and appliances.

Part #S-33108

Rev. 10/90

HELPFUL HINTS

ABOUT

LP-GAS (PROPANE) AND LP-GAS (PROPANE) CONTAINERS



SO YOU MAY ENJOY USING THE WORLD'S MOST VERSATILE FUEL - ALWAYS FOLLOW ALL SAFETY WARNINGS AND PRODUCT INSTRUCTIONS.

LP-gas is a highly flammable fuel contained under pressure and may cause fires and/or explosions if improperly used.

LP-gas (liquid petroleum gas) is a true gas compressed into liquid form for easy transportation and storage. It is also known as propane or bottled gas. It is safe and economical and, because of its portability, it provides modern living convenience no matter where you travel.

LP-gas is flammable, is always contained under pressure and the liquid can freeze skin. Therefore, in the interest of safety, it is important to understand the basic facts about LP-gas and LP-gas containers.

Federal DOT regulations require periodic inspections and requalifications of cylinders (see NPGA Pamphlet 118). **DO NOT USE** damaged or rusted tanks.

MANCHESTER TANK & EQUIPMENT CO.

2880 Norton Ave., Lynwood, CA 90262

2738 Lithonia Industrial Blvd., Lithonia, GA 30058

1201 No. Gary Ave., Lubbock, TX 79415

29389 Lexington Park Dr., Elkhart, IN 46514

P.O. Box 511, Tillsonburg, Ont., N4G4J1, Canada

P.O. Box 953, Hannibal, MO 63401

23209 Airport Dr., Petersburg, VA 23803

285 Davis Rd., Crossville, TN 38555

SOME BASIC PRECAUTIONS TO ENSURE SAFETY AND 100% PROBLEM-FREE USE

- Never allow your LP-gas tank or cylinder to be filled above the maximum safe level as indicated by the fixed liquid level gauge (oulage). Do not use the visible gauge for filling.
- Do not use a wrench or pliers to close the POL service valve or fixed liquid level gauge on your tank. These valves are designed to be closed leak-tight by hand or screwdriver as appropriate. If wrenches are necessary to stop a leak, the valve needs repair or replacement.
- When tightening the POL Nut (leithand thread) on the service valve, draw it up snug with a proper wrench — don't jam it. This is a machined male brass fitting which seals securely against a female seat in the POL valve — no pipe dope is necessary. Check for leaks after connecting. Apply soapy water to service valve. Leaks will be detected by the appearance of bubbles. If bubbles appear, tighten POL connector and repeat leak test.
- When using tank, slowly open POL service valve all the way. Listen to the regulator. A hiss means a leak.
- Check all tank and line connections periodically to be sure they are tight. When testing for leaks use soapy water — not matches.
- Make certain your cylinder is properly fastened in place.
- On dual tank installation, turn tanks with open part of tank guard towards trailer (travel trailer installation). This protects valves and regulator against flying rocks and mud which may be thrown to the rear on gravel or dirt roads.
- If you take your LP-gas tank to an LP-gas dealer for filling, transport it in the proper position in which it is used, with the valves closed and **POL plug inserted**. Secure the tank against falling or rolling.
- Since LP-gas is non-corrosive, you need not worry about the inside of your tank. However, the outside should be kept from rusting by a periodic coat of paint in a light reflective color.
- Practice safety at all times. If you have questions about the operation of your appliance or LP-gas systems, contact your local LP-gas dealer.
- Do not store LP-gas tanks or cylinders indoors or in enclosed areas. Do not expose LP-gas container to heat. Always store with service valve closed and plugged.
- Do not attempt to repair LP-gas containers, valves or regulators.
- Valve information supplied by appropriate manufacturer.

ADDITIONAL COPIES OF HELPFUL HINTS

AVAILABLE AT NO CHARGE.

CAUTION

USE LP-GAS TANKS AND CYLINDERS IN PROPER POSITION

Use vapor only. All LP-gas appliances for cooking, heating, lighting, water heating and refrigeration are designed to operate on LP-gas vapor only. Therefore, all LP-gas tanks and cylinders designed for vapor service must be transported, installed and used in the proper position. Do not transport, install or use a vertical cylinder (see Fig. No. 3) in a horizontal or upside down position. Never use a horizontal cylinder or tank (see Fig. No. 4) on its improper side. Liquid LP-gas could enter the system designed for vapor only, creating a hazardous condition.

Always use a POL plug when transporting or storing disconnected cylinders or tanks (full or empty).

Manchester LP-gas containers are permanently marked with "top" stamped on a tab welded to the tank or "arrows must point up" stamped in the guard or bracket to identify the proper position.

All LP-gas tanks and cylinders must be securely attached in the proper position for intended use. Use all brackets provided to ensure proper support and positioning.

FILLING YOUR LP-GAS CONTAINER

Caution! Overfilling is hazardous! Do not overfill your LP-gas container. Stop filling when liquid appears at the fixed liquid level gauge. Most LP-gas containers are equipped with a fixed liquid level gauge which contacts the liquid level at 80% of container capacity allowing 20% for expansion. LP-gas containers not equipped with a fixed liquid level gauge can only be filled by weight.

LP-gas containers must not be filled over 80% of total capacity. Propane expands approximately 1.5% for each 10° F temperature rise. Only qualified personnel should fill your container. Pumps do not stop filling "automatically." Pumps "by-pass", when tanks are dangerously filled to total capacity. If overfilled, excessive pressure could develop within the container causing the relief valve to open, relieving pressure to a safe level at which time it will automatically close. However, LP-gas released through the safety relief valve is flammable; thus it could cause a fire.

The fixed liquid level gauge is used only to determine safe fill levels and does not indicate lower levels. LP-gas containers are available with visible gauges that monitor the amount of gas in the container at all times, reading from full to empty. If your container is not equipped with a gauge, replacement cylinders with sight gauges are available from your dealer for an additional cost. Do not use visible gauges for filling.

PURGING OF AIR FROM LP-GAS CONTAINERS

Air in LP-gas containers must be removed during the initial filling with LP-gas. If the container is not properly purged, air in the container dilutes the LP-gas vapor. Failure to purge may cause excessive tank pressure, slow filling and poor operation of Automatic Stop Fill valve. Appliances then require constant adjustment and pilot lights won't stay lit. This condition would exist until all air is depleted, leaving pure LP-gas vapor.

Have your LP-gas container purged, using LP-gas vapor to ensure satisfactory appliance performance. It only takes a few minutes and your LP-gas dealer is equipped to perform this service.

COMMON TERMS OF LP-GAS TANKS

1. POL-Vapor withdrawal service valve.
2. 20% Fixed Liquid Level Gauge. (Sometimes inaccurately called a 10% valve).
3. Vapor withdrawal tube. (Used on tanks where POL Valve is not located on top of tank.)
4. Bottom ring, stand legs, or mounting brackets.
5. Safety relief valve. Do not tamper.
6. Spud & nut with excess flow required on all RV's.
7. Two-stage pressure regulator.
8. Automatic Stop Fill Valve with 1-3/4" ACME.
9. Visible sight gauge. Available with remote sender.

DOT AND ASME TANKS

Generally speaking, LP-gas tanks are built to the specifications of either the ASME or DOT pressure safety codes which are used extensively. Basically, the difference between the two codes is that valves, fittings and brackets may be located on the ends only on DOT cylinders, while on the ASME tanks they may be located on ends as well as sides. These tanks are required to be rated in gallons (ASME) or pounds (DOT) water capacity. Manchester production and testing methods are the most modern available to assure top quality.

All valves and fittings on Manchester cylinders are listed by UL.

LP-GAS REGULATORS

LP-gas regulators reduce the pressure of LP-gas vapor from tank pressure to 6 1/4 oz. or 1" W.C. for use at the appliances. The regulator is the heart of the LP-gas system and although it seldom requires service, care should be taken to protect it from the elements which could cause it to malfunction. In addition, your LP-gas system should be kept free of moisture which could cause regulator freeze-up. Installation of a good regulator enclosure will protect your regulator and anhydrous methanol injected into your LP-gas container will help to prevent freeze-ups (1 pint per 100 gallons capacity).

CAUTION - ALWAYS BE SURE THAT THE REGULATOR

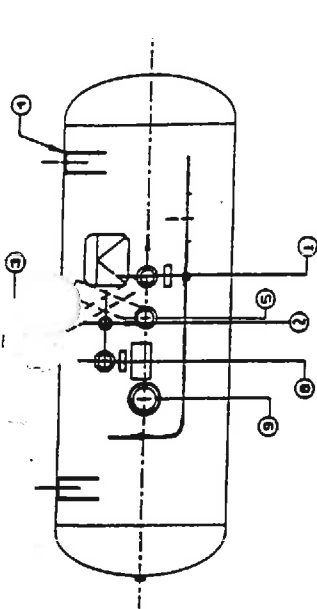


FIG. NO. 1
ASME Horizontal Motor home tank

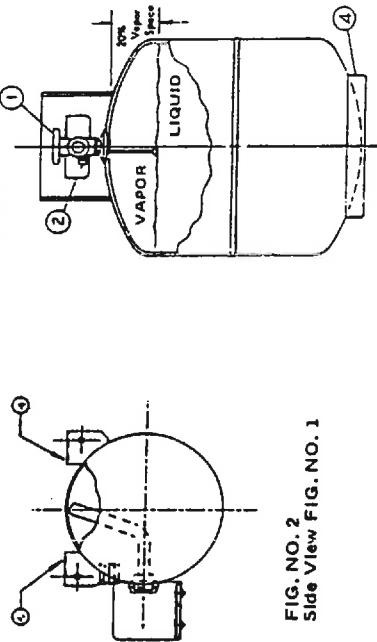


FIG. NO. 2
Side View FIG. NO. 1

FIG. NO. 3
Standard vertical
20 lb. DOT cylinder.

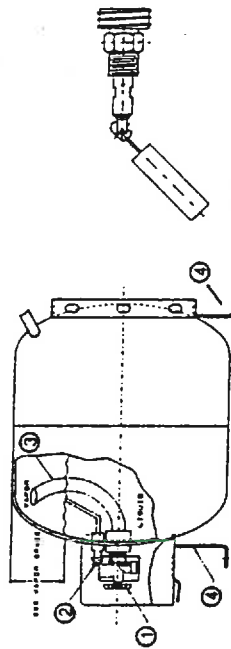


FIG. NO. 4
DOT 20 lb. cylinder
designed for horizontal use.

FIG. NO. 5
Automatic
stop fill valves required
on any permanently
mounted tanks.

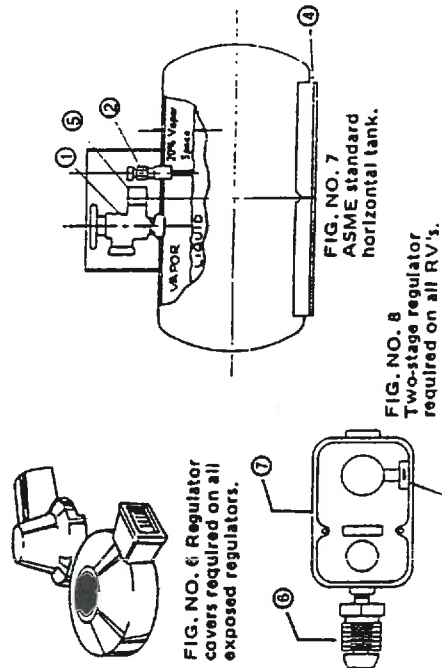


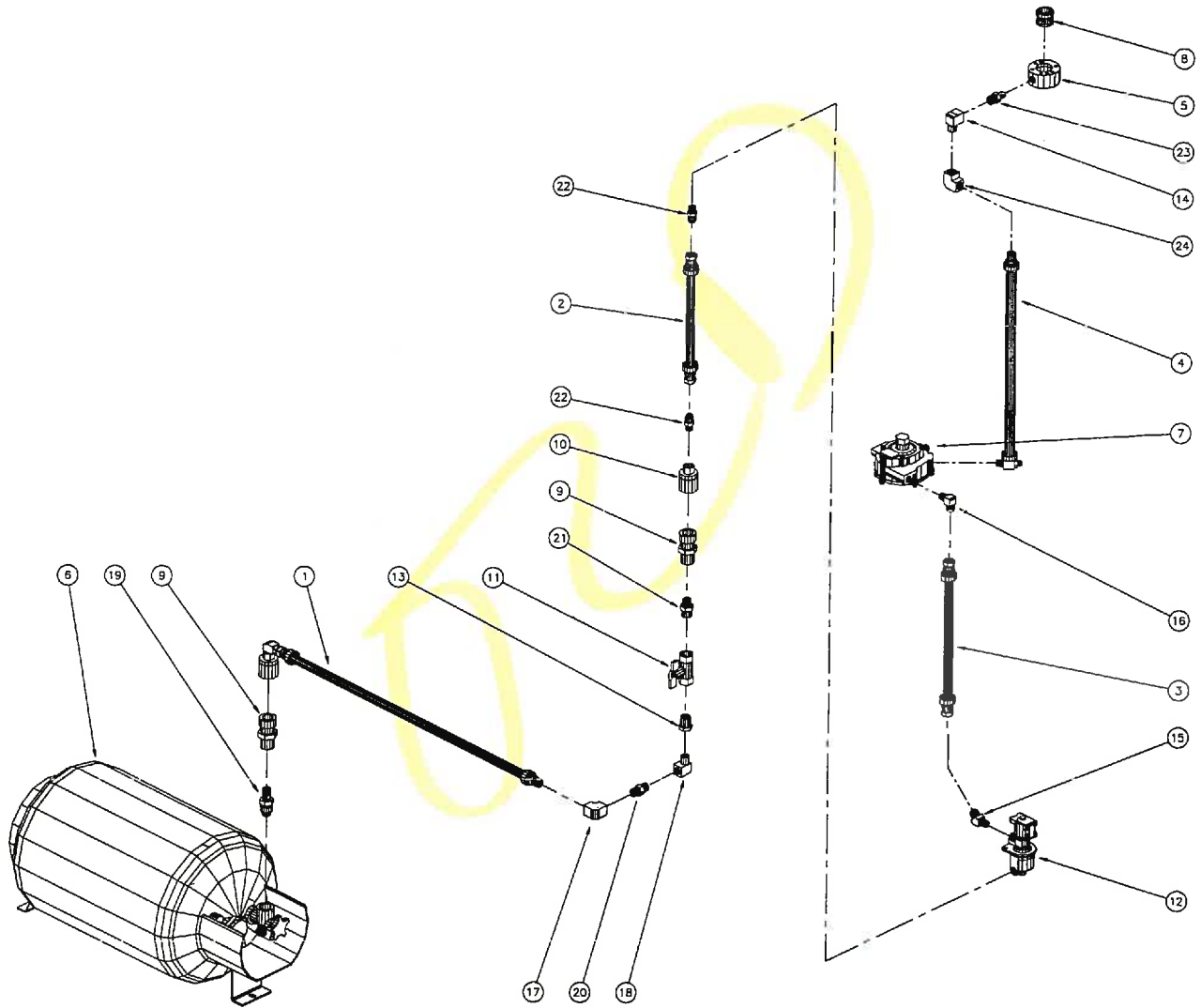
FIG. NO. 6
Regulator
covers required on all
exposed regulators.

FIG. NO. 7
ASME standard
horizontal tank.

FIG. NO. 8
Two-stage regulator
required on all RV's.

Figure 10-1: Propane Flow

D3270



Propane Flow Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	-----	Hose Assembly, Propane Tank	1
2	068-391	Hose, Propane Tank and Cart to Propane Sol.	1
3	068-392	Hose, Propane Sol. to Propane Reg.	1
4	068-393	Hose, Propane Reg. to Carb. Inlet	1
5	001-031	Adapter Set, Propane Carburetor Inlet	1
6	159-012	Propane Tank, 30 lb. Horizontal "DOT" Appvd	1
7	135-005	Regulator, Engine Propane B & S 14 HP	1
8	181-010	Venturi, Beam Propane	1
9	052-046	Propane Quick Connect, Male	2
10	052-047	Propane Quick Connect, Female	1
11	169-032	Valve, 1/2" Propane Shut-Off	1
12	169-030	Valve, Beam Filterlock Propane Shut-Off	1
13	052-064	Bushing, 1/2 M x 3/8 F Brass	1
14	052-085	Elbow, 1/4" Brass Street	1
15	052-491	Elbow, 3/8" Flare x 1/4" 45 Degree MPT	1
16	052-492	Elbow, 3/8" Flare x 1/4" 90 Degree. NPT	1
17	052-142	Elbow, 3/8" F x F Brass	1
18	052-086	Elbow, 3/8" Brass Street	1
19	052-494	Nipple, POL x 1/4" M Propane	1
20	052-074	Nipple, 3/8 Brass Hex	1
21	052-075	Nipple, 3/8" x 1/2" Brass Hex	1
22	052-490	Nipple, 3/8" Flare x 1/4" MPT	2
23	052-073	Nipple, 1/4" x 3/8" Brass Hex	1
24	052-142	Elbow, 3/8" F x F Brass	1

Electrical System

CM 302

Section 11-1

The CM 302 electrical system, in keeping with the entire machine concept, has been kept to a minimum so as to keep any necessary troubleshooting as easy as possible.

The entire electrical system operates on 12 volts DC which is provided by a battery. Battery levels are sustained by a 16 amp alternator inside the engine.

NOTE: When a new battery is installed, check that it is properly charged before installation or damage to the charging regulator may occur.

The orange wire going from the engine starter solenoid to terminal #5 on the ignition switch is a fusible link and provides protection to the electrical system in case of failure.

Ignition Switch:

Terminal No.	Wire Color	Function
1	Not Used	
2	White	To Carburetor Solenoid (when used)
3	Black	To Stop Switch Terminal on Engine
4	Yellow	To Solenoid (tab terminal)
5	Orange	To Battery (battery terminal on solenoid)
6	Red	To Regulator / Rectifier

Switch Position	Continuity
1. Off	1 + 3 + 6
2. Run	2 + 5 + 6
3. Start	2 + 4 + 5

Figure 11-1: Wiring Schematic

D3144, Rev B

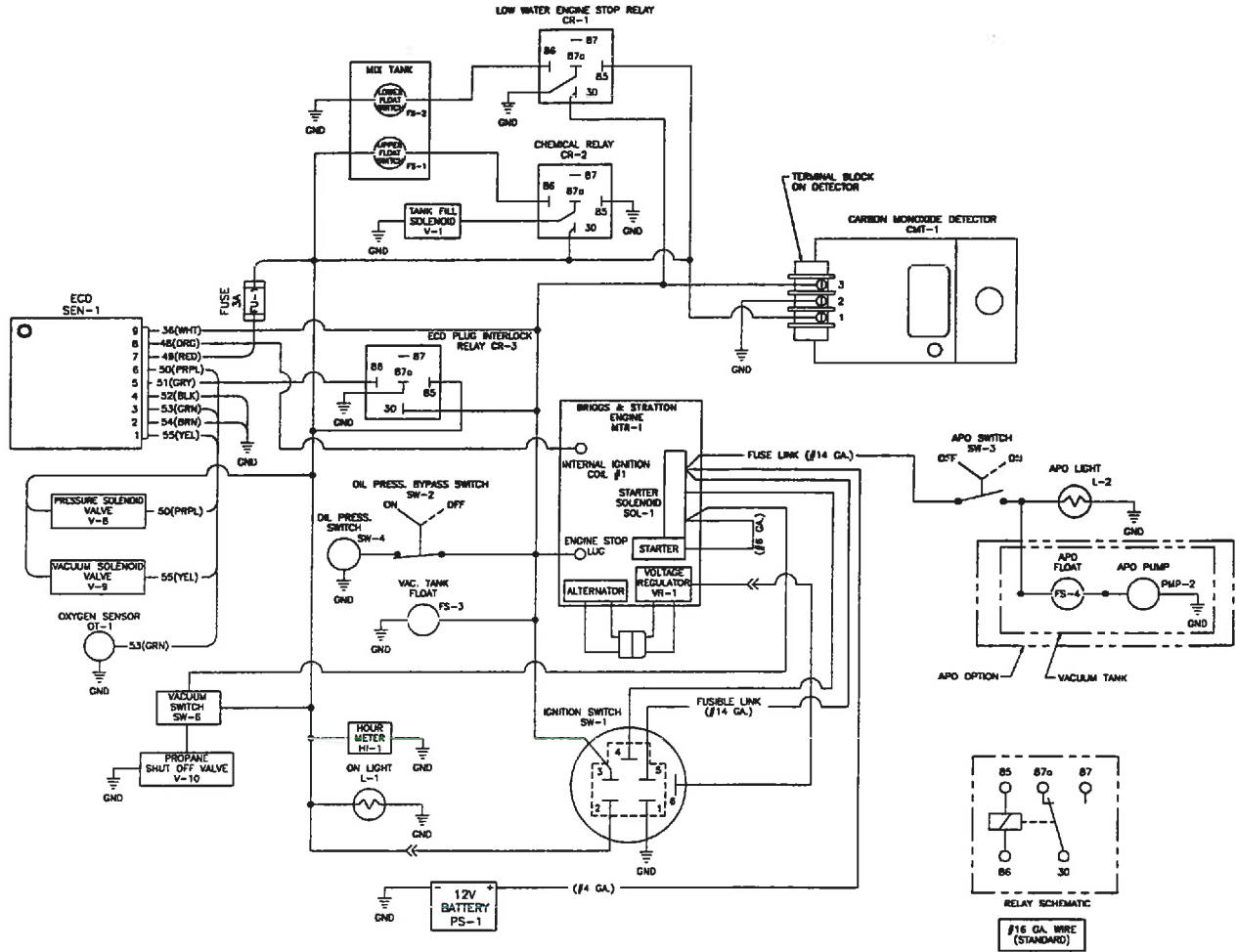


Figure 11-3 Wiring Diagram

D3130 Sht 1, Rev B

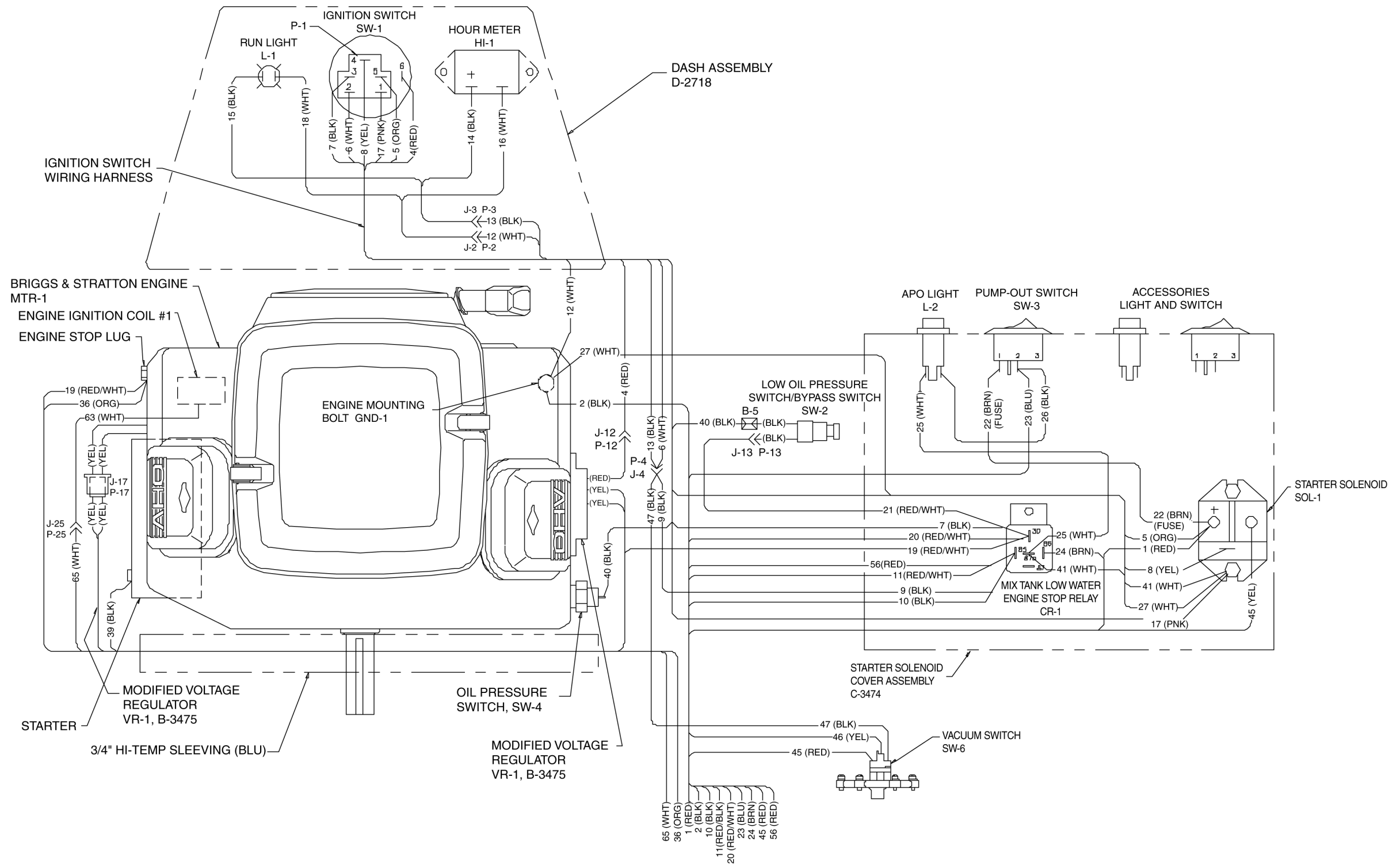
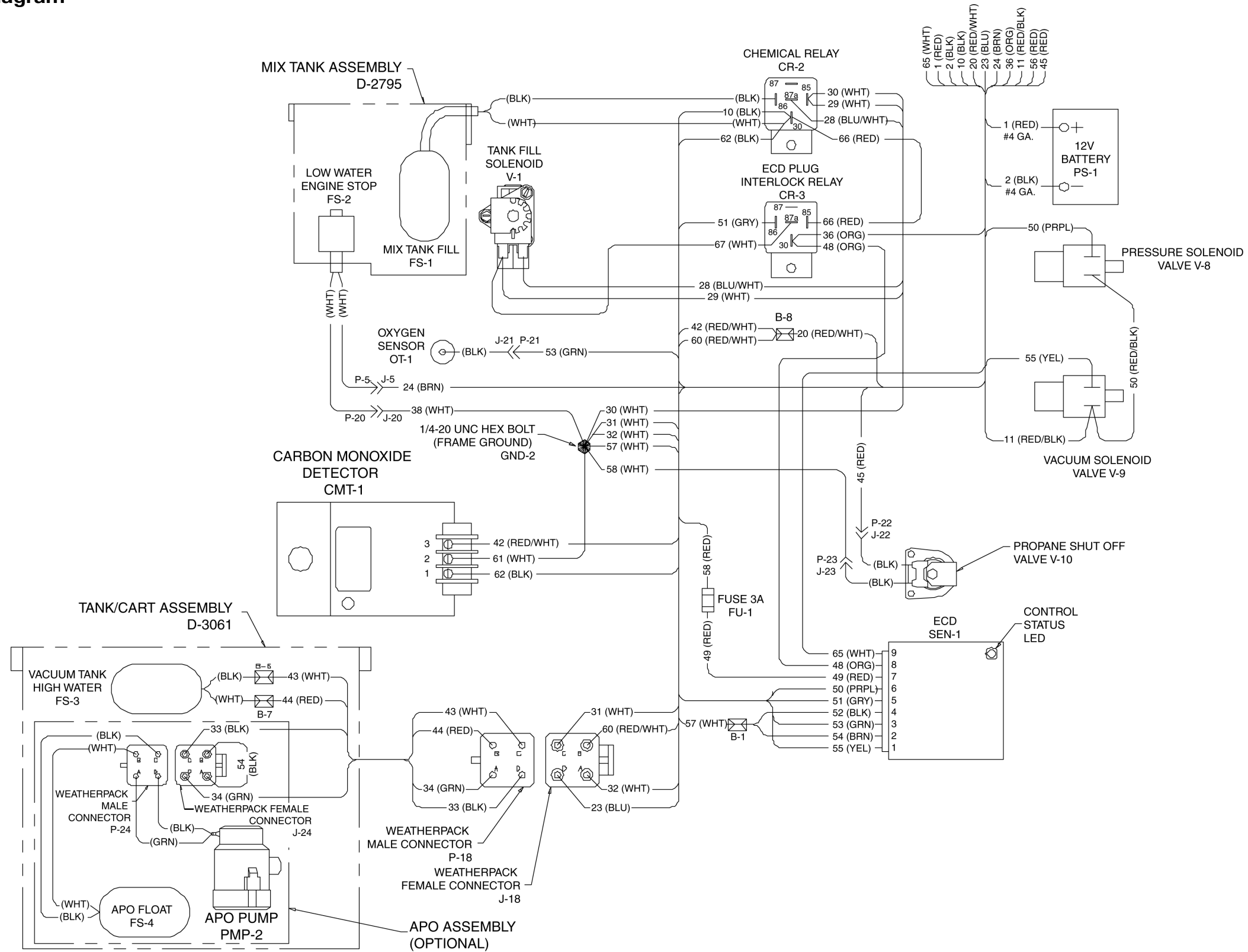


Figure 11-3 Wiring Diagram

D3130 Sht 2, Rev B



Electrical Troubleshooting

CM 302

Section 11-5

No	Problem / Possible Cause	Solution
1	The engine is not charging the battery.	
1.1	The <i>regulator/rectifier</i> is bad.	Check the B+ voltage from the regulator/rectifier to ground. With the engine running at normal RPM, the voltage should be 12.5 to 14.5 DC volts. If necessary, replace the regulator/rectifier.
1.2	The <i>stator</i> winding is bad.	Check for AC voltage at the regulator/rectifier. The stator should be producing an AC voltage of around 25 to 40 volts. (Check your owner's manual for the exact voltage.) If necessary, replace the stator winding.

No	Problem / Possible Cause	Solution
2	The fusible link is blown.	
2.1	The <i>fusible link</i> is weak or there is an <i>electrical short</i> in the system.	Replace the weak link. Check the unprotected wires for a short-circuit. Check under the dash panel for a loose wire or a wire that has rubbed its insulation off and is shorting-out to ground. Unscrew each individual wire, except the white wires, one at a time until the breaker does not trip. Then trace that circuit.

Figure 11-1: Wiring Schematic

D3144, Rev A

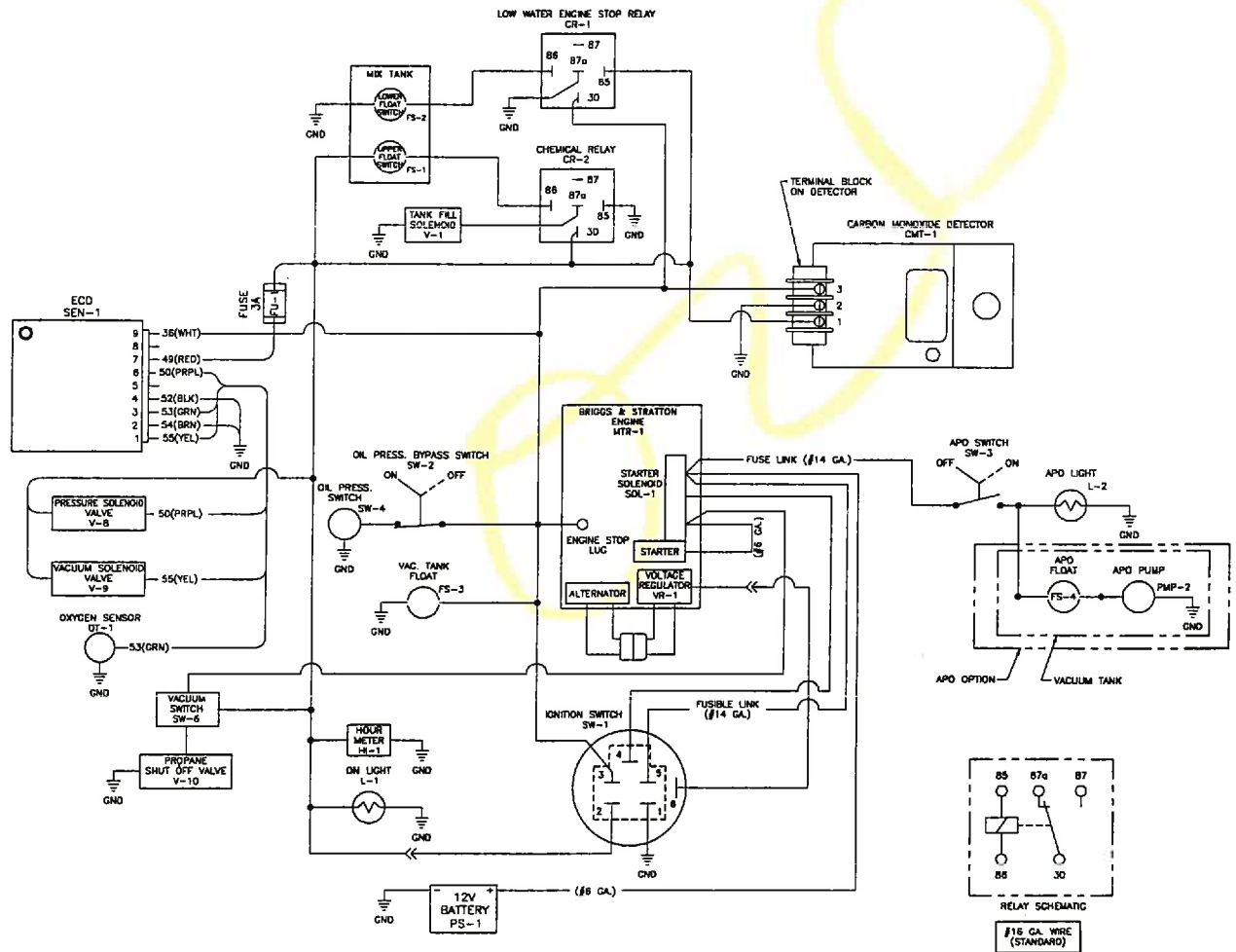
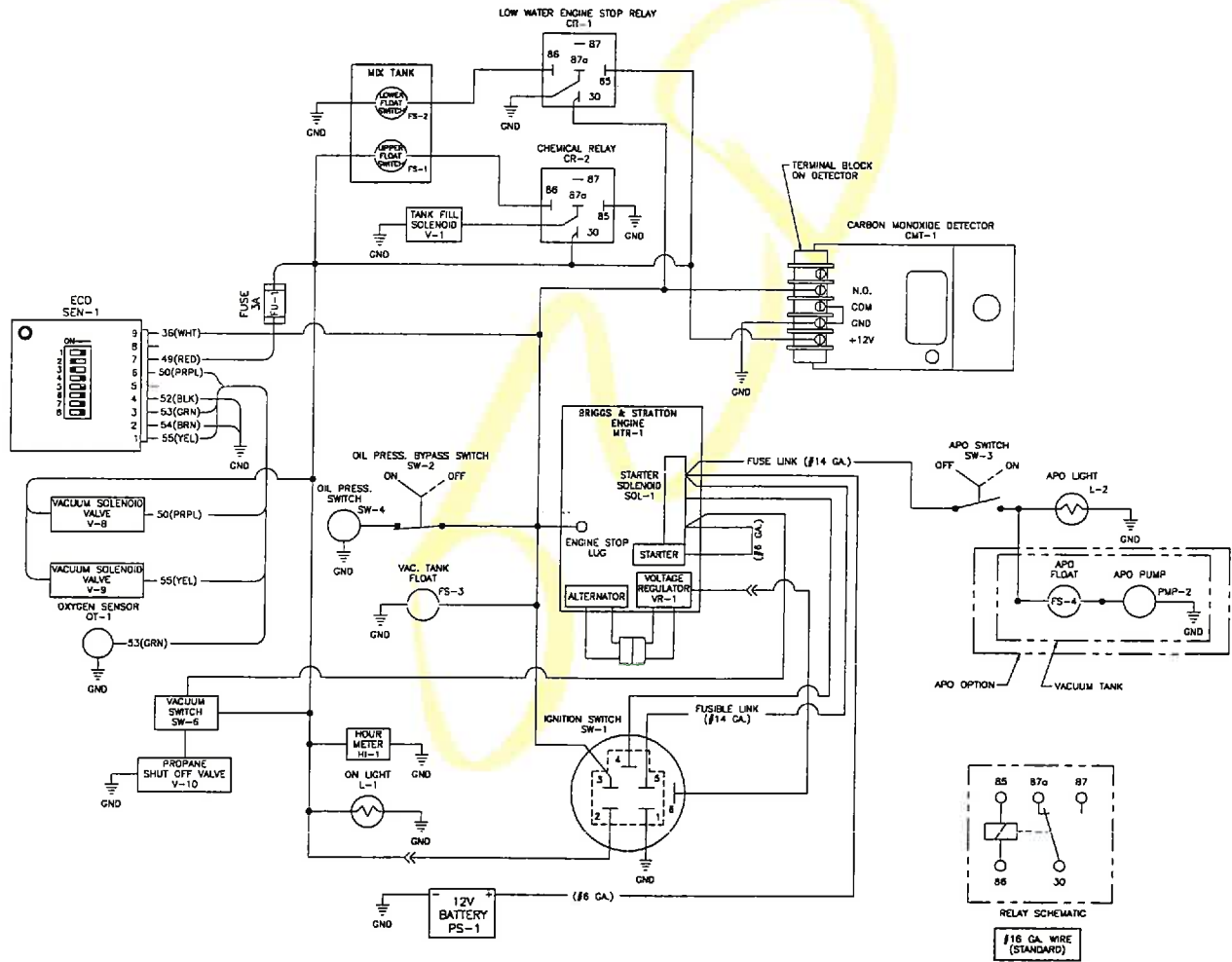


Figure 11-1: Wiring Schematic

D3144



Machine Maintenance

CM 302

Section 12-1

To avoid costly repairs and down-time, it is imperative to develop and practice good maintenance procedures from the beginning. These procedures fall into daily, weekly, monthly and quarterly increments, and are outlined below. All recommended maintenance must be performed by competent service personnel.

Important: Record date and machine hours in maintenance log.

We have provided a maintenance log for your convenience at the end of this section. *Records of maintenance must be kept and copies may be required to be furnished to HydraMaster/CleanMaster before the warranty is honored.* It is recommended that you affix a copy of the log on the vehicle door near your unit for convenience and to serve as a maintenance reminder.

OVERALL MACHINE MAINTENANCE

Maintaining the original appearance of your unit is important for two reasons:

1. It represents a big dollar investment for your cleaning business and its appearance should reflect that fact. A dirty machine is not professional.
2. Maintenance, troubleshooting, and repair is much easier to accomplish on a clean, well maintained unit. Regular cleaning of the machine offers you an opportunity to visually inspect all facets of the machine and spot potential problems before they occur.

OPERATIONAL MAINTENANCE

DAILY

- Wipe machine down thoroughly with a damp cloth.
- Flush recovery tank out thoroughly.
- Empty filter bag and inspect for rips, tears, etc. Replace as needed.
- Inspect and clean vacuum slot on cleaning wand.
- Check wand head for sharp edges that could tear carpet. File down as needed.
- Clean wand to maintain original appearance.
- Wipe down vacuum and high pressure hoses as needed.
- Visually inspect hoses for cuts, etc.
- Check engine oil level.
- Check high pressure pump oil. Add as necessary.
- Inspect garden hose screen. Clean as needed.
- Visually inspect machine for loose wires, oil leaks, water leaks, etc.
- Lubricate blower with an oil based lubricant through blower inlet.

WEEKLY

- Wipe down entire unit as needed.
- Thoroughly clean recovery tank using high pressure hot water (unit with optional high pressure cleaning gun may be used for this).
- Remove stainless steel filter in recovery tank and thoroughly clean, removing all lint build-up. Inspect for damage and reinstall.
- Remove filter bag. Thoroughly clean and reinstall. If torn, replace.
- Empty chemical from chemical container. Wash out thoroughly to remove any chemical build-up.
- Inspect chemical feed line strainer and use solution to remove any chemical build-up.
- Thoroughly clean wand and inspect for clogged jet, debris in vacuum slot and leaking fittings at valve.
- Thoroughly clean vacuum and high pressure hoses including hose cuffs. Inspect for wear or damage to hoses and quick connect fittings.

Inspect hose connect/adapter screen for debris. Remove and clean thoroughly.

Inspect all lines for wear or abrasions that may cause possible leaks.

One time change of oil and oil filter **after first 20 hours** of use.

Inspect vacuum tank s/s filter and filter bag for tears, holes, etc.

Clean, repair or replace as needed.

Check oil level in blower.

Check drive system screws. Tighten as needed.

Check pump drive belt for wear.

Check pump pulleys.

Check high pressure water lines for wear or chafing.

Check all nuts and bolts. Tighten as needed.

Inspect vacuum relief valve. Clean and lubricate as necessary.

Clean vacuum tank thoroughly with high pressure washer.

Check wiring for chafing.

Flush water and chemical system.

Change engine oil (every 50 hrs.).

MONTHLY

Change oil filter (every other oil change).

Check engine air cleaner filter. Clean as necessary.

Remove pressure By-pass Valve piston plate. Grease plate. Reinstall.

Check water level in battery. Clean connections as needed.

QUARTERLY

Check fuel lines.

Clean and gap spark plugs.

Check drive coupler for cracks or wear. Replace as necessary.

Change oil in blower.

Change pump oil.

Grease blower bearing fittings.

AS REQUIRED: DE-SCALING

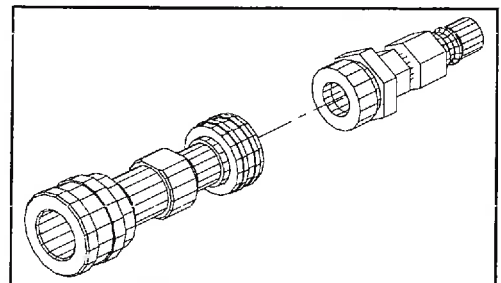
Scale deposits on the interior of the heating system can cause a noticeable loss in heating performance. Deposits of this kind result from hard water deposits, excessive chemical use, improper chemicals, etc. The frequency with which de-scaling procedures are required will vary. If your area has particularly hard water or you see evidence of deposits in the water system, you may have to de-scale monthly.

To de-scale your system, add an appropriate de-scaler chemical to your mix tank. Circulate it through the heating system. Let it stand. Flush and repeat as necessary. Clean all screens and strainers, and check them frequently following de-scaling.

NOTE: If you are using T.M. DeScaler through the flow meter, make sure to run clean water through the flow meter after this procedure.

To de-scale using the recirculation kit (part no. 078-058), start with an empty mix tank. Fill a third of the mix tank with T.M. DeScaler. Follow the recommendations on the T.M. DeScaler label for proportions. Verify that the upper float is not lying horizontal, but floats below.

Attach the recirculation fitting provided in the kit to the garden hose quick connect (see illustration to right) and this combination to the front of the machine.



Attach one section of female/female solution hose to the outgoing solution fitting on the front of the machine and the other end to the garden hose and recirculation fitting combination that is attached to the front of the machine (or as many sections as you want, if you wish to de-scale your hoses).

Start the machine and allow it to run for three to five minutes. Do not leave the T.M. DeScaler solution in the system. Flush the system with clean water and turn the machine OFF.

MAINTENANCE LOG

MAX HRS	DAILY SERVICE	OIL RECOMMENDATIONS							
8	ENGINE OIL check	BLOWER	40 weight non-detergent						
8	PUMP OIL check	PUMP	5 - 30 weight synthetic motor oil						
8	HOSE SCREEN clean	ENGINE	30 weight motor oil						
8	MACHINE general inspection		NOTE: Overhead valve engines can use multi-viscosity oil, but will experience increased oil consumption.						
8	BLOWER INLET spray with lubricant								
	WEEKLY SERVICE	DATE & HOURS							
20	OIL change with filter		Break-in. One time only.						
25	VAC TANK FILTER BAG clean								
25	BLOWER check oil level								
25	DRIVE SYSTEM tighten screws								
25	BELTS & PULLEYS check for wear								
25	HIGH PRESSURE LINES check for chafing								
25	NUTS & BOLTS check tightness								
25	VACUUM RELIEF VALVE inspect, clean, lube								
25	VACUUM TANK clean								
25	WIRING check for chafing								
25	CHEMICAL SYSTEM flush with vinegar								
50	ENGINE OIL change								
	MONTHLY SERVICE								
100	OIL FILTER change								
100	ENGINE AIR CLEANER clean								
100	BY-PASS VALVE grease piston and o-rings								
100	BATTERY WATER LEVELS check								
	QUARTERLY SERVICE (3 MONTHS)								
300	FUEL LINES check								
300	SPARK PLUGS clean and gap								
300	DRIVE COUPLER check for wear								
400	BLOWER OIL change								
400	PUMP OIL change								
400	BLOWER grease bearing								

MAINTENANCE LOG

MAX HRS	DAILY SERVICE	OIL RECOMMENDATIONS					
8	ENGINE OIL check	BLOWER	40 weight non-detergent				
8	PUMP OIL check	PUMP	5 - 30 weight synthetic motor oil				
8	HOSE SCREEN clean	ENGINE	30 weight motor oil				
8	MACHINE general inspection	NOTE: Overhead valve engines can use multi-viscosity oil, but will experience increased oil consumption.					
8	BLOWER INLET spray with lubricant						
WEEKLY SERVICE		DATE & HOURS					
20	OIL change with filter	Break-in. One time only.					
25	VAC TANK FILTER BAG clean						
25	BLOWER check oil level						
25	DRIVE SYSTEM tighten screws						
25	BELTS & PULLEYS check for wear						
25	HIGH PRESSURE LINES check for chafing						
25	NUTS & BOLTS check tightness						
25	VACUUM RELIEF VALVE inspect, clean, lube						
25	VACUUM TANK clean						
25	WIRING check for chafing						
25	CHEMICAL SYSTEM flush with vinegar						
50	ENGINE OIL change						
MONTHLY SERVICE							
100	OIL FILTER change						
100	ENGINE AIR CLEANER clean						
100	BY-PASS VALVE grease piston and o-rings						
100	BATTERY WATER LEVELS check						
QUARTERLY SERVICE (3 MONTHS)							
300	FUEL LINES check						
300	SPARK PLUGS clean and gap						
300	DRIVE COUPLER check for wear						
400	BLOWER OIL change						
400	PUMP OIL change						
400	BLOWER grease bearing						

Failure to protect hoses against burns from engine/blower exhaust. Damage to hoses from being run over by vehicles. Kinking or cracking from failure to store or unroll hoses correctly. Normal wear and tear from everyday use.

CLEANING WAND: Failure to protect against freezing. Obvious physical abuse of wand.

WATER HEATING SYSTEM: Over pressurization of the system (recommended maximum working pressure - 800 PSI). Failure to protect against freezing.

HARD WATER DEPOSITS: Failure to use or maintain a water softening system or a properly installed magnetic-type de-scaler with machine operating in designated "Hard Water Areas" (3.5 grains or more per gallon).

WARRANTY PROCEDURE

Warranty coverage is available to you **ONLY** through HydraMaster Corporation, 11015 47th Avenue W, Mukilteo, WA 98275. When warranty parts are needed, write **HydraMaster Warranty Dept.** at the above address, or call the Warranty/Service Dept. at (425) 775-7275. **No collect calls will be accepted.** When calling, be sure to have machine information and serial number ready for the service representative. **Hours of Warranty/Service Dept. are 8:00 am to 5:00 pm Pacific Time.**

IMPORTANT: HydraMaster's warranty policy provides replacement parts without charge for thirty (30) days to customers maintaining current account status. An invoice will be sent to the customer for the amount of the parts sent. The customer's faulty parts **must be** returned for evaluation prior to the expiration of the thirty (30) day period. Upon warranty approval, a credit will be issued the customer for the replacement parts invoice. **Warranty disapproval or failure to return the faulty parts within the thirty (30) day period allowed will result in the customer being charged for the replacement parts sent.**

California Emission Control Warranty Statement

YOUR WARRANTY RIGHTS AND OBLIGATIONS

The California Air Resources Board and HydraMaster Corporation are pleased to explain the emission control system warranty on your 1998 and later utility engine. In California, new utility and lawn and garden equipment engines must be designed, built, and equipped to meet the State's stringent anti-smog standards. HydraMaster Corporation must warrant the emission control system on your utility equipment engine for the periods of time listed below provided there has been no abuse, neglect, or improper maintenance of your utility equipment engine.

Your emission control system may include parts such as the carburetor or fuel injection system, the ignition system, and catalytic converter. Also included may be hoses, belts, connectors, and other emission-related assemblies.

Where a warrantable condition exists, HydraMaster Corporation will repair your utility equipment engine at no cost to you including diagnosis, parts and labor.

MANUFACTURER'S WARRANTY COVERAGE

The 1998 and later utility and lawn and garden equipment engines are warranted for **two years**. If any emission-related part on your engine is defective, the part will be repaired or replaced by HydraMaster Corporation.

OWNER'S WARRANTY RESPONSIBILITIES

As the utility and lawn and garden equipment engine owner, you are responsible for the performance of the **required maintenance listed in your owner's manual**. HydraMaster Corporation recommends that you retain all receipts covering maintenance on your utility equipment engine, but HydraMaster Corporation

cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance. As the utility equipment engine owner, you should however be aware that HydraMaster Corporation may deny you warranty coverage if your utility equipment engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

You are responsible for presenting your utility equipment engine to a HydraMaster Corporation Authorized Service Center as soon as the problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed **30 days**.

If you have any questions regarding your warranty rights and responsibilities, you should contact HydraMaster Corporation at 11015 47th Avenue W, Mukilteo, Washington 98275. Phone at (425) 775-7275 or Fax to (425) 774-6903.

MANUFACTURER'S EXPLANATION OF WARRANTY COVERAGE

The engine manufacturer warrants to the original owner and each subsequent purchaser that each new engine will be free from manufacturing defects in materials or workmanship under normal use during a period of two years from the date of delivery, provided it is operated and maintained in accordance with engine owner manual operating instructions.

Repair or replacement of any warranted part will be performed at no cost to the owner at a warranty station. For the HydraMaster Corporation repair station nearest you call (425) 775-7275.

Any warranted part which is not scheduled for replacement as required maintenance, or which is scheduled only for regular inspection of the effect of "repair or replace as necessary" is warranted for the warranty period. Any warranted part which is scheduled for replacement as required maintenance is warranted for the period of time up to the first scheduled replacement point for that part.

The owner will not be charged for diagnostic labor which leads to the determination that a warranted part is defective; if the diagnostic service is performed at a warranty station.

HydraMaster Corporation is liable for damages to other engine components caused by the failure of a warranted part still under warranty. HydraMaster Corporation is not liable for failures of warranted parts caused by the use of add-on or modified parts.

Warranty service or repairs are available at all HydraMaster Corporation service centers that are franchised to service this engine.

Any HydraMaster Corporation approved replacement part may be used in the performance of warranty maintenance or repairs on emission-related parts and will be provided to the owner without charge if the part is still under warranty.

The owner is responsible for the performance of the required maintenance, as defined in the HydraMaster Corporation owner's manual for this engine.

SPECIFIC EMISSION RELATED WARRANTED PARTS

Part	Part No.
Carburetor	029-006
Air Filter Element	049-012
ECD Wire Harness	063-025
Exhaust Manifold	090-034
Catalytic Converter	090-038
2" Compact Silencer	093-027
Spark Plug	106-016 (Champion RC12YC)
LPG Regulator	135-005
ECD Sensor - Main Computer Module	149-030
ECD Control Sensor - Nonheated Oxy	149-031
Fuel Filter and Lockoff	169-030
Fuel Main Power Adjustment Valve	169-035
Intake Manifold	Stock
Ignition System (B&S part no.)	492341

To obtain information on the nearest service center or to file a warranty claim, call (425) 775-7275 or write to HydraMaster/CleanMaster Corporation at 11015 47th Avenue W, Mukilteo, Washington 98275.

WHAT IS NOT COVERED

The warranty will not apply to defects caused by abuse, neglect or improper maintenance.

The use of add-ons or modified parts can be grounds for disallowing a warranty claim. HydraMaster Corporation is not liable to cover failures of warranted parts caused by the use of add-ons or modified parts.

The owner is responsible for the performance of the required maintenance, as defined by HydraMaster Corporation, in the owner's manual.

California Emission Control Warranty Statement

YOUR WARRANTY RIGHTS AND OBLIGATIONS

The California Air Resources Board and HydraMaster Corporation are pleased to explain the emission control system warranty on your 1996 ~~Small Utility Equipment Engine~~ ^{and} ~~Small Utility Equipment Engine~~. In California, new utility and lawn and garden equipment engines must be designed, built, and equipped to meet the state's stringent anti-smog standards. HydraMaster Corporation must warrant the emission control system on your Small Utility Equipment Engine for the periods of time listed below provided there has been no abuse, neglect, or improper maintenance of your Small Utility Equipment Engine.

Your emission control system includes parts which adapt the engine to operate on Liquefied Petroleum Gas (LPG). These parts are all related to the fuel system.

Where a warrantable condition exists, HydraMaster Corporation will repair your Small Utility Equipment Engine at no cost to you including diagnosis, parts, and labor.

MANUFACTURER'S WARRANTY COVERAGE

The 1996 and later Small Utility Equipment Engines are warranted for two years. If any emission-related part on your engine is defective, the part will be repaired or replaced by HydraMaster Corporation.

OWNER'S WARRANTY RESPONSIBILITIES

As the Small Engine Equipment owner, you are responsible for the performance of the required maintenance listed in your owner's manual. HydraMaster Corporation recommends that you retain all receipts covering maintenance on

your Small Utility Equipment Engine, but HydraMaster Corporation cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

As the Small Utility Equipment Engine owner, you should be aware, however, that HydraMaster Corporation may deny you warranty coverage if your Small Utility Equipment Engine or part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

You are responsible for presenting your Small Utility Equipment Engine to an HydraMaster Corporation Authorized Service Center as soon as a problem exists. The repairs should be completed in a reasonable amount of time not to exceed 30 days.

If you have any questions regarding your warranty rights and responsibilities, you should contact HydraMaster Corporation at 11015 47th Avenue W, Mukilteo, Washington 98275. Phone at (206) 775-7272 or Fax to (206) 771-7156.

MANUFACTURER'S EXPLANATION OF WARRANTY COVERAGE

Warranty Commencement Date

The warranty period for HydraMaster Corporation's Small Utility Equipment Engine shall begin on the date the equipment is delivered to a retail purchaser.

Length of Coverage

HydraMaster Corporation warrants to the initial owner and each subsequent purchaser that the engine is free from defects in materials and workmanship which cause the failure of a warranted part for a period of two (2) years.

What is Covered

Repair or replacement of any warranted part will be rendered at no charge to the owner at an Authorized Dealer.

Any manufacturer-approved replacement part may be used in the performance

of maintenance or repairs. However, the manufacturer is not responsible for non-manufacturer parts.

Any warranted part which is not scheduled for replacement as required maintenance, or which is scheduled only for regular inspection to the effect of "repair or replace as necessary" shall be warranted for the warranty period. Any warranted part which is scheduled for replacement as required maintenance shall be warranted for the period of time up to the first scheduled replacement point for that part.

There will be no charge for diagnostic labor which leads to the determination that a warranted part is defective, if the diagnostic work is performed at an Authorized Dealer.

HydraMaster Corporation is liable for damages to other engine components caused by the failure of a warranted part still under warranty.

SPECIFIC EMISSION RELATED WARRANTED PARTS

<i>Part</i>	<i>Part No.</i>
Fuel Filter and Lockoff	169-030
Spark Plug	106-016 (Champion RC12YC)
Intake Manifold	Stock
Exhaust Manifold	090-034
Air Filter Element	049-012
Carburetor	029-006
LPG Regulator	135-005
Catalytic Converter	090-038

To obtain information on the nearest service center or to file a warranty claim, call (206) 775-7272 or write to HydraMaster/CleanMaster Corporation at 11015 47th Avenue W, Mukilteo, Washington 98275.

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The owner is responsible for the performance of the required maintenance, as defined by HydraMaster Corporation, in the owner's manual.

Failure to protect hoses against burns from engine/blower exhaust. Damage to hoses from being run over by vehicles. Kinking or cracking from failure to store or unroll hoses correctly. Normal wear and tear from everyday use.

CLEANING WAND: Failure to protect against freezing. Obvious physical abuse of wand.

WATER HEATING SYSTEM: Over pressurization of the system (recommended maximum working pressure - 800 PSI). Failure to protect against freezing.

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IMPORTANT: HydraMaster's warranty policy provides replacement parts without charge for thirty (30) days to customers maintaining current account status. An invoice will be sent to the customer for the amount of the parts sent. The customer's faulty parts **must be** returned for evaluation prior to the expiration of the thirty (30) day period. Upon warranty approval, a credit will be issued the customer for the replacement parts invoice. **Warranty disapproval or failure to return the faulty parts within the thirty (30) day period allowed will result in the customer being charged for the replacement parts sent.**

HYDRAMASTER

Corporation
11015 47th Avenue W, Mukilteo, WA 98275

CM 302

Technicians Safety Manual

Machine Serial Number _____

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HYDRAMASTER® Corporation
Mukilteo, Washington

182-302

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Revised May 7, 1998

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Technician's Safety Manual*

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Introduction

CM 302

Section 1-1

WHAT YOU *WILL FIND* IN THIS MANUAL

- Technician safety information
- Propane awareness information
- Transportation, storage and refueling information for propane cylinders
- Loading and unloading instructions
- Operating instructions
- Carpet cleaning tips
- What to do in the event of an emergency
- Phone #'s for parts, service, and warranty
- Federal regulations applicable to operation of this equipment

WHAT YOU *WILL NOT FIND* IN THIS MANUAL

- Warranty policy (see Service Manual)
- Machine parts diagrams (See Service Manual)
- Engine maintenance information (see Service Manual)
- Electrical diagrams (see Service Manual)

- Installation procedures (see Installation Manual)
- Sales Rep's responsibility (see Installation Manual)
- Purchaser's responsibility (see Installation Manual)

Safety Features

CM 302

Section 1-3

The CM 302 machine has been engineered with both the technicians safety and the safety of the equipment in mind.

Safety engineered features include:

- 1) A low emission propane engine.
- 2) A catalytic combustor.
- 3) An electronic emission control device.
- 4) An automatic fuel shut-off solenoid.
- 5) A sealed fuel compartment.
- 6) Belt and exhaust guards.
- 7) A low water shut-off device.
- 8) A low oil pressure shut-off device.
- 9) A waste tank shut-off device.
- 10) Self sealing propane quick connects.
- 11) A 30 pound, DOT approved propane cylinder.
- 12) Conspicuous technician warnings and precautions.
- 13) U.L. listed fuel system components.

Propane Safety

CM 302

Section 2-1

PROPANE CAUTIONS

◆ WARNING ◆

Prior to machine start up, check the fuel tank, hoses and fuel lines for leaks.

◆ WARNING ◆

Always operate the machine in a well ventilated area.

◆ WARNING ◆

When the equipment is not in use remove the propane tank and store outside in an appropriate outdoor area. Do not store propane tanks indoors.

◆ WARNING ◆

Remove the propane tank from the equipment before refueling.

◆ CAUTION ◆

Do not fill propane container(s) to more than 80% capacity.

◆ CAUTION ◆

Propane cylinders must be stored in accordance with the National Fire Protection Association standard 58 chapter 5.

◆ CAUTION ◆

Transportation of portable propane cylinders must be in accordance with National Fire Protection Association standard 58 chapters 3 and 6.

◆ WARNING ◆

Carpet cleaning equipment should only be used by fully trained machine technicians.

◆ CAUTION ◆

Freezing this equipment can be costly. Take all necessary precautions to protect this equipment from freezing temperatures.

◆ WARNING ◆

During the operation of this equipment, many surfaces on the machine will become very hot. When near the equipment for any reason care must be taken not to touch any hot surface, such as heating systems, engine, exhaust, etc.

◆ WARNING ◆

It is unsafe to smoke in the vicinity of this equipment.

◆ WARNING ◆

Never touch any part of the machine that is in motion. Severe bodily injury may result.

◆ WARNING ◆

The engine exhaust from this product contains chemicals know to the State of California to cause cancer, birth defects or other reproductive harm.

◆ WARNING ◆

Escaping propane vapor can freeze skin tissue causing frost bite.

◆ WARNING ◆

Propane vapor is heavier than air and will collect in the lowest confined space in the event of a leak.

◆ WARNING ◆

Propane smell... If you smell gas:

- a) Extinguish any open flames, pilot lights, and all smoking materials.
- b) Do not touch electrical switches.
- c) Shut off the gas supply at the tank valve.
- d) Open doors and other ventilating openings.

- e) Leave the area until odor clears.
- f) Have the gas system checked and leakage source corrected before using again.

◆ WARNING ◆

All propane fuel system connections shall be checked periodically for leaks with soapy water or equivalent.

◆ WARNING ◆

Never use a match or flame to check for leaks.

◆ WARNING ◆

Propane container valves shall be closed when equipment is not in use.

◆ WARNING ◆

Propane containers may only be filled by qualified persons.

◆ WARNING ◆

Always follow the engine manufacturers recommendations for proper engine maintenance and operation.

◆ CAUTION ◆

The owner of a propane carpet cleaning machine shall ensure that the

technician has participated in a training course on the safe handling of propane and the proper operation of the equipment.

◆ CAUTION ◆

This unit weighs over 350 pounds. Care must be used when transporting this equipment. **Do not try to lift the equipment!**

Propane as Fuel Choice

CM 302

Section 2-6

HydraMaster, being a leader in the floor care industry, has taken every precaution possible in the design of this equipment to ensure the safety of the technician. Safety is our primary concern. Therefore, the fuel of choice for this equipment is Liquefied Petroleum Gas (LPG, or more commonly referred to as propane). Propane is one of the cleanest burning commercial fuels available. The compounds produced by the combustion of propane are carbon dioxide, carbon monoxide, and oxides of nitrogen. Even though these can be toxic compounds in high concentrations, in this equipment everything possible has been done to ensure that these compounds do not reach harmful levels.

Propane has many advantages over other liquid fuels. For instance:

- ▶ This fuel is readily available. Propane can be purchased in virtually any town in America.
- ▶ Propane cylinders are commercially available and offer a safe and convenient way to transport this fuel.
- ▶ Propane has been used successfully for many years by the floor care industry for indoor applications.
- ▶ There are well established safety standards for the indoor use of propane fuel.
- ▶ Propane is a very clean burning fuel, so it does not leave carbon deposits on interior engine components. This results in better engine life.
- ▶ Propane boils at -40 degrees F so it can not spill. It is enhanced with a strong odor that is perceptible well below the flammable level so leaks can easily be detected.

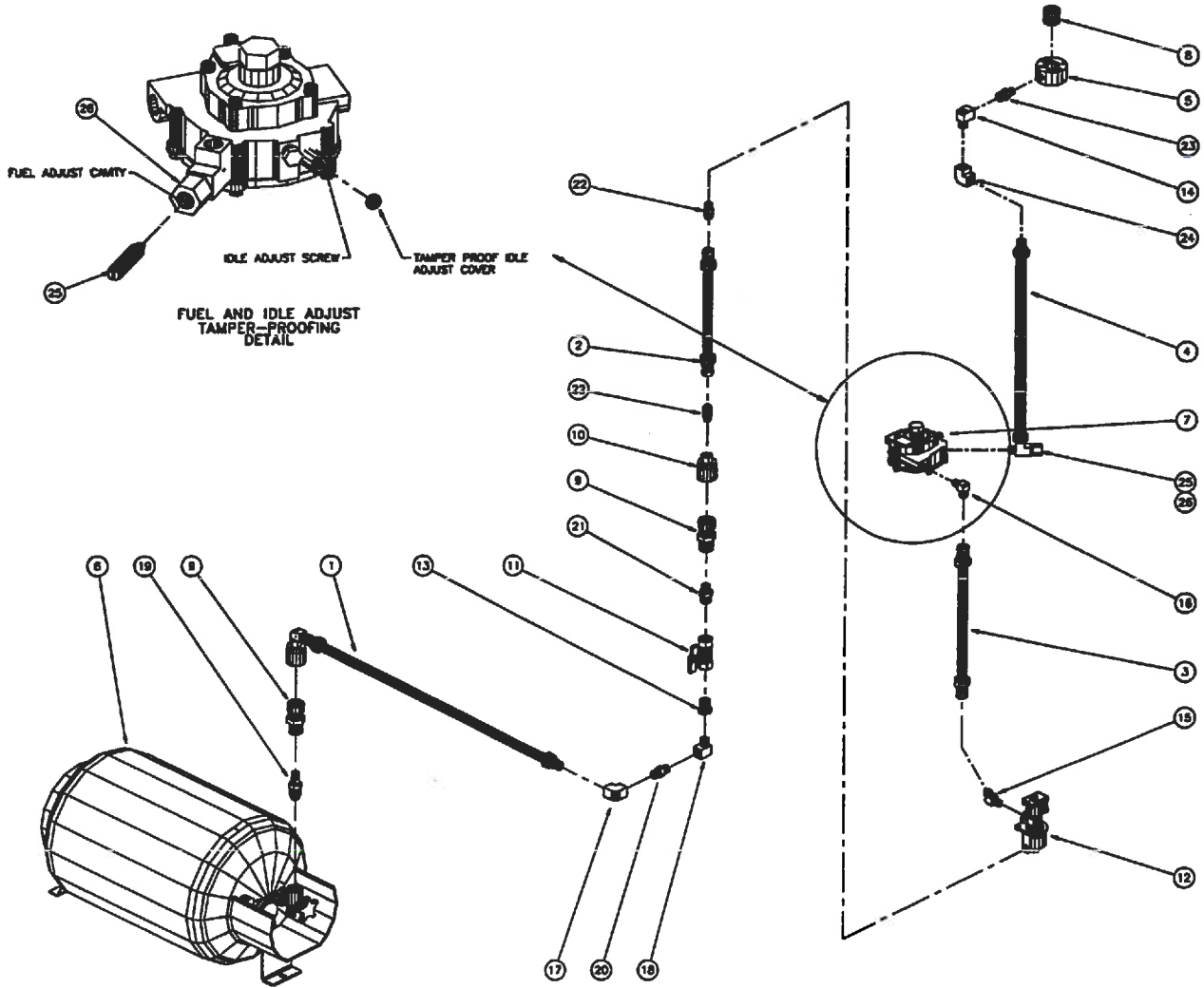
FUEL SYSTEM FLOW

The fuel system flow is as follows:

1. When the tank valve is opened pressurized propane vapor travels through a quick connect (item 9), a hose (item 1) which has a quick connect on it and to a shut-off valve (item 11).
2. When the valve (item 11) is opened, the propane vapor then travels through the quick connect fittings (items 9 and 10) to another shut-off valve (item 12).
3. When the engine is started, this valve (item 12) opens and allows propane vapor to reach the pressure regulator (item 7).
4. The pressure regulator reduces the propane pressure and regulates the flow of vapor to the engine.
5. The vapor then travels through the main metering valve on the hose shown as item 4.
6. The vapor then reaches the venturi (item 8) and is injected into the engine.

Figure 10-1: Propane Flow

D3270, Rev A

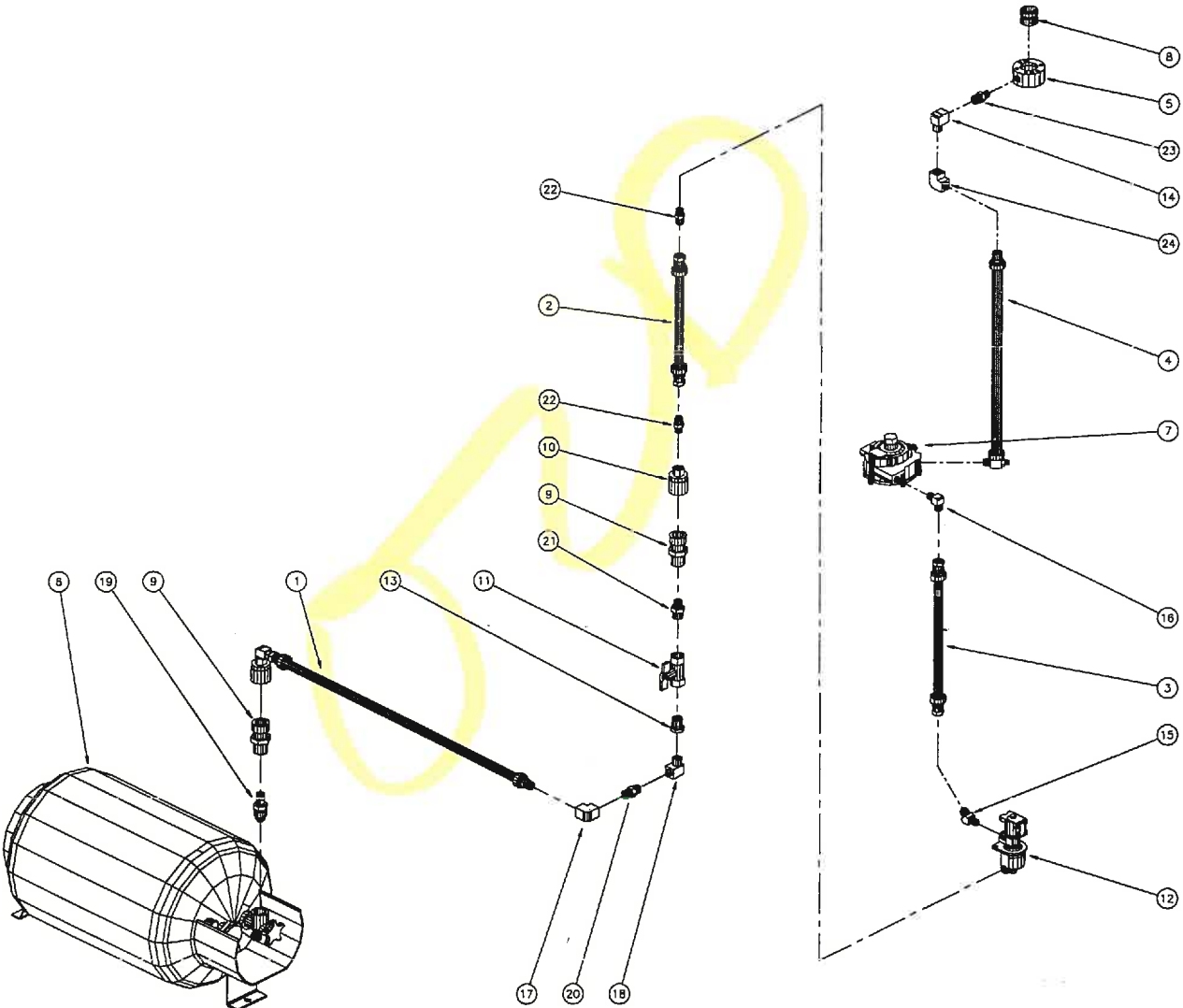


Propane Flow Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	-----	Hose Assembly, Propane Tank	1
2	068-391	Hose, Propane Tank and Cart to Propane Sol.	1
3	068-392	Hose, Propane Sol. to Propane Reg.	1
4	068-393	Hose, Propane Reg. to Carb. Inlet	1
5	001-031	Adapter Set, Propane Carburetor Inlet	1
6	159-012	Propane Tank, 30 lb. Horizontal "DOT" Appvd	1
7	135-005	Regulator, Engine Propane B & S 14 HP	1
8	181-010	Venturi, Beam Propane	1
9	052-046	Propane Quick Connect, Male	2
10	052-047	Propane Quick Connect, Female	1
11	169-032	Valve, ½" Propane Shut-Off	1
12	169-030	Valve, Beam Filterlock Propane Shut-Off	1
13	052-064	Bushing, ½ M x ⅜ F Brass	1
14	052-085	Elbow, ¼" Brass Street	1
15	052-491	Elbow, ⅜" Flare x ¼" 45 Degree MPT	1
16	052-492	Elbow, ⅜" Flare x ¼" 90 Degree NPT	1
17	052-142	Elbow, ⅜" F x F Brass	1
18	052-086	Elbow, ⅜" Brass Street	1
19	052-494	Nipple, POL x ¼" M Propane	1
20	052-074	Nipple, ⅜ Brass Hex	1
21	052-075	Nipple, ⅜" x ½" Brass Hex	1
22	052-490	Nipple, ⅜" Flare x ¼" MPT	2
23	052-073	Nipple, ¼" x ⅜" Brass Hex	1
24	052-142	Elbow, ⅜" F x F Brass	1
25	169-031	Valve Needle, Main Power Valve	1
26	042-032	Housing, Main Power Valve	1

Figure 2-1: Propane Flow

D3270



Propane Flow Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	-----	Hose Assembly, Propane Tank	1
2	068-391	Hose, Propane Tank and Cart to Propane Sol.	1
3	068-392	Hose, Propane Sol. to Propane Reg.	1
4	068-393	Hose, Propane Reg. to Carb. Inlet	1
5	001-031	Adapter Set, Propane Carburetor Inlet	1
6	159-012	Propane Tank, 30 lb. Horizontal "DOT" Appvd	1
7	135-005	Regulator, Engine Propane B & S 14 HP	1
8	181-010	Venturi, Beam Propane	1
9	052-046	Propane Quick Connect, Male	2
10	052-047	Propane Quick Connect, Female	1
11	169-032	Valve, 1/2" Propane Shut-Off	1
12	169-030	Valve, Beam Filterlock Propane Shut-Off	1
13	052-064	Bushing, 1/2 M x 3/8 F Brass	1
14	052-085	Elbow, 1/4" Brass Street	1
15	052-491	Elbow, 3/8" Flare x 1/4" 45 Degree MPT	1
16	052-492	Elbow, 3/8" Flare x 1/4" 90 Degree NPT	1
17	052-142	Elbow, 3/8" F x F Brass	1
18	052-086	Elbow, 3/8" Brass Street	1
19	052-494	Nipple, POL x 1/4" M Propane	1
20	052-074	Nipple, 3/8 Brass Hex	1
21	052-075	Nipple, 3/8" x 1/2" Brass Hex	1
22	052-490	Nipple, 3/8" Flare x 1/4" MPT	2
23	052-073	Nipple, 1/4" x 3/8" Brass Hex	1
24	052-142	Elbow, 3/8" F x F Brass	1

Propane Handling

CM 302

Section 3-1

REFUELING PROPANE TANKS

◆ CAUTION ◆

Use only the propane tank specified or supplied with the equipment. Do not substitute any other tank.

◆ CAUTION ◆

Never fill the propane tank for this equipment more than 80% of capacity. This is a vapor tank, filling it beyond 80% may cause liquid propane to enter the equipment and cause damage.

HydraMaster has designed this equipment to use a horizontally-mounted 30 pound DOT tank. This is a vapor tank and must be kept with the properly indicated side up.

The NFPA discusses the proper refueling of propane cylinders in chapter 4 of standard #58. Briefly stated it warns against the overfilling of vapor tanks, that filling should be accomplished by "qualified personnel" only and that it is the responsibility of that qualified person to inform you in writing of any tanks that do not comply with sections 2-2 and 2-3 of NFPA 58.

The NFPA defines "qualified personnel" by this statement, "in the interest of safety all persons employed in handling LP-Gases shall be trained in proper handling and operating procedures, which the employer shall document. Effective Jan 1, 1993, all employees shall carry written certification of their job qualifications issued by the training agent or a written document issued by the authority having jurisdiction identifying the functions each person is authorized

to perform." (NFPA 58 1-6)

In the event that a propane tank becomes overfilled, venting of the tank is permitted only under the following conditions, "outdoors, container venting shall be done under conditions that will result in rapid dispersion of the product being released. Consideration shall be given to such factors as distance to buildings, terrain, wind direction and velocity, and use of a vent stack so that a flammable mixture will not reach a point of ignition." (NFPA 58, 4-3.2.1) Propane can be released by opening the small relief valve located next to the main tank valve. Allow the tank to vent until fuel vapor is no longer visible.

◆ **WARNING** ◆

Escaping propane vapor can freeze skin tissue causing frost bite.

Portable Containers

CM 302

Section 3-3

TRANSPORTATION OF PROPANE CYLINDERS

Vehicular Transport:

Containers must be determined to be leak-free before loading into a vehicle.

Cylinders must be DOT approved.

The vehicle in which propane cylinders are transported must comply with the following:

"The cargo space of the vehicle shall be isolated from the driver's compartment, the engine, and its exhaust system. Open-bodied vehicles shall be considered to be in compliance with this provision. Closed-bodied vehicles having separate cargo, driver's, and engine compartments shall also be considered to be in compliance with this provision.

"Exception: Closed-bodied vehicles such as passenger cars, vans, and station wagons shall not be used for transporting more than 215 lb (98 kg) water capacity [nominal 90 lb (41 kg) LP-Gas capacity] but not more than 108 lb (49 kg) water capacity [nominal 45 lb (20 kg) LP-Gas capacity] per container (see 6-2.2.6 and 6-2.2.7), unless the driver's and engine compartments are separated from the cargo space by a vapor tight partition which contains no means of access to the cargo space." (NFPA 58 6-2.2.5)

Transport Inside Buildings:

"Transportation (movements) of containers within a building shall

comply with the following:

(b) Valve outlets on containers having water capacities greater than 2 ½ lb... shall be tightly plugged.

(c) Only emergency stairways not generally used by the public shall be used, and reasonable precautions shall be taken to prevent the containers from falling down the stairs.

(d) Freight or passenger elevators shall be permitted to be used when occupied only by those engaged in moving the container." (NFPA 58 3-4.2.7)

"Buildings Undergoing Minor Renovation When Frequented by the Public. Containers shall be permitted to be used and transported for repair or minor renovation in buildings frequented by the public as follows:

(a) During the hours of the day the public normally is in the building the following shall apply:

(1) The maximum water capacity of individual containers shall be 50 lb..., and the number of containers in the building shall not exceed the number of workers assigned to using the LP-Gas.

(2) Containers having a water capacity greater than 2.7 lb [and filled with no more than 16.8 oz LP-Gas (*empty*)] shall not be left unattended.

(b) During the hours of the day when the building is not open to the public, containers shall be permitted to be used and transported in the building for repair or minor renovation...provided, however, that containers with a greater water capacity than 2.7 lb [and filled with no more than 16.8 oz LP-Gas (*empty*)] shall not be left unattended." (NFPA 58 3-4.4)

STORAGE OF CM 302

◆ CAUTION ◆

Do not store the CM 302 unit indoors with the propane cylinder installed. Remove the cylinder and store outdoors as indicated below.

The CM 302 may be stored safely in any enclosed area provided it does not block access to any building fire safety equipment, or block any area intended for the safe egress of people.

◆ WARNING ◆

Do not store the unit in an area that may experience freezing temperatures unless the "freeze guard" procedure has been done prior to placing the unit in storage.

STORAGE OF PROPANE CYLINDERS

Propane cylinders shall not be stored inside buildings frequented by the public.

Storage outdoors shall be in compliance with NFPA 58 5-4. In brief this states that portable containers shall be a minimum of 5 feet from doorways, windows, property lines, busy thoroughfares and sidewalks. The containers must be protected by industrial fencing or in a ventilated metal locker or rack that prevents tampering with valves and pilferage of the cylinders. The location must also be protected from vehicular impact.

Storage locations are also required to have a fire extinguisher installed, with a minimum capacity of 18 lb. dry chemical with a B:C rating.

Transportation

CM 302

Section 4-1

One unique feature of the CM 302 is the ease with which the machine can be transported. The unit has been designed to easily mount in any make of cargo van.

In order to be able to mount the unit in a van, the optional truckmount system will have to be purchased.

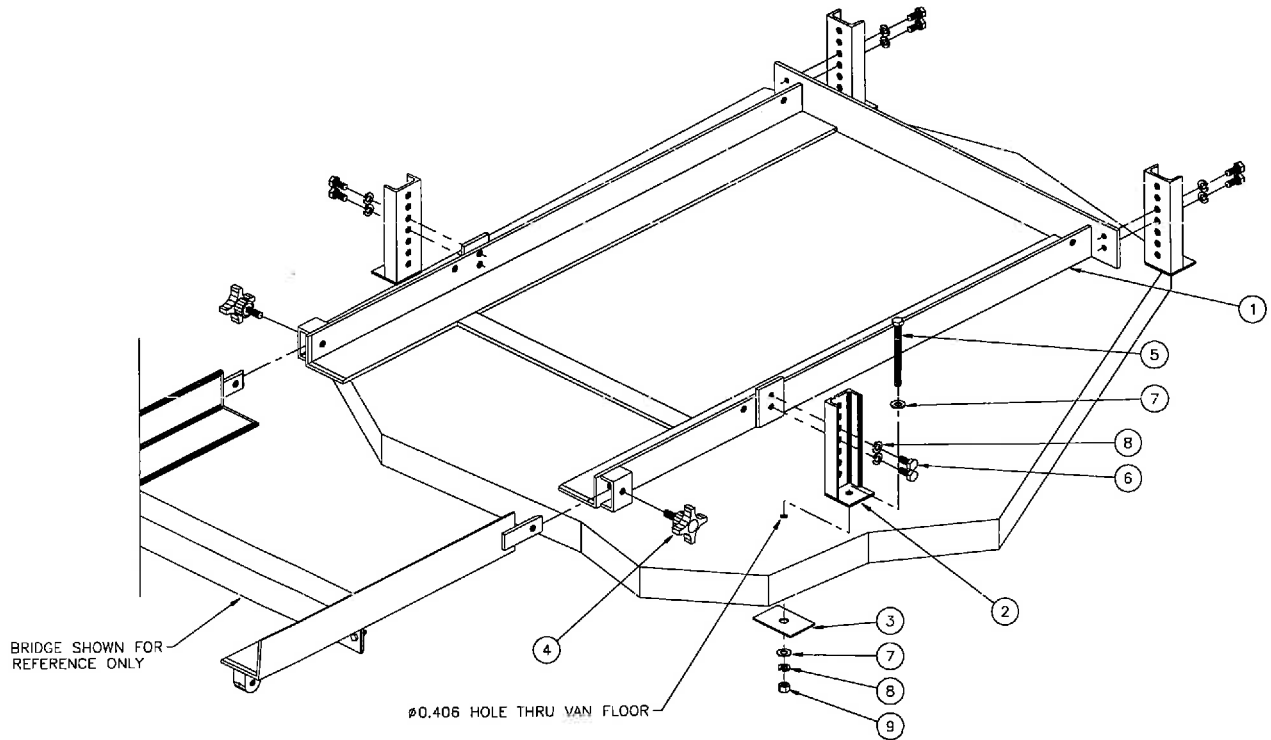
The CM 302 has been designed as a component system. This allows the power unit and the tank assembly to be separated for truckmounting.

With the truckmount system installed in the van the unit can be removed from the tank assembly by raising the extension rail on the back of the unit, placing the unit against the van, removing the locking pins and sliding the unit into the van.

Once the unit is secured the tank assembly can also be placed in the van. If the unit is to be operated in the van, the tank assembly must be vented to the outside of the vehicle.

Figure 4-1: Van Mounting Frame Assembly

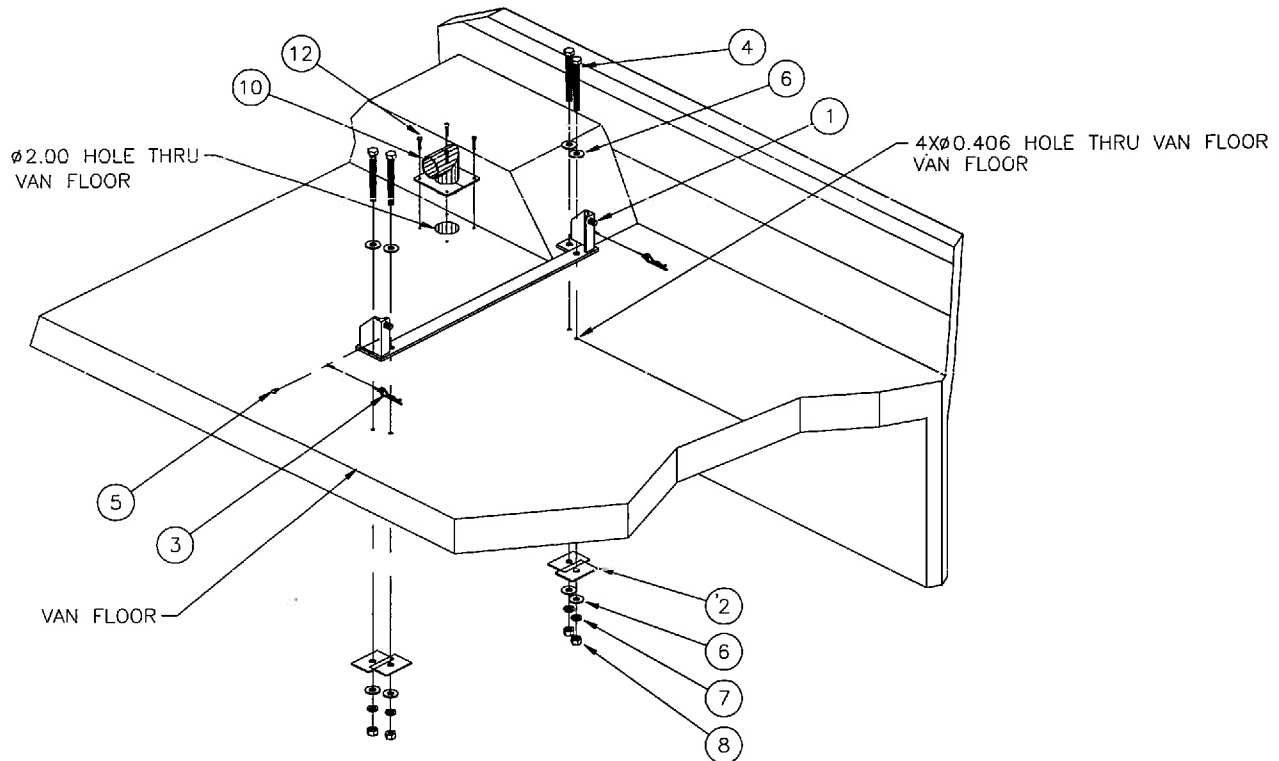
D3085



ITEM	PART NO	DESCRIPTION	QTY
1	000-015-291	Bracket, Truck Mounting	1
2	000-015-292	Bracket, Adjustable Frame	4
3	600-011-003	Tie Down Cleat Washer	4
4	000-061-106	Knob, 4 Flute Black with $\frac{3}{8}$ " Stud	2
5	000-143-150	Screw, $\frac{3}{8}$ - 16 x 4" Hex Tap	4
6	000-143-017	Screw, $\frac{3}{8}$ - 16 x $\frac{3}{4}$ " HHC	8
7	000-174-005	Washer, $\frac{3}{8}$ Flat	8
8	000-174-021	Washer, $\frac{3}{8}$ Lock	12
9	000-094-014	Nut, $\frac{3}{8}$ - 16 Hex	4

Figure 4-2: Tank Cart Hold-Down Bracket and Vent Adapter Install

D3492



ITEM	PART NO	DESCRIPTION	QTY
(See also Figure 4-4)			
1	000-015-343	Bracket, Tank/Cart to Truck - Hold Down	1
2	600-011-003	Tie Down Cleat Washer	4
3	000-103-026	Hitch Pin Assembly	2
4	000-143-150	Screw, 3/8 - 16 x 4" Hex Tap (All Thread)	4
5	000-143-166	Screw, 10 - 24 x 3/8" s/s HHC	2
6	000-174-005	Washer, 3/8 Flat	8
7	000-174-021	Washer, 3/8 Lock	8
8	000-094-014	Nut, 3/8 - 16 Hex	4
9	000-114-008	Rail Set, Loading Rt and Lt with Spacer	1
10	000-001-025	Adapter, 2" Thru Van Floor Vent	1
11	000-068-397	Hose Assembly, 2" Vapor Vent	1
12	000-143-536	Screw, #10 x 1" PH HD Sheet Metal	4

**Figure 4-3: Van Mounting Frame Install
(Side Door View)**

D3085

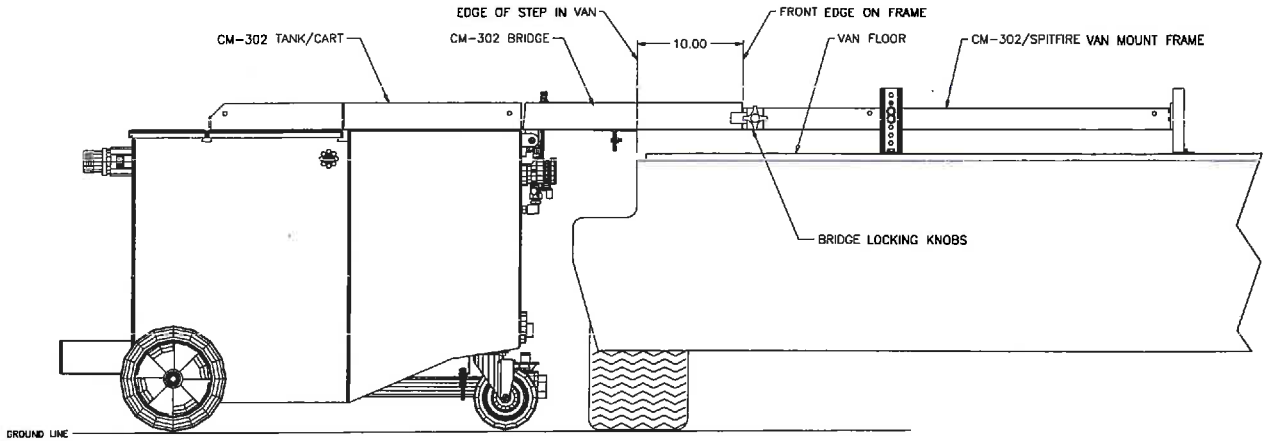


Figure 4-4: Tank Cart in Hold-Down Position

D3492

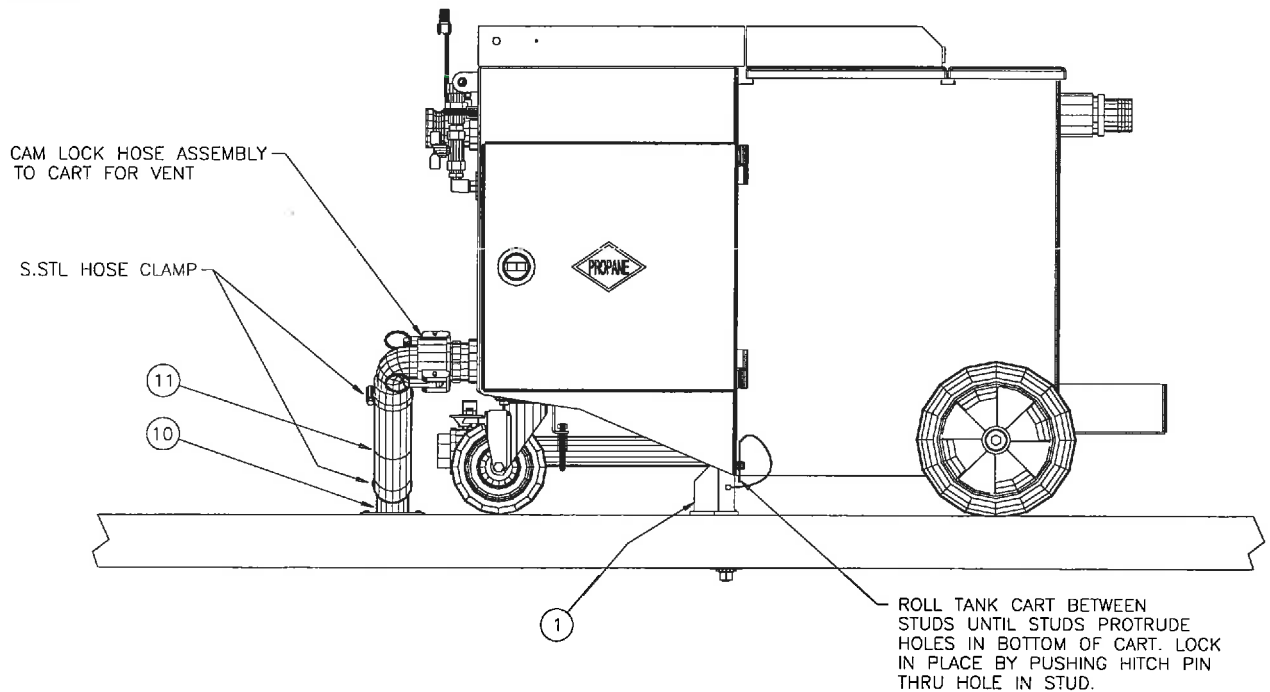
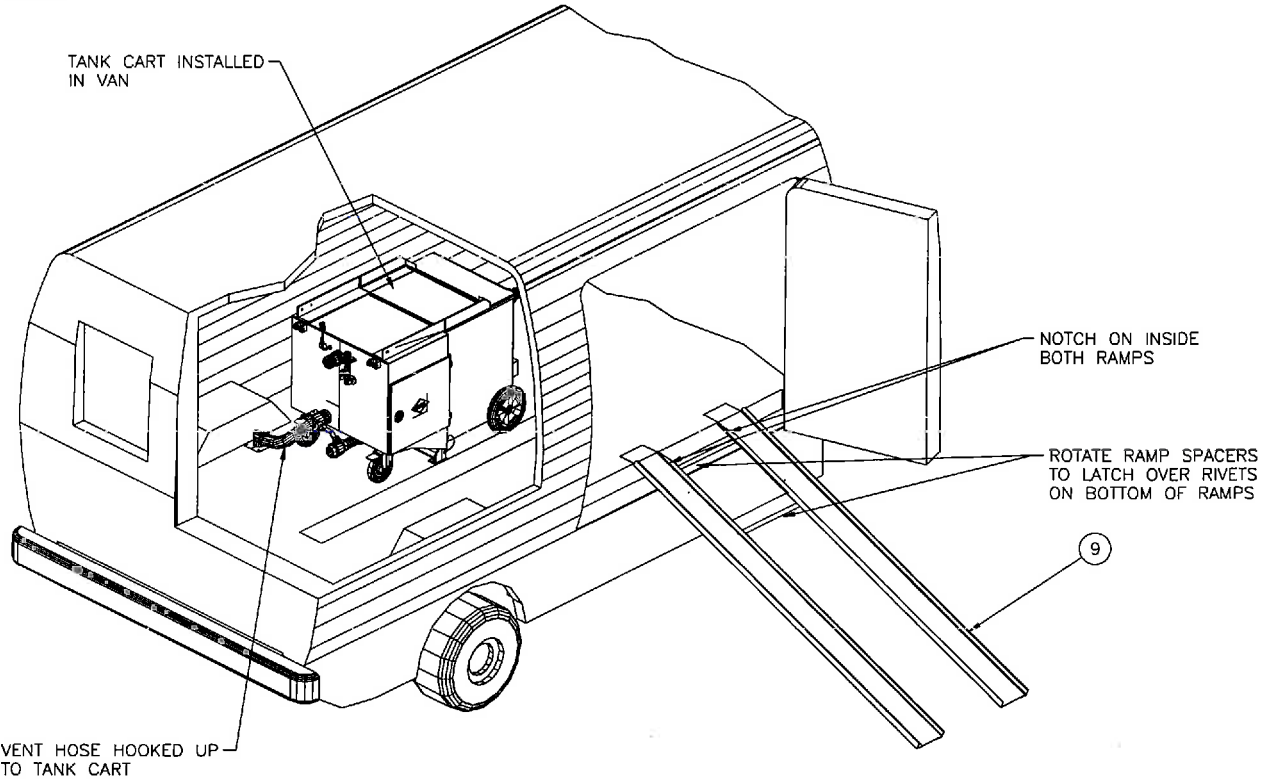


Figure 4-5: Tank Cart Loading Ramp

D3492

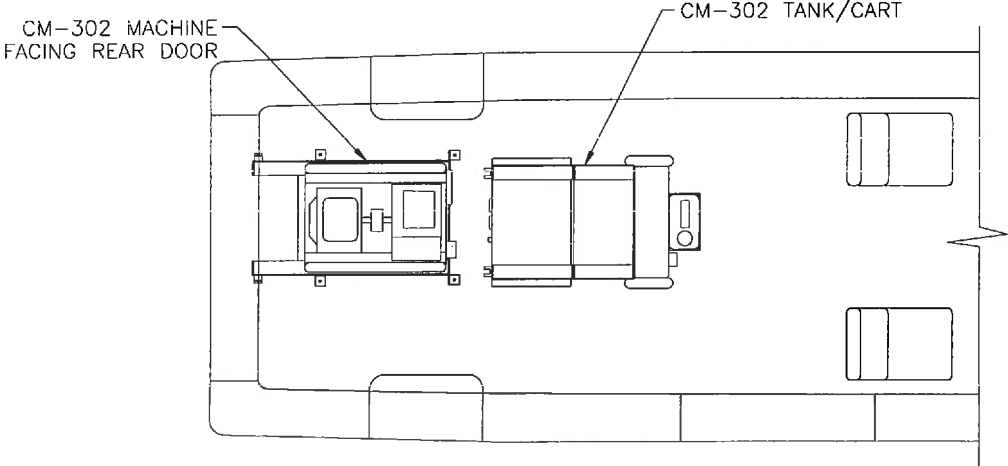


◆ WARNING ◆

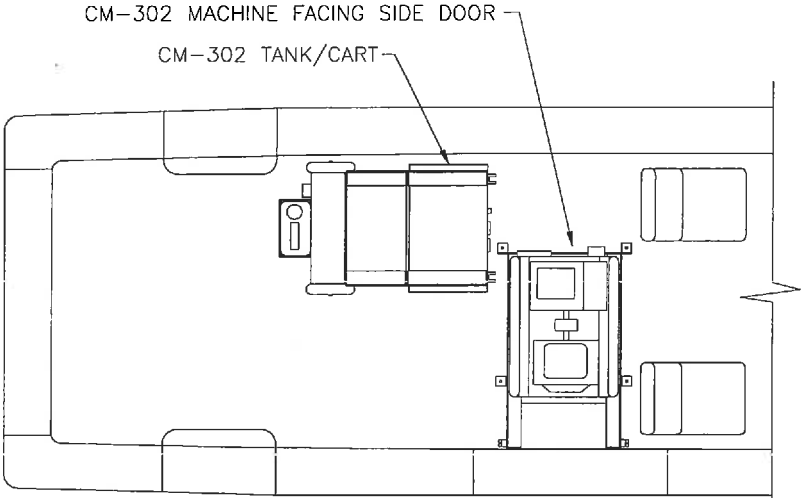
Ramp designed for use with unladen cart only. Empty tanks prior to loading or unloading. Do not walk on ramp.

Figure 4-6: CM 302 Installation Options

C3669



REAR DOOR INSTALLATION



SIDE DOOR INSTALLATION

Operation

CM 302

Section 5-1

The operation of this equipment is subject to all applicable state and municipal regulations as defined by the "authority having jurisdiction" (see glossary for definition).

SET UP

Indoor Application:

1. Remove the unit from the storage area.
2. Obtain a full propane cylinder from the outside storage area. Before entering the building, check the propane cylinder for an over-full condition. If the cylinder is over-full see the section entitled "Propane Handling."

◆ WARNING ◆

An overfilled vapor tank, if put into operation, may allow liquid propane to enter the propane system and cause damage or explosion.

3. Place the machine in a well ventilated area and install the propane cylinder into the machine.
4. Make the propane connections. Open the propane tank valve and check for leaks. Close the propane tank valve for transport.

◆ WARNING ◆

If you smell gas:

- a) Extinguish any open flames, pilot lights, and all smoking materials
- b) Do not touch electrical switches.

- c) Shut off the gas supply at the tank valve.
 - d) Open doors and other ventilating openings.
 - e) Leave the area until odor clears.
 - f) Have the gas system checked and leakage source corrected before using again.
5. Move the machine to the area to be cleaned, place the machine in the largest available open area.
 6. Make the hose connections to the machine, vacuum, solution, incoming water, and automatic pump out.

START UP

1. Perform daily and periodic maintenance as specified in this Owner's Manual.
2. Open the propane compartment access panel and turn the propane tank valve counterclockwise 3 full turns. Close the compartment access panel.
3. **CAUTION:** Mix tank must be full prior to ignition.
4. Open the shut-off valve on the outside of the machine.
5. Place the throttle in the "SLOW" position. This is approximately 1400 RPM.
6. Start the unit by turning the ignition key clockwise to the start position and engaging the starter motor until the engine begins to run (do not keep the starter motor engaged for more than 10 seconds at a time).
NOTE: If the engine will not start, depress the oil pressure by-pass switch and hold until the engine begins running.
Allow the engine to run for 3 to 5 minutes. Then increase the engine RPM to "FAST" for normal carpet cleaning. This is approximately 3000 RPM.
7. Spray the wand to void all air from the system. When the mix tank begins a fill cycle, the chemical flowmeter may be adjusted to the desired setting. Set the cleaning pressure at 300 PSI.
NOTE: A chemical flowmeter set at 5 GPH is a 1 to 30 mix ratio and 10 GPH is a 1 to 15 ratio.
8. Run the machine for several minutes with a vacuum load until the desired temperature is achieved.
9. Commence cleaning operation.

FLOOD DAMAGE WORK

◆ CAUTION ◆

When using equipment for flood damage, you *must* have a fresh water source hooked up at all times to allow a cold water source into the machine. This will prevent overheating during long periods of vacuum recovery.

SHUT DOWN

1. Flush clear water through the chemical system for 10 seconds. Turn off chemical flowmeter.
2. Cool the machine by spraying the cleaning wand into the vacuum hose for three to five minutes. The chemical will be flushed from the unit, hoses and cleaning tool.
NOTE: If the machine is not properly cooled, the mix tank can overflow.
3. Remove the vacuum hose.
4. At this time, the blower should be lubricated with an oil based lubricant.
NOTE: If freeze guarding is necessary, perform the freeze guard procedure at this time.
5. Close the propane tank valve. Run machine until the engine stops.
6. Turn the ignition switch off.
7. Return the throttle to the idle position.
8. Drain the mix tank.
9. Drain the recovery tank. Clean the vacuum filter prior to storage of the unit.

NOTE: In accordance with the EPA, state and local laws, **do not dispose of waste water into gutters, storm drains, streams, reservoirs, etc.**

LOCAL WATER PRECAUTIONS

The quality of water varies greatly. Many areas have an excess of minerals in the water which results in what is commonly called "hard water." These minerals tend to adhere to the insides of heater coils and other parts of the machines causing damage and a loss of cleaning effectiveness. This influences the reliability and efficiency of equipment in direct proportion to the level of hardness.

HARD WATER ADVISORY

HydraMaster recognizes that any hard water deposits which might occur within the water system of our truckmounts is a serious problem. The precision technology of truckmount heat exchanger systems is intolerant of any foreign material. Hard water deposits will ultimately decrease the performance of the system and are expected to seriously lower the reliability of the machine.

To validate a machine's warranty, HydraMaster requires that all machines operating in designated "Hard Water Areas" (3.5 grains or more per gallon) be fitted with a water softening system or a properly installed magnetic-type de-scaler must be used and maintained. Periodic de-scaling or acid-rinsing alone is *not* adequate in these areas. HydraMaster does not recommend any particular type or brand, however the relative effectiveness of some types of magnetic de-scalers or softeners may require additional periodic use of de-scaling agents.

HydraMaster also recommends, in the strongest possible terms, that machines in *all areas* be fitted with a water softening system for improved operation and reliability.

HydraMaster has included five hard water test strips with your machine. These can be used to test the water in your immediate and surrounding areas as they can vary greatly. Assume all water obtained from wells is hard.

◆ CAUTION ◆

Failure to take appropriate measures to prevent scale build up can result in **system failure** and **loss of warranty** on affected parts.

HARD WATER AREA MAP

The map at the end of the section defines areas in the United States which compromise fluid related components such as hoses, fittings, heaters, pumps,

valves and water cooled engines. For other countries, hard water area maps can be obtained from geological societies.

WATER SOFTENER

Cleaning efficiency and equipment life is increased, chemical use decreased, and the appearance of cleaned carpets enhanced when water softeners are incorporated in hard water areas. The manufacturer strongly urges the use of water softener units in areas exceeding 3.5 grains per gallon. Failure to use a water softener in these areas will invalidate the machine's warranty. Using a hard water area map as a reference, determine the quality of water in your area and take action immediately, if necessary.

Reports from several of our machine users commending the results of the use of water softeners in conjunction with their machines prompts us to recommend the procedure to everyone in a "hard water" area.

The relatively low cost of a water softener service is more than made up for by an increased life of machine parts, reduced chemical costs and continued cleaning efficiency. The water softener will also increase the *effectiveness* of the cleaning chemicals, therefore less chemical will be needed.

Contact a water softener distributor in your area for information on the rental of a simple water treatment unit to carry in your truck. Be sure to change the water softener in accordance with the capability of the softener. For example: If the softener will treat 900 gallons of water and the machine uses an average of 30 gallons per hour, for an average of 5 hours a day, this equals 150 gallons per day. In 6 days the machine would use 900 gallons of water. Therefore, the softener would need to be changed every 6 working days for maximum softening.

WASTE WATER DISPOSAL ADVISORY

There are laws in most communities prohibiting the dumping of recovered

"gray" water from carpet cleaning in any place but a sanitary treatment system.

This cleaning rinse water, recovered into your unit's vacuum tank, contains materials such as detergents. These must be processed before being safe for streams, rivers and reservoirs.

IN ACCORDANCE WITH THE EPA, STATE AND LOCAL LAWS, DO NOT DISPOSE OF WASTE WATER INTO GUTTERS, STORM DRAINS, STREAMS, RESERVOIRS, ETC.

In most cases, an acceptable method of waste water disposal is to discharge into a municipal sewage treatment system after first filtering out solid material such as carpet fiber. Access to the sanitary system can be obtained through a toilet, laundry drain, RV dump, etc. Permission should first be obtained from any concerned party or agency.

One disposal method which usually complies with the law is to accumulate the waste water and haul it to an appropriate dump site. Another solution to the disposal problem is to equip yourself with an Automatic Pump-Out System. These systems are designed to remove waste water from the extractor's recovery system and actively pump the water through hoses to a suitable disposal drain. Properly designed, they will continuously monitor the level of waste water and pump it out simultaneously to the cleaning operation. The hidden benefit of this process is that the technician does not have to stop his cleaning to empty the recovery tank. HydraMaster makes an A.P.O. System available which can be ordered with new equipment or installed later.

The penalties for non-compliance can be serious. Always check local laws and regulations to be sure you are in compliance.

ECD UNIT OPERATION

Your CM 302 carpet cleaning machine is equipped with an emission control device. This unit continually monitors the combustion efficiency of the engine and controls the fuel-to-air ratio to keep the engine running as efficiently as

possible.

The ECD unit has an indicator light that allows you to see what the control device is doing. The light has five different conditions that indicate how the engine is operating. They are:

Fast Green Blink	Engine Cold (start up only)
Slow Green Blink	Normal Operation
Solid Red	Beyond Range (check wiring)
Clear (no color)	Fuel-to-Air Ratio Too Lean
Solid Green	Fuel-to-Air Ratio Too Rich

Under normal operation the fast green blink light will appear when the engine is first started until the engine is warm. Then the light will change to a slow green blink. If the red light should ever appear this indicates that the engine requires service. The engine will be shut down in two to five minutes and may not be started until the engine has been serviced.

NOTE: The solid red light or clear light may appear if the fuel tank is near empty. Check the propane tank fuel level or replace with a full tank and check the machine again. If the red, clear or solid green lights persist, have the machine serviced by a qualified technician.

CARBON MONOXIDE DETECTOR

(The following information is from the *Carbon Monoxide Detector User's Guide* by Nighthawk Systems, Inc., 1996.)

Carbon monoxide (CO) is invisible, odorless, tasteless and non-irritating—completely undetectable to your five senses. That's why it's so important to your safety that you have a carbon monoxide detector. But, how do you know what to do if your detector alarms?

You have to *learn* what to do, because your five senses won't tell you. Familiarize yourself with the facts about carbon monoxide, how your new

detector works, and what to do if it alarms.

HOW THE DETECTOR DETERMINES WHEN TO ALARM

Your detector uses advanced technology to monitor the environment and warn you of unacceptable levels of carbon monoxide. An internal microcomputer works together with the carbon monoxide sensor inside the detector to determine the levels of carbon monoxide in the air and to calculate the rate that CO would be absorbed into the human body.

The microcomputer is calibrated to trigger the detector's alarm before most people would experience any symptoms of carbon monoxide poisoning. Because carbon monoxide is a cumulative poison, long-term exposures to low levels can cause symptoms, as well as short-term exposures to high levels. Your detector has a **time weighted alarm**, so the higher the level of carbon monoxide present, the sooner the alarm will be triggered.

This detector meets the alarm response time requirements of UL Standard 2034 which are as follows:

At 100 ppm, the detector must alarm within 90 minutes.

At 200 ppm, the detector must alarm within 35 minutes.

At 400 ppm, the detector must alarm within 15 minutes.

At 600 ppm, the detector must alarm within 5 minutes.

ACCURACY OF THE DIGITAL DISPLAY

Each detector is calibrated at a CO concentration of 100 ppm (+/- 25 ppm) in air, at 80°F (+/- 10°F) and 40% (+/- 3%) relative humidity. Depending on the ambient condition (temperature, humidity) and the condition of the sensor, the detector readings may vary.

The digital reading tolerances are listed below:

Ambient: 80°F (+/- 10°F), atmospheric pressure +/- 10%, 40% +/- 3% relative humidity.

Sensor: Thoroughly conditioned (minimum 7-day warmup period), stabilized and non-contaminated.

<u>Reading</u>	<u>Tolerance (of displayed reading)</u>
0-150 ppm	+/- 35% +/- 15 ppm
151-250 ppm	+/- 20%
251-999 ppm	+/- 30%

HOW TO TEST YOUR DETECTOR

There are two aspects of the detector's operation that can be tested; the electronics and the sensor response. Instructions on testing each are outlined on the following pages.

TESTING THE ELECTRONICS

You should test the detector once a week, following the directions listed below. If at any time you test the detector and it does not perform as described below, have it replaced immediately.

Observe the detector weekly to make sure the red dot is blinking, indicating normal operation.

If the dot is not blinking, unplug the detector for three minutes, then plug in again. This will clear the detector for restart. If the dot does not resume blinking, your detector may be malfunctioning.

To test the detector, press the Test/Reset button and hold it down for 10 to 15 seconds. If the detector is operating properly, you should notice the following:

- ▶ After holding the test button for 10 to 15 seconds, a loud, *constant* alarm will sound. (**Note:** the 85 decibel alarm is quite loud at close range and could cause hearing loss after prolonged exposure. When you test the detector, we advise you to place your finger

over the sounder opening in the upper center of the detector.)

- ▶ You will see several changing three digit numbers (from 100 to 350) appear on the digital display. These numbers ARE NOT a carbon monoxide reading; they merely represent a *simulated* reading the detector displays during its testing procedure.
- ▶ Release the test button. This will turn off the alarm.
- ▶ After you release the test button, "888" will appear on the digital display to show that all LED segments are working properly.
- ▶ Then, three bars will appear on the digital display to indicate the detector is now in the reset mode. The three bars will remain for two and a half minutes, the red dot will continue blinking.
- ▶ Within five minutes, a reading will appear on the digital display. The number will probably be zero (0). This is a normal condition for most households and shows that no measurable amount of CO is being detected.

NOTE: Pressing the Test/Reset button tests the functions of the detector's internal components, circuitry and micro-computer.

You do not need to press the test button to take a co reading. CO readings are automatically shown on the detector's digital display. If the detector shows zero (0), then no measurable amount of CO has been sensed by the detector within the past two and a half minutes.

TESTING THE SENSOR RESPONSE

While it is not required, on occasion you may wish to observe and become familiar with your detector's response in the actual presence of carbon monoxide. The best and safest way to do this is with either a cigarette or an incense stick. To perform this test you will need: your detector (that has been

powered up for at least two hours), matches or a butane lighter, an ashtray, and either a cigarette or an incense stick.

WARNING: This test should be done by adults only. Children should be warned never to light matches or butane lighters. Please use caution when performing the test described below. Avoid burns from flame or hot materials. Avoid inhaling excessive smoke from the cigarette or incense stick. Extinguish all flames and properly discard all hot materials.

Step 1. With a match or a lighter, light a single cigarette or incense stick. Extinguish the match or lighter. Make sure an ashtray is available to discard ashes, matches and the burned cigarette or incense stick.

Step 2. Hold the smoldering cigarette or incense stick 12 - 15 inches directly *below* the bottom air vents of the CO detector, making sure the stream of smoke rises into the vents.

Step 3. Continue holding the cigarette or incense stick directly below the detector for 3 - 5 minutes. This time is needed as the detector samples the air every 2½ minutes. **Note:** Do not hold the cigarette or incense stick closer than 12 inches to the detector as smoke *will* cause a yellow stain to develop on the detector's outer case.

Step 4. After 3 - 5 minutes you should see a reading on the digital display. If the reading is greater than 600 ppm, the detector will alarm in about five minutes.

Step 5. If your detector alarms, you can silence it by pressing Test/Reset button.

Step 6. Extinguish the cigarette or incense stick by pressing the smoldering tip into the ashtray.

HOW TO KNOW IF YOUR DETECTOR IS MALFUNCTIONING

Your detector performs an internal self-diagnosis every two and a half minutes to make sure that it is functioning properly. The detector is designed to alert you in the unusual event of a malfunction.

IF THE DETECTOR MALFUNCTIONS

In the rare event that your detector malfunctions, it will alert you with one of these signal groups (depending upon the type of malfunction that occurs):

Malfunction Signal Group 1 - Component Failure

- An intermittent "chirping" alarm will sound every 25 seconds, and
- An "Err" message will appear on the digital display

OR,

Malfunction Signal Group 2 - Microprocessor Failure

- The alarm will sound continuously, and
- The digital display will be blank, and
- The alarm cannot be shut off by pushing the "Test/Reset" button

Unplug the detector immediately and return for warranty exchange.

WHAT TO DO IF YOU'RE NOT SURE

Please familiarize yourself with the malfunction alert, and do not confuse these signals with an alarm.

If your detector sounder is beeping, and you are not sure if it is a CO alarm or malfunction alert, reset the alarm, open windows for ventilation, turn off fuel-burning appliances (like kerosene or oil heaters, furnaces, gas ranges, wood-burning stoves, water heaters, or other fossil-fuel burning appliances). For furnaces, you can simply turn down the thermostat to its lowest setting. Open windows and doors for ventilation.

Before you call a qualified technician (such as a licensed heating contractor, utility service technician, chimney sweep or fuel provider) to check your residence for CO, remember that you will probably be charged for a service call.

Never ignore a CO detector alarm. A true alarm is an indication of potentially dangerous levels of carbon monoxide. CO detectors are designed to alert you to the presence of carbon monoxide before an emergency, before most people would experience symptoms of carbon monoxide poisoning, giving you time to resolve the problem calmly.

HOW TO CARE FOR YOUR DETECTOR

To keep your detector in good working order, you must follow these simple steps:

DO:

- Test the detector once a week by pressing the Test/Reset button.
- Vacuum the detector cover once a month to remove accumulated dust. Use the soft brush attachment of your vacuum cleaner, and unplug the detector from the electrical outlet before vacuuming.
- Instruct children never to touch, unplug or otherwise interfere with the detector. Warn children of the dangers of CO poisoning.

DON'T:

- Never use detergents or solvents to clean the detector. Chemicals can permanently damage or temporarily contaminate the sensor.
- Avoid spraying air fresheners, hair spray, paint or other aerosols near the detector.
- Do not paint the detector. Paint will seal the vents and interfere with proper sensor operation.
- Do not mount the detector directly above or near a diaper pail, as high amounts of methane gas can cause temporary readings on the digital display.

Note: If you will be staining or stripping wood floors or furniture, painting, wall-papering, or using aerosols or adhesives for a do-it-yourself project or hobby,

before you begin, remove the detector to a remote location to prevent possible damage to or contamination of the sensor. You may wish to unplug the detector and store in a plastic bag during the project.

The following is a list of substances that at high levels can affect the sensor and cause temporary readings on the digital display that are not carbon monoxide readings:

Methane, propane, iso-butane, ethylene, ethanol, alcohol, iso-propanol, benzene, toluene, ethyl acetate, hydrogen, hydrogen sulfide, sulfur dioxides.

Also most aerosol sprays, alcohol based products, paints, thinners, solvents, adhesives, hair sprays, after shaves, perfumes, auto exhaust (cold start) and some cleaning agents.

THE PEAK LEVEL MEMORY BUTTON

Located on the front of our CO detectors is another unique feature—the peak level memory button.

The main function of this button is to allow you to see the highest CO level recorded by the unit since it was last reset. This way, if the detector has been alarming for some time before you get to it (like if you were away), you simply press this button and it will display the highest level it recorded.

For instance: If the detector was displaying, say 20 ppm, and you press the peak level button and it shown 200 ppm, you know the problem was much worse before you got to the detector. Now you know exactly how big a problem you are dealing with and you can react accordingly.

The peak level memory button is also a big help to a service technician or fireman you may have called to investigate a CO problem. Because you should open windows and turn off appliances when the detector alarms, the CO level displayed on the detector will most likely be "0" (or at least much lower) by the time a technician arrives. With the touch of the peak level button, they too can see just how big a problem they're dealing with.

If you are going to call a service technician to investigate a CO problem, **DO NOT** reset the peak level memory before they arrive.

TO RESET THE PEAK LEVEL MEMORY

Note: Pressing the test/reset button alone does not reset the peak level memory. To do so, you must follow these two steps in this exact order:

Step 1. Press the peak level button.

Step 2. With the peak level button still pressed, press the test/reset button as well.

The number on the display will turn to "0". In a second or two, three bars will be displayed. The memory has now been cleared and the detector will begin monitoring for CO within a few minutes.

The only other way the peak level memory can be reset is if the detector is disconnected from its power source.

UNDERSTAND THE EFFECTS OF CARBON MONOXIDE EXPOSURE

Low Levels:

Generally 35 ppm and below.

Mid Levels:

Generally 35 ppm to 100 ppm.

High Levels:

Generally 100 ppm and above if no one is experiencing symptoms.

Dangerous Levels:

Generally 100 ppm and above if someone is experiencing symptoms.

Concentration of CO in Air (ppm = parts per million)	Approximate Inhalation Time and Symptoms Developed
50 ppm	The maximum allowable concentration for continuous exposure for healthy adults in any 8-hour period, according to OSHA.
200 ppm	Slight headache, fatigue, dizziness, nausea after 2-3 hours.
400 ppm	Frontal headaches within 1-2 hours, life threatening after 3 hours.
800 ppm	Dizziness, nausea and convulsions within 45 minutes. Unconsciousness within 2 hours. Death within 2-3 hours.
1,600 ppm	Headache, dizziness and nausea within 20 minutes. Death within 1 hour.
3,200 ppm	Headache, dizziness and nausea within 5-10 minutes. Death within 25-30 minutes.
6,400 ppm	Headache, dizziness and nausea within 1-2 minutes. Death within 5-10 minutes.
12,800 ppm	Death within 1-3 minutes.

WHAT TO DO WHEN THE ALARM SOUNDS

Determine if anyone in the household is experiencing symptoms of CO poisoning. The following symptoms are related to CARBON MONOXIDE POISONING and should be discussed with ALL members of the household:

Common Mild Exposure Symptoms:

Slight headache, nausea, vomiting, fatigue ("flu-like" symptoms).

Common Medium Exposure Symptoms:

Throbbing headache, drowsiness, confusion, fast heart rate.

Common Extreme Exposure Symptoms:

Convulsions, unconsciousness, heart and lung failure.
It can cause brain damage and death.

If you experience even mild symptoms of CO poisoning, consult your doctor immediately!

WARNING: Actuation of this device indicates the presence of carbon monoxide (CO) which can be fatal.

DANGEROUS LEVEL ALARMS

Unit reads 100 ppm or above and someone is experiencing symptoms of CO poisoning.

Emergency Procedure:

Follow if you suspect Co and anyone is experiencing symptoms of CO poisoning:

Gather your family and other members of the residence together and immediately evacuate the home. This is a potentially life-threatening EMERGENCY situation. Get everyone outside into fresh air. Call 911 or your local fire department from a telephone outside your home. Do not re-enter your home under any condition until help has arrived and the problem causing the CO has been corrected.

HIGH LEVEL ALARMS

Unit reads 100 ppm or above of carbon monoxide.

If no one is experiencing symptoms of carbon monoxide poisoning, write down the reading on the digital display, then press the reset button on the detector which will turn off the alarm. If the detector alarms again within six minutes, it is sensing high levels of CO and can quickly become a dangerous situation. If this happens, follow the **Emergency Procedure** from the previous page.

After pressing the reset button, turn off the fuel-burning appliances (kerosene or oil heaters, furnaces, gas ranges, wood-burning stoves, water heaters, or other fossil-fuel burning appliances). For furnaces, you can simply turn down the thermostat to its lowest setting. Open windows for ventilation.

Verify that the detector is in full alarm and not alerting you to a malfunction. Sometimes you can mistake the malfunction alert for a CO alarm.

Continue to ventilate the home, keep fuel-burning appliances in the "off" position.

MID LEVEL ALARMS

Unit reads between 35 ppm and 100 ppm of carbon monoxide.

Alarms and/or readings in the mid-level range (35 ppm to 100 ppm) are cause for concern. Normally it would take a few hours at this level of exposure for a healthy adult to experience symptoms of CO poisoning. Individuals at high risk may be adversely affected by much shorter periods of exposure to these levels.

Follow the same procedure as given for Dangerous Level Alarms and High Level Alarms. This is not an emergency situation, but you should take action to find and fix the source of the CO and avoid prolonged exposure to these levels. Ventilate the premises and turn off fuel-burning appliances until the problem is fixed.

Carpet Cleaning Tips

CM 302

Section 6-1

Your mobile carpet cleaning plant has been engineered using the latest and most sophisticated technology available to produce the finest carpet cleaning results possible. Despite this, however, it remains only a tool of the carpet cleaning trade, and it can produce only as good a job as the person operating it.

PRECAUTIONS

There are no short cuts to good carpet cleaning. It requires time, cleaning knowledge and the use of good chemicals. Therefore, the manufacturer recommends the use of spotting agents and traffic lane cleaners, as required, prior to the actual cleaning of carpeting.

The use of some chemicals through your mobile carpet cleaning plant can seriously damage the internal plumbing, high pressure pump and heater (chemicals such as concentrated acid, solvents, and some paint, oil, and grease removers with high concentration of solvents).

The manufacturer recommends only the use of chemicals containing rust and corrosion inhibitors and water softening agents to prevent chemical build-up which may lead to component failure and warranty invalidation.

◆ CAUTION ◆

The increased demand for "clear water" rinsing results in the need for special care when using these acid based chemicals in your equipment. The negative side of these products is the corrosive effects the acid can have on metals, including swivels, pumps, heat exchangers, etc.

HydraMaster's *ClearWater Rinse* has been formulated to protect vital components. HydraMaster will not warranty parts that have been damaged from using unprotected acid products that have obviously caused failures.

CLEANING STROKE PROCEDURE

Purpose: To eliminate excess moisture remaining in the carpet fiber and the sawtooth appearance which results from diagonal movement of the cleaning tool on all types of carpet.

Procedure: Always move the cleaning tool in smooth, forward and backward strokes. Apply slight pressure to the forward stroke while the solution is injected into the carpet. When extracting (drying), apply firm pressure on the forward stroke to ensure a positive "lock" for the vacuum and minimize the "hopping" effect resulting on carpet that is not smooth. During the forward and reverse strokes, movement to the right or left should only be accomplished at the extreme rear of the stroke. Overlapping is also important to ensure even application of solution and prevent saturation when the cleaning wand is stopped twice at the same point at the rear of the cleaning stroke.

Failure to adopt this procedure can result in increased chance of "clean streaks," fiber shrinkage, brown-out and longer drying periods.

OVER-WETTING

Over-wetting is annoying to all concerned and sometimes leaves a bad impression of the cleaning process used.

THESE ARE SEVERAL AREAS THAT WILL CAUSE OVER-WETTING

1. Too few vacuum strokes or improper saw-tooth vacuum strokes as shown in the following illustration.
2. Obstructed, cut or kinked hoses.
3. Vacuum tank drain valve left partially open.

4. Clogged vacuum blower filter or vacuum tank lid not sealing properly.
5. Cleaning a heavily foam-saturated carpet without defoamer. (We recommend crystal type.)

Figure 6-1

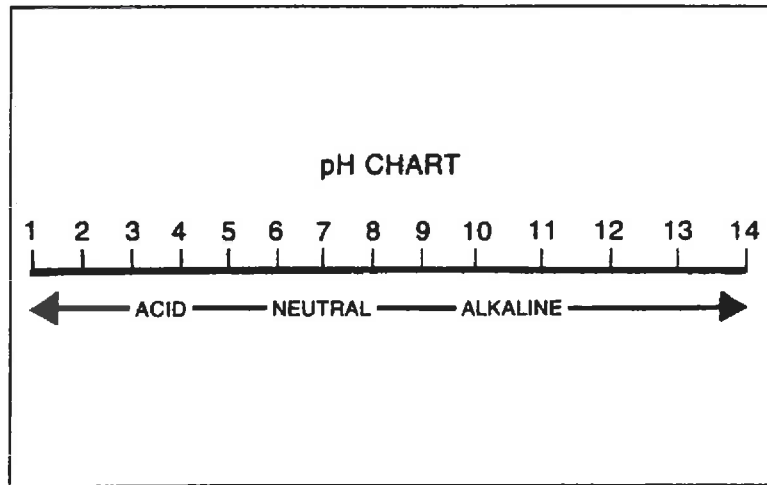
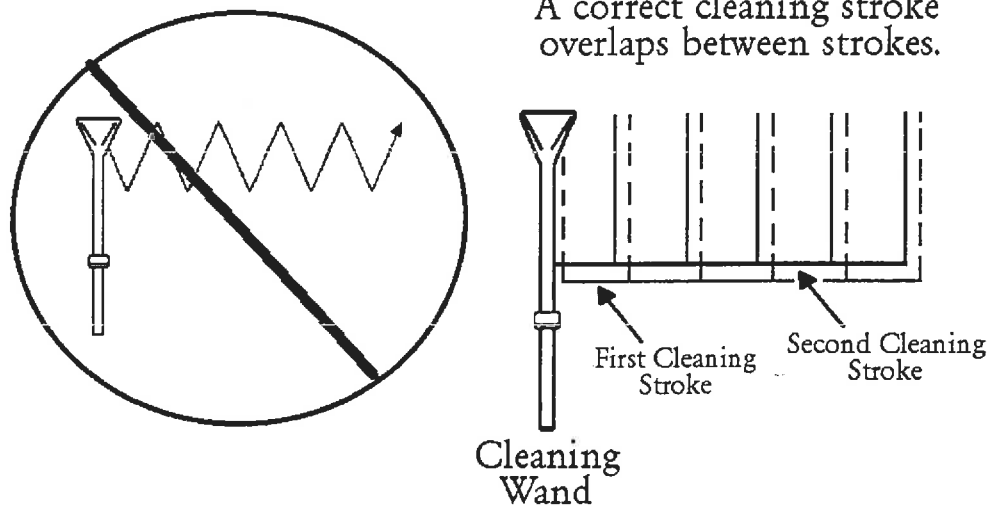


Figure 6-2: **CLEANING STROKE PROCEDURE**



Crisis Management

CM 302

Section 7-1

HydraMaster is committed to providing quality carpet cleaning machines and the CM 302 is no exception. Every effort has been made to ensure the technician's safety while operating the propane-powered CM 302. However, unforeseen circumstances or part failures can at times result in problems. Being prepared for these situations can reduce the risk of serious injury.

This information is provided, not in expectation of a crisis, but so that you know what to do in the event of an emergency.

1. Notify appropriate assistance agency (Medical, Police, Fire department, etc.). Alert the agency that propane is involved or suspected to be involved. This will allow them to take appropriate precautions when responding. Cooperate fully with emergency personnel.
2. Notify your local distributor.
3. Your local distributor will notify HydraMaster Corporation.

EMERGENCY PHONE NUMBERS

In the United States, emergency help can be obtained by dialing **911**. However, we suggest that you write in your local emergency numbers below for reference.

Local Fire Department -

Poison Control -

Propane Supplier -

FIRE EXTINGUISHER RECOMMENDATIONS

HydraMaster recommends that a fire extinguisher be carried with the equipment at all times. The NFPA recommends that storage areas containing LP-Gas have a fire extinguisher (minimum capacity of 18 lb. dry chemical and a B:C rate) installed in close proximity.

EMERGENCY PROCEDURES

Follow the steps below for propane leaks and propane fires.

1. Evacuation.
2. Call for assistance.

If you can stop the leak without endangering yourself or others, you can:

1. Identify the source of the propane leak.
2. Shut off the propane, either at the leak point or before the leak point in the system.
3. Move away any ignitable items from the leak area.
4. Put out any fire with a fire extinguisher.

Burns: A liquid propane burn is similar to frostbite. Treat with first aid or seek professional medical attention.

Appendixes

CM 302

Section 8-1

GLOSSARY

Authority Having Jurisdiction: The “authority having jurisdiction” is the organization, office or individual responsible for “approving” equipment, an installation or a procedure.

NOTE: The phrase “authority having jurisdiction” is used in NFPA documents in a broad manner since jurisdictions and “approval” agencies vary as do their responsibilities. Where public safety is primary, the “authority having jurisdiction” may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the “authority having jurisdiction.” In many circumstances the property owner or his designated agent assumes the role of the “authority having jurisdiction”; at government installations, the commanding officer or departmental official may be the “authority having jurisdiction.”¹

CARB: California Air Resources Board.

The Air Resources Board is responsible for the enforcement of California’s Clean Air Act. This act has primary application to outdoor air quality but requires the certification of all small gas engines sold in the state of California. Some manufacturers of propane floor buffers have taken the position that the CARB standard does not apply to their product but is useful only as a yardstick for assessing propane machine emission levels.

Carbon Monoxide: “Carbon monoxide (CO) is a widespread and insidious hazard. This colorless, tasteless, and odorless gas gives no warning of its presence, so people breathing it do not realize they are being poisoned until symptoms begin to show.

“Most people are exposed to CO that is formed by poor combustion. When

hydrocarbon fuels burn completely, carbon dioxide and water form. When they burn incompletely, because not enough oxygen is present, they form CO and other chemicals.

"It is impossible to avoid some exposure to CO, for its sources are everywhere in our society, e.g. fumes from internal combustion engines, furnaces, water heaters, fireplaces and charcoal grills. Your body even produces minute amounts of it. Inhalation of cigarette smoke is the most prevalent source in the United States. The U.S. Occupational Safety and Health Administration has set the maximum level for continuous exposure to CO in industrial buildings at 35 ppm over an eight-hour period.

"CO enters the body through the lungs, and interferes with the blood's ability to carry oxygen to the body. Oxygen binds to hemoglobin molecules in red blood cells in the oxygen-rich environment of the lungs and is released in the oxygen-poor environment of other tissues. Hemoglobin has nearly 300 times the affinity for CO as it does for oxygen, so when CO is present, far less oxygen binds to hemoglobin.

"Symptoms of CO poisoning include severe headaches, dizziness, blurred vision, nausea, vomiting, confusion, disorientation, loss of muscle control, fatigue, sleepiness, rapid heartbeat or pulse, tightening of the chest, chest pain (angina) when exercising, fainting, and loss of consciousness. Those affected by CO may feel ill in a CO-laden environment, and fine after they leave. CO poisoning proceeds in four steps:

1. The blood has less oxygen-carrying capacity as carboxyhemoglobin forms.
2. Tissues become starved for oxygen, especially in the brain.
3. The respiratory center in the brain is depressed, decreasing respiration.
4. Heart failure occurs from an inadequate oxygen supply.

"Treatment of CO-induced asphyxiation must be prompt. It may be enough to move the victim to fresh air; however, respiratory assistance and oxygen, sometimes under pressure, may be needed. Air washes out half the CO in the blood in four hours. Pure oxygen reduces this to 40 minutes. Victims should

be kept quiet to minimize their oxygen requirements.

"Except for its strong combination with hemoglobin, CO has no toxic affect on body tissues. While CO does not accumulate in the body, long-term exposure can damage the nervous system if the brain is oxygen starved. Red corpuscles are not damaged by CO, as they can transport oxygen again after they give up any CO they carry.

"Carbon monoxide does not affect everyone equally—pregnant women, people with heart problems, and children are more susceptible. Key factors that influence the speed and degree of CO poisoning include CO level, length of exposure, age, health, weight, and sex. The gas also has a stronger effect at high altitudes where less oxygen is available.

"The key to preventing CO in exhaust emissions from forklifts and other vehicles powered by internal combustion engines is to keep them well tuned. Proper tuning establishes a balance that ensures ample oxygen is present, but not so much that some of the hydrocarbons do not burn and exit the engine in the exhaust."²

Gas: Liquefied Petroleum Gas in either the liquid or vapor state. The more specific terms "liquid LP-Gas" or "vapor LP-Gas" are normally used for clarity.³

Liquefied Petroleum Gas (LP-Gas or LPG): Any material having a vapor pressure not exceeding that allowed for commercial propane composed predominantly of the following hydrocarbons, either by themselves or as mixtures: propane, propylene, butane (normal butane or isobutane), and butylenes.⁴

NFPA: National Fire Protection Association.⁵

The NFPA is a national association that established guidelines for fire safety procedures. This is not a federal-agency. The NFPA has no authority to police or enforce compliance with its published guidelines. The NFPA states, "The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or

procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items."⁶

NOX: Oxides of Nitrogen.⁷

Properties: Nitric oxide (NO) at room temperature is a colorless, nonflammable, toxic gas that when mixed with air forms brown fumes of nitrogen dioxide (NO₂), which is extremely reactive and a strong oxidizing agent.

In light commercial and residential combustion applications, nitric oxide gas is typically present with nitrogen dioxide in a ratio of one part NO₂ to nineteen parts NO. At normal ambient temperatures, nitric oxide combines with atmospheric oxygen to form nitrogen dioxide at a rate dependent on the concentration of oxygen and the square of the concentration of nitric oxide.

Physiological Effects: Nitric oxide, with the attendant formation of nitrogen dioxide, results in a strong respiratory irritant, which may be fatal. Symptoms may be moderate at first, and include tightness in the chest, headaches, irritation of the eyes, nausea, and a slow loss of strength. Delayed symptoms may be severe and cause increased difficulty in breathing, and pulmonary edema (abnormal fluid buildup in the lungs). Untreated cases could lead to eventual death.

PPM Level Attributes:

25 ppm - Eight-hour time-weighted average (TWA) exposure limit set by the U.S. Occupational Safety and Health Administration (OSHA).^{8,9}

100 to 150 ppm - Exposure for 30-60 minutes could lead to delayed pulmonary edema.

200 to 700 ppm - A few breaths may result in fatal pulmonary edema after 5-8 hours have passed.

First Aid: Remove victim to fresh air and administer oxygen. If breathing has stopped, give artificial respiration. The main objective of the treatment is to provide an adequate supply of oxygen to the tissues so as to prevent, or at least minimize, the development of pulmonary edema. Oxygen must be supplied as soon as possible in amounts adequate to maintain the normal color of the skin and mucous membranes. Seek medical attention immediately.

OSHA: Occupational Safety and Health Administration. A federal agency.

OSHA is a federal agency that creates safety standards for the Department of Labor. Most individual states have adopted the federal standards created by OSHA and it is the state that has the responsibility to enforce them. There are a few states, however that have chosen to add to the federal standards and thereby have created their own. Washington state has its own code of standards. The broad term used in referring to all Washington state codes is "Washington Administrative Code" or "WAC." The specific Washington state codes that we are concerned with are the "WISHA" or Washington Industrial Safety and Health Act rules. The state of California also has its own code of regulations, known as the "CCR" or "California Code of Regulations." Michigan has its own code of regulations. Most other states have adopted the federal code as their own and are termed "OSHA identical."

Applicable OSHA and WISHA Standards: The OSHA standard that is applicable to this project is Title 29, Part 1910 "Occupational Safety and Health Standards." OSHA 1910, subpart H, section 1910.110 deals with the storage and handling of liquefied petroleum gases (this is comparable to chapter 24, part F-1 of WISHA standards). OSHA 1910, subpart Z, section 1910.1000 deals air contaminants (this is comparable to chapter 62, part H of WISHA). OSHA 1910, subpart G, section 1910.95 deals with occupational noise exposure (this is comparable to chapter 62, part K of WISHA).

Portable Container: A container designed to be readily moved, as distinguished from containers designed for stationary installations. Portable containers, designed for transportation, filled to their maximum filling density include

"cylinders," "cargo tanks," and "portable tanks" all three of which are separately defined. Containers designed to be readily moved from one usage location to another, but substantially empty of product, are "portable storage containers" and are separately defined.¹⁰

Qualification of Personnel. In the interest of safety, all persons employed in handling LP-Gases shall be trained in proper handling and operating procedures which the employer shall document. Effective Jan 1, 1993, all employees shall carry written certification of their job qualification issued by the training agent or a written document issued by the authority having jurisdiction identifying the functions each person is authorized to perform.¹¹

REGULATIONS AND STANDARDS

HydraMaster has considered the following regulations and standards in designing the CM 302 and used them as guides:

NFPA 58 "Standard for the storage and handling of liquefied petroleum gases," 1992 edition.

This standard deals with the safe storage and handling of liquefied petroleum gas (LPG or Propane).

NFPA 501C "Recreational vehicles."

This standard deals with the design of over the road vehicles that have propane systems installed in them. This standard was consulted for reference only.

NFPA 505 "Powered industrial trucks including type, areas of use, maintenance, and operation."

This standard deals with the use of industrial trucks (e.g. forklifts). This standard was consulted because of its consideration of the use of Propane fuel indoors.

NOTE: The NFPA is a national association that established guidelines for fire safety procedures. This is not a federal agency. The NFPA has no authority to police or enforce compliance with its published guidelines. Most states however have adopted the NFPA standards as part of their own 'Code of Regulations.'

CFR 29 Federal Code of Regulations, "Occupational Safety and Health Administration" (OSHA).

The OSHA standard that is applicable to this equipment is Title 29, Part 1910, "Occupational Safety and Health Standards." Subpart H, section 1910.110 deals with the storage and handling of liquefied petroleum gases. Subpart Z, section 1910.1000 deals with air contaminants. Subpart G, section 1910.95 deals with occupational noise exposure.

NOTE: Most individual states have adopted the federal standards created by OSHA and it is the state that has the responsibility to enforce them. There are a few states, however that have chosen to add to the federal standards and thereby have created their own. Washington state has its own code of standards. The broad term used in referring to all Washington state codes is "Washington Administrative Code" or "WAC." The specific Washington state codes that we are concerned with are the "WISHA" or Washington Industrial Safety and Health Act rules. The state of California also has its own code of regulations, known as the CCR or California Code of Regulations. Michigan has its own code of regulations. Most other states have adopted the federal code as their own and are termed "OSHA identical."

CCR 13 California Code of Regulations, Sections 2400-2407, "Utility and Lawn and Garden Equipment Engines."

Chapter 9 of Title 13 deals with 'Off-Road Vehicles and Engine Pollution Control Devices'. This chapter establishes Exhaust Emission Standards for engines rated below 25 horsepower and sold in the state of California.

NOTE: The engine on this equipment has been Certified by the California Air Resources Board for sale in the state of California. The engine has also been Certified by the Environmental Protection Agency and given the Engine Family name of VHD480U1L2EA.

Loudness Levels of Familiar Noises¹²
 (Approximate Average Including Ear Network)

Approximate Noise Levels	Relative Intensities*	Decibels	Familiar Noises
Deafening	10^{13}	130	Threshold of painful feeling. Airplane and propeller at 10 feet.
	10^{12}	120	
	10^{11}	110	Train passing at high speed.
	10^{10}	100	Riveter at 30 feet, auto horn at 20 feet, pneumatic drill at 10 feet.
	10^9	90	Subway train, fire siren at 75 feet, noisy street, auto at 60 mph.
Noisy	10^8	80	Very noisy restaurant, auto at 40 mph, avg. stenographic room.
	10^7	70	Factories, auto at 20 mph, noisy office, average restaurant.
Average	10^6	60	Department store, average conversation at 3 feet.
	10^5	50	Average office, quiet street, noisy residence.
Quiet	10^4	40	Quiet restaurant, museum, average school, library reading rooms.
Very Quiet	10^3	30	Auditoriums, average whisper at 5 feet, very quiet residence.
	10^2	20	Broadcasting studio, zero of AIEE Scale 14 db.
Sound Proof Rooms	10	10	Zero of Original Scale 8.5 db.
		0	Threshold of audibility.

* Intensity above threshold = 10^{16} watts per sq. cm.

DESIGN CRITERIA

HydraMaster has used the following as design criteria:

Emission Control Limits

Carbon Monoxide (CO)

35 ppm (40 mg per cubic meter) TWA (OSHA)

50 ppm (55 mg per cubic meter) PEL w/ 200 ppm ceiling (OSHA)

NOTE: WISHA, (Washington state equivalent of OSHA) Chapter 62, Part H deals with air contaminants. The entire standard is listed as "PEL" and has only the one limit of 35 ppm.

300 grams per brake horsepower-hour (CARB)

Nitric Oxide (NOX)

25 ppm (30 mg per cubic meter) TWA (OSHA)

10 grams per brake horsepower-hour (CARB)

TWA: Time Weighted Average. Average exposure over an 8 hour period.

PEL: Permissible Exposure Limit. Exposure limit for any single test period.

(The OSHA limits deal with volume of contaminants in the atmosphere in which a person is occupying regardless of the source. The CARB limits deal with the specific volume of contaminants in the exhaust of a gas-powered engine.)

Noise Control Limits

At 85 decibels, a hearing conservation program is required by OSHA.

REFERENCES FOR THIS SECTION

1. *NFPA 58, Standard for the Storage and Handling of Liquefied Petroleum Gases, 1992 Edition*, p. 9.
2. *CO Emissions Controller, Increases Fuel Economy While Lowering Emissions*, ADV-5209 0893, by Suburban Propane.
3. *NFPA 58, Standard for the Storage and Handling of Liquefied Petroleum Gases, 1992 Edition*, p. 10.
4. *Ibid.*
5. *Ibid.*, p. 11.
6. *Ibid.*, p. 9.
7. *Nonoxor II, Instruction 19-9120, Rev.1 - June 1991* by Bacharach, Inc., pp. 9, 10.
8. *Code of Federal Regulations, Title 29 CFR Parts 1900-1910 (Labor)*, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
9. *Threshold Limit Values and Biological Exposure Indices, 1989-90 ed.*, American Conference of Governmental Industrial Hygienists (ACGIH), 6500 Glenway Ave., Bldg. D-7, Cincinnati, OH 45211.
10. *NFPA 58, Standard for the Storage and Handling of Liquefied Petroleum Gases, 1992 Edition*, p. 11.
11. *Ibid.*, p. 8.
12. By Paxton Products Inc., Santa Monica, California.

FLOOD DAMAGE WORK

◆ CAUTION ◆

When using equipment for flood damage, you *must* have a fresh water source hooked up at all times to allow a cold water source into the machine. This will prevent overheating during long periods of vacuum recovery.

SHUT DOWN

1. Remove the vacuum hose.
2. Flush clear water through the chemical system for 10 seconds. Vinegar should be rinsed through the system weekly. Turn off chemical flowmeter.
NOTE: De-scaler should be rinsed through the entire system monthly.
3. Turn on the cleaning tool to flush the chemical from the unit, hoses and cleaning tool.
4. Lubricate the blower with an oil based lubricant.
NOTE: If freeze guarding is necessary, perform the freeze guard procedure at this time.
5. Throttle the machine down.
6. Close the propane tank valve. Run machine until the engine stops.
7. Turn the ignition switch off.
8. Drain the vacuum tank, disposing of the waste water in an appropriate location. Clean the vacuum filter prior to storage of the unit.

LOCAL WATER PRECAUTIONS

The quality of water varies greatly. Many areas have an excess of minerals in the water which results in what is commonly called "hard water." These minerals tend to adhere to the insides of heater coils and other parts of the machines causing damage and a loss of cleaning effectiveness. This influences the reliability and efficiency of equipment in direct proportion to the level of hardness.

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Technician's Safety Manual*

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SHUT DOWN

1. Remove the vacuum hose.
2. Flush clear water through the chemical system for 10 seconds. Vinegar should be rinsed through the system weekly. Turn off chemical flowmeter.
NOTE: De-scaler should be rinsed through the entire system monthly.
3. Turn on the cleaning tool to flush the chemical from the unit, hoses and cleaning tool.
4. Lubricate the blower with an oil based lubricant.
NOTE: If freeze guarding is necessary, perform the freeze guard procedure at this time.
5. Throttle the machine down.
6. Turn the machine off.
7. Drain the vacuum tank, disposing of the waste water in an appropriate location. Clean the vacuum filter prior to storage of the unit.

LOCAL WATER PRECAUTIONS

The quality of water varies greatly. Many areas have an excess of minerals in the water which results in what is commonly called "hard water". These minerals tend to adhere to the insides of heater coils and other parts of the machines causing damage and a loss of cleaning effectiveness. This influences the reliability and efficiency of your equipment.

WATER SOFTENER

Cleaning efficiency and equipment life is increased, chemical use decreased, and the appearance of cleaned carpets enhanced when water softeners are incorporated in hard water areas. The manufacturer strongly urges the use of water softener units in areas exceeding 3 1/2 grains per gallon. Using a hard water area map as a reference, determine the quality of water in your area and take action immediately, if necessary.

Reports from several of our machine users commending the results of the use

of water softeners in conjunction with their machines prompts us to recommend the procedure to everyone in a "hard water" area.

The relatively low cost of a water softener service is more than made up for in the increased life of machine parts and continued cleaning efficiency. The water softener will also increase the effectiveness of the cleaning chemical being used and, therefore, less chemical will be needed.

Contact a water softener distributor in your area for information on the rental of a simple water treatment unit to carry in your truck. Be sure to change the water softener in accordance with the capability of the softener. For example: If the softener will treat 900 gallons of water and the machine uses an average of 30 gallons per hour, for an average of 5 hours a day, this equals 150 gallons per day. In 6 days the machine would use 900 gallons of water. Therefore, the softener would need to be changed every 6 working days for maximum softening.

WASTEWATER DISPOSAL ADVISORY

There are laws in most communities prohibiting the dumping of recovered "gray" water from carpet cleaning in any place but a sanitary treatment system.

This cleaning rinse water, recovered into your unit's vacuum tank, contains materials such as detergents. These must be processed before being safe for streams, rivers and reservoirs.

IN ACCORDANCE WITH THE EPA, STATE AND LOCAL LAWS, DO NOT DISPOSE OF WASTEWATER INTO GUTTERS, STORM DRAINS, STREAMS, RESERVOIRS, ETC.

In most cases, an acceptable method of wastewater disposal is to discharge into a municipal sewage treatment system after first filtering out solid material such as carpet fiber. Access to the sanitary system can be obtained through a toilet, laundry drain, RV dump, etc. Permission should first be obtained from any concerned party or agency.

One disposal method which usually complies with the law is to accumulate the wastewater and haul it to an appropriate dump site. Another solution to the disposal problem is to equip yourself with an Automatic Pump-Out System. These systems are designed to remove wastewater from the extractor's recovery system and actively pump the water through hoses to a suitable disposal drain. Properly designed, they will continuously monitor the level of wastewater and pump it out simultaneously to the cleaning operation. The hidden benefit of this process is that the technician does not have to stop his cleaning to empty the recovery tank. HydraMaster makes an A.P.O. System available which can be ordered with new equipment or installed later.

The penalties for non-compliance can be serious. Always check local laws and regulations to be sure you are in compliance.

ECD UNIT OPERATION

Your CM 302 carpet cleaning machine is equipped with an emission control device. This unit continually monitors the combustion efficiency of the engine and controls the fuel-to-air ratio to keep the engine running as efficiently as possible.

The ECD unit has an indicator light that allows you to see what the control device is doing. The light has five different conditions that indicate how the engine is operating. They are:

Fast Green Blink	Engine Cold (start up only)
Slow Green Blink	Normal Operation
Solid Red	Beyond Range (check wiring)
Clear (no color)	Fuel-to-Air Ratio Too Lean
Solid Green	Fuel-to-Air Ratio Too Rich

Under normal operation the fast green blink light will appear when the engine is first started until the engine is warm. Then the light will change to a slow green blink. If the red light should ever appear this indicates that the engine requires service. The engine will be shut down in two to five minutes and may

not be started until the engine has been serviced.

NOTE: The solid red light or clear light may appear if the fuel tank is near empty. Check the propane tank fuel level or replace with a full tank and check the machine again. If the red, clear or solid green lights persist, have the machine serviced by a qualified technician.

CARBON MONOXIDE DETECTOR

(The following information is from the *Carbon Monoxide Detector User's Guide* by Nighthawk Systems, Inc., 1996.)

Carbon monoxide (CO) is invisible, odorless, tasteless and non-irritating—completely undetectable to your five senses. That's why it's so important to your safety that you have a carbon monoxide detector. But, how do you know what to do if your detector alarms?

You have to *learn* what to do, because your five senses won't tell you. Familiarize yourself with the facts about carbon monoxide, how your new detector works, and what to do if it alarms.

HOW THE DETECTOR DETERMINES WHEN TO ALARM

Your detector uses advanced technology to monitor the environment and warn you of unacceptable levels of carbon monoxide. An internal microcomputer works together with the carbon monoxide sensor inside the detector to determine the levels of carbon monoxide in the air and to calculate the rate that CO would be absorbed into the human body.

The microcomputer is calibrated to trigger the detector's alarm before most people would experience any symptoms of carbon monoxide poisoning. Because carbon monoxide is a cumulative poison, long-term exposures to low levels can cause symptoms, as well as short-term exposures to high levels. Your detector has a **time weighted alarm**, so the higher the level of carbon

monoxide present, the sooner the alarm will be triggered.

This detector meets the alarm response time requirements of UL Standard 2034 which are as follows:

At 100 ppm, the detector must alarm within 90 minutes.

At 200 ppm, the detector must alarm within 35 minutes.

At 400 ppm, the detector must alarm within 15 minutes.

At 600 ppm, the detector must alarm within 5 minutes.

ACCURACY OF THE DIGITAL DISPLAY

Each detector is calibrated at a CO concentration of 100 ppm (+/- 25 ppm) in air, at 80°F (+/- 10°F) and 40% (+/- 3%) relative humidity. Depending on the ambient condition (temperature, humidity) and the condition of the sensor, the detector readings may vary.

The digital reading tolerances are listed below:

Ambient: 80°F (+/- 10°F), atmospheric pressure +/- 10%, 40% +/- 3% relative humidity.

Sensor: Thoroughly conditioned (minimum 7-day warmup period), stabilized and non-contaminated.

<u>Reading</u>	<u>Tolerance (of displayed reading)</u>
0-150 ppm	+/- 35% +/- 15 ppm
151-250 ppm	+/- 20%
251-999 ppm	+/- 30%

HOW TO TEST YOUR DETECTOR

There are two aspects of the detector's operation that can be tested; the electronics and the sensor response. Instructions on testing each are outlined on the following pages.

TESTING THE ELECTRONICS

You should test the detector once a week, following the directions listed below. If at any time you test the detector and it does not perform as described below, have it replaced immediately.

Observe the detector weekly to make sure the red dot is blinking, indicating normal operation.

If the dot is not blinking, unplug the detector for three minutes, then plug in again. This will clear the detector for restart. If the dot does not resume blinking, your detector may be malfunctioning.

To test the detector, press the Test/Reset button and hold it down for 10 to 15 seconds. If the detector is operating properly, you should notice the following:

- ▶ After holding the test button for 10 to 15 seconds, a loud, *constant* alarm will sound. (**Note:** the 85 decibel alarm is quite loud at close range and could cause hearing loss after prolonged exposure. When you test the detector, we advise you to place your finger over the sounder opening in the upper center of the detector.)
- ▶ You will see several changing three digit numbers (from 100 to 350) appear on the digital display. These numbers ARE NOT a carbon monoxide reading; they merely represent a *simulated* reading the detector displays during its testing procedure.
- ▶ Release the test button. This will turn off the alarm.
- ▶ After you release the test button, "888" will appear on the digital display to show that all LED segments are working properly.
- ▶ Then, three bars will appear on the digital display to indicate the detector is now in the reset mode. The three bars will remain for two and a half minutes, the red dot will continue blinking.

- ▶ Within five minutes, a reading will appear on the digital display. The number will probably be zero (0). This is a normal condition for most households and shows that no measurable amount of CO is being detected.

NOTE: Pressing the Test/Reset button tests the functions of the detector's internal components, circuitry and micro-computer.

You do not need to press the test button to take a CO reading. CO readings are automatically shown on the detector's digital display. If the detector shows zero (0), then no measurable amount of CO has been sensed by the detector within the past two and a half minutes.

TESTING THE SENSOR RESPONSE

While it is not required, on occasion you may wish to observe and become familiar with your detector's response in the actual presence of carbon monoxide. The best and safest way to do this is with either a cigarette or an incense stick. To perform this test you will need: your detector (that has been powered up for at least two hours), matches or a butane lighter, an ashtray, and either a cigarette or an incense stick.

WARNING: This test should be done by adults only. Children should be warned never to light matches or butane lighters. Please use caution when performing the test described below. Avoid burns from flame or hot materials. Avoid inhaling excessive smoke from the cigarette or incense stick. Extinguish all flames and properly discard all hot materials.

Step 1. With a match or a lighter, light a single cigarette or incense stick. Extinguish the match or lighter. Make sure an ashtray is available to discard ashes, matches and the burned cigarette or incense stick.

Step 2. Hold the smoldering cigarette or incense stick 12 - 15 inches directly *below* the bottom air vents of the CO detector, making sure the stream of smoke rises into the vents.

Step 3. Continue holding the cigarette or incense stick directly below the detector for 3 - 5 minutes. This time is needed as the detector samples the air every 2½ minutes. **Note:** Do not hold the cigarette or incense stick closer than 12 inches to the detector as smoke *will* cause a yellow stain to develop on the detector's outer case.

Step 4. After 3 - 5 minutes you should see a reading on the digital display. If the reading is greater than 600 ppm, the detector will alarm in about five minutes.

Step 5. If your detector alarms, you can silence it by pressing Test/Reset button.

Step 6. Extinguish the cigarette or incense stick by pressing the smoldering tip into the ashtray.

HOW TO KNOW IF YOUR DETECTOR IS MALFUNCTIONING

Your detector performs an internal self-diagnosis every two and a half minutes to make sure that it is functioning properly. The detector is designed to alert you in the unusual event of a malfunction.

IF THE DETECTOR MALFUNCTIONS

In the rare event that your detector malfunctions, it will alert you with one of these signal groups (depending upon the type of malfunction that occurs):

Malfunction Signal Group 1 - Component Failure

- An intermittent "chirping" alarm will sound every 25 seconds, and
- An "Err" message will appear on the digital display

OR,

Malfunction Signal Group 2 - Microprocessor Failure

- The alarm will sound continuously, and

- The digital display will be blank, and
- The alarm cannot be shut off by pushing the "Test/Reset" button

Unplug the detector immediately and return for warranty exchange.

WHAT TO DO IF YOU'RE NOT SURE

Please familiarize yourself with the malfunction alert, and do not confuse these signals with an alarm.

If your detector sounder is beeping, and you are not sure if it is a CO alarm or malfunction alert, reset the alarm, open windows for ventilation, turn off fuel-burning appliances (like kerosene or oil heaters, furnaces, gas ranges, wood-burning stoves, water heaters, or other fossil-fuel burning appliances). For furnaces, you can simply turn down the thermostat to its lowest setting. Open windows and doors for ventilation.

Before you call a qualified technician (such as a licensed heating contractor, utility service technician, chimney sweep or fuel provider) to check your residence for CO, remember that you will probably be charged for a service call.

Never ignore a CO detector alarm. A true alarm is an indication of potentially dangerous levels of carbon monoxide. CO detectors are designed to alert you to the presence of carbon monoxide before an emergency, before most people would experience symptoms of carbon monoxide poisoning, giving you time to resolve the problem calmly.

HOW TO CARE FOR YOUR DETECTOR

To keep your detector in good working order, you must follow these simple steps:

DO:

- Test the detector once a week by pressing the Test/Reset button.

- Vacuum the detector cover once a month to remove accumulated dust. Use the soft brush attachment of your vacuum cleaner, and unplug the detector from the electrical outlet before vacuuming.
- Instruct children never to touch, unplug or otherwise interfere with the detector. Warn children of the dangers of CO poisoning.

DON'T:

- Never use detergents or solvents to clean the detector. Chemicals can permanently damage or temporarily contaminate the sensor.
- Avoid spraying air fresheners, hair spray, paint or other aerosols near the detector.
- Do not paint the detector. Paint will seal the vents and interfere with proper sensor operation.
- Do not mount the detector directly above or near a diaper pail, as high amounts of methane gas can cause temporary readings on the digital display.

Note: If you will be staining or stripping wood floors or furniture, painting, wall-papering, or using aerosols or adhesives for a do-it-yourself project or hobby, **before you begin, remove the detector to a remote location to prevent possible damage to or contamination of the sensor.** You may wish to unplug the detector and store in a plastic bag during the project.

The following is a list of substances that at high levels can affect the sensor and cause temporary readings on the digital display that are not carbon monoxide readings:

Methane, propane, iso-butane, ethylene, ethanol, alcohol, iso-propanol, benzene, toluene, ethyl acetate, hydrogen, hydrogen sulfide, sulfur dioxides.

Also most aerosol sprays, alcohol based products, paints, thinners, solvents, adhesives, hair sprays, after shaves, perfumes, auto exhaust (cold start) and some cleaning agents.

THE PEAK LEVEL MEMORY BUTTON

Located on the front of our CO detectors is another unique feature—the peak

level memory button.

The main function of this button is to allow you to see the highest CO level recorded by the unit since it was last reset. This way, if the detector has been alarming for some time before you get to it (like if you were away), you simply press this button and it will display the highest level it recorded.

For instance: If the detector was displaying, say 20 ppm, and you press the peak level button and it shown 200 ppm, you know the problem was much worse before you got to the detector. Now you know exactly how big a problem you are dealing with and you can react accordingly.

The peak level memory button is also a big help to a service technician or fireman you may have called to investigate a CO problem. Because you should open windows and turn off appliances when the detector alarms, the CO level displayed on the detector will most likely be "0" (or at least much lower) by the time a technician arrives. With the touch of the peak level button, they too can see just how big a problem they're dealing with.

If you are going to call a service technician to investigate a CO problem, DO NOT reset the peak level memory before they arrive.

TO RESET THE PEAK LEVEL MEMORY

Note: Pressing the test/reset button alone does not reset the peak level memory. To do so, you must follow these two steps in this exact order:

Step 1. Press the peak level button.

Step 2. With the peak level button still pressed, press the test/reset button as well.

The number on the display will turn to "0". In a second or two, three bars will be displayed. The memory has now been cleared and the detector will begin monitoring for CO within a few minutes.

The only other way the peak level memory can be reset is if the detector is disconnected from its power source.

UNDERSTAND THE EFFECTS OF CARBON MONOXIDE EXPOSURE

Low Levels:

Generally 35 ppm and below.

Mid Levels:

Generally 35 ppm to 100 ppm.

High Levels:

Generally 100 ppm and above if no one is experiencing symptoms.

Dangerous Levels:

Generally 100 ppm and above if someone is experiencing symptoms.

Concentration of CO in Air (ppm = parts per million)	Approximate Inhalation Time and Symptoms Developed
50 ppm	The maximum allowable concentration for continuous exposure for healthy adults in any 8-hour period, according to OSHA.
200 ppm	Slight headache, fatigue, dizziness, nausea after 2-3 hours.
400 ppm	Frontal headaches within 1-2 hours, life threatening after 3 hours.
800 ppm	Dizziness, nausea and convulsions within 45 minutes. Unconsciousness within 2 hours. Death within 2-3 hours.
1,600 ppm	Headache, dizziness and nausea within 20 minutes. Death within 1 hour.
3,200 ppm	Headache, dizziness and nausea within 5-10 minutes. Death within 25-30 minutes.
6,400 ppm	Headache, dizziness and nausea within 1-2 minutes. Death within 5-10 minutes.
12,800 ppm	Death within 1-3 minutes.

WHAT TO DO WHEN THE ALARM SOUNDS

Determine if anyone in the household is experiencing symptoms of CO poisoning. The following symptoms are related to CARBON MONOXIDE POISONING and should be discussed with ALL members of the household:

Common Mild Exposure Symptoms:

Slight headache, nausea, vomiting, fatigue ("flu-like" symptoms).

Common Medium Exposure Symptoms:

Throbbing headache, drowsiness, confusion, fast heart rate.

Common Extreme Exposure Symptoms:

Convulsions, unconsciousness, heart and lung failure.
It can cause brain damage and death.

If you experience even mild symptoms of CO poisoning, consult your doctor immediately!

WARNING: Actuation of this device indicates the presence of carbon monoxide (CO) which can be fatal.

DANGEROUS LEVEL ALARMS

Unit reads 100 ppm or above and someone is experiencing symptoms of CO poisoning.

Emergency Procedure:

Follow if you suspect Co and anyone is experiencing symptoms of CO poisoning:

Gather your family and other members of the residence together and immediately evacuate the home. This is a potentially life-threatening EMERGENCY situation. Get everyone outside into fresh air. Call 911 or your local fire department from a telephone outside your home. Do not re-enter your home under any condition until help has arrived and the problem causing the CO has been corrected.

HIGH LEVEL ALARMS

Unit reads 100 ppm or above of carbon monoxide.

If no one is experiencing symptoms of carbon monoxide poisoning, write down the reading on the digital display, then press the reset button on the detector which will turn off the alarm. If the detector alarms again within six minutes, it is sensing high levels of CO and can quickly become a dangerous situation. If this happens, follow the **Emergency Procedure** from the previous page.

After pressing the reset button, turn off the fuel-burning appliances (kerosene or oil heaters, furnaces, gas ranges, wood-burning stoves, water heaters, or other fossil-fuel burning appliances). For furnaces, you can simply turn down the thermostat to its lowest setting. Open windows for ventilation.

Verify that the detector is in full alarm and not alerting you to a malfunction. Sometimes you can mistake the malfunction alert for a CO alarm.

Continue to ventilate the home, keep fuel-burning appliances in the "off" position.

MID LEVEL ALARMS

Unit reads between 35 ppm and 100 ppm of carbon monoxide.

Alarms and/or readings in the mid-level range (35 ppm to 100 ppm) are cause for concern. Normally it would take a few hours at this level of exposure for a healthy adult to experience symptoms of CO poisoning. Individuals at high risk may be adversely affected by much shorter periods of exposure to these levels.

Follow the same procedure as given for Dangerous Level Alarms and High Level Alarms. This is not an emergency situation, but you should take action to find and fix the source of the CO and avoid prolonged exposure to these levels. Ventilate the premises and turn off fuel-burning appliances until the problem is fixed.

not be started until the engine has been serviced.

NOTE: The solid red light or clear light may appear if the fuel tank is near empty. Check the propane tank fuel level or replace with a full tank and check the machine again. If the red, clear or solid green lights persist, have the machine serviced by a qualified technician.

CARBON MONOXIDE DETECTOR

(The following information is from the *Carbon Monoxide Detector User's Guide* by Nighthawk Systems, Inc., 1996.)

Carbon monoxide (CO) is invisible, odorless, tasteless and non-irritating—completely undetectable to your five senses. That's why it's so important to your safety that you have a carbon monoxide detector. But, how do you know what to do if your detector alarms?

You have to *learn* what to do, because your five senses won't tell you. Familiarize yourself with the facts about carbon monoxide, how your new detector works, and what to do if it alarms.

HOW TO TEST YOUR DETECTOR

There are two aspects of the detector's operation that can be tested; the electronics and the sensor response. Instructions on testing each are outlined on the following pages.

TESTING THE ELECTRONICS

You should test the detector once a week, following the directions listed below. If at any time you test the detector and it does not perform as described below, have it replaced immediately.

Observe the detector weekly to make sure the red dot is blinking, indicating normal operation.

If the dot is not blinking, unplug the detector for three minutes, then plug in again. This will clear the detector for restart. If the dot does not resume blinking, your detector may be malfunctioning.

To test the detector, press the Test/Reset button and hold it down for 10 to 15 seconds. If the detector is operating properly, you should notice the following:

- ▶ After holding the test button for 10 to 15 seconds, a loud, *constant* alarm will sound. (**Note:** the 85 decibel alarm is quite loud at close range and could cause hearing loss after prolonged exposure. When you test the detector, we advise you to place your finger over the sounder opening in the upper center of the detector.)
- ▶ You will see several changing three digit numbers (from 100 to 350) appear on the digital display. These numbers ARE NOT a carbon monoxide reading; they merely represent a *simulated* reading the detector displays during its testing procedure.
- ▶ Release the test button. This will turn off the alarm.
- ▶ After you release the test button, "888" will appear on the digital display to show that all LED segments are working properly.
- ▶ Then, three bars will appear on the digital display to indicate the detector is now in the reset mode. The three bars will remain for two and a half minutes, the red dot will continue blinking.
- ▶ Within five minutes, a reading will appear on the digital display. The number will probably be zero (0). This is a normal condition for most households and shows that no measurable amount of CO is being detected.

NOTE: Pressing the Test/Reset button tests the functions of the detector's

internal components, circuitry and micro-computer.

You do not need to press the test button to take a CO reading. CO readings are automatically shown on the detector's digital display. If the detector shows zero (0), then no measurable amount of CO has been sensed by the detector within the past two and a half minutes.

TESTING THE SENSOR RESPONSE

While it is not required, on occasion you may wish to observe and become familiar with your detector's response in the actual presence of carbon monoxide. The best and safest way to do this is with either a cigarette or an incense stick. To perform this test you will need: your detector (that has been powered up for at least two hours), matches or a butane lighter, an ashtray, and either a cigarette or an incense stick.

WARNING: This test should be done by adults only. Children should be warned never to light matches or butane lighters. Please use caution when performing the test described below. Avoid burns from flame or hot materials. Avoid inhaling excessive smoke from the cigarette or incense stick. Extinguish all flames and properly discard all hot materials.

Step 1. With a match or a lighter, light a single cigarette or incense stick. Extinguish the match or lighter. Make sure an ashtray is available to discard ashes, matches and the burned cigarette or incense stick.

Step 2. Hold the smoldering cigarette or incense stick 12 - 15 inches directly *below* the bottom air vents of the CO detector, making sure the stream of smoke rises into the vents.

Step 3. Continue holding the cigarette or incense stick directly below the detector for 3 - 5 minutes. This time is needed as the detector samples the air every 2½ minutes. **Note:** Do not hold the cigarette or incense stick closer than 12 inches to the detector as smoke *will* cause a yellow stain to develop on the detector's outer case.

Step 4. After 3 - 5 minutes you should see a reading on the digital display. If the reading is greater than 600 ppm, the detector will alarm in about five minutes.

Step 5. If your detector alarms, you can silence it by pressing Test/Reset button.

Step 6. Extinguish the cigarette or incense stick by pressing the smoldering tip into the ashtray.

HOW TO KNOW IF YOUR DETECTOR IS MALFUNCTIONING

Your detector performs an internal self-diagnosis every two and a half minutes to make sure that it is functioning properly. The detector is designed to alert you in the unusual event of a malfunction.

IF THE DETECTOR MALFUNCTIONS

In the rare event that your detector malfunctions, it will alert you with one of these signal groups (depending upon the type of malfunction that occurs):

Malfunction Signal Group 1 - Component Failure

- An intermittent "chirping" alarm will sound every 25 seconds, and
- An "Err" message will appear on the digital display

OR,

Malfunction Signal Group 2 - Microprocessor Failure

- The alarm will sound continuously, and
- The digital display will be blank, and
- The alarm cannot be shut off by pushing the "Test/Reset" button

Unplug the detector immediately and return for warranty exchange.

WHAT TO DO IF YOU'RE NOT SURE

Please familiarize yourself with the malfunction alert, and do not confuse these signals with an alarm.

If your detector sounder is beeping, and you are not sure if it is a CO alarm or malfunction alert, reset the alarm, open windows for ventilation, turn off fuel-burning appliances (like kerosene or oil heaters, furnaces, gas ranges, wood-burning stoves, water heaters, or other fossil-fuel burning appliances). For furnaces, you can simply turn down the thermostat to its lowest setting. Open windows and doors for ventilation.

Before you call a qualified technician (such as a licensed heating contractor, utility service technician, chimney sweep or fuel provider) to check your residence for CO, remember that you will probably be charged for a service call.

Never ignore a CO detector alarm. A true alarm is an indication of potentially dangerous levels of carbon monoxide. CO detectors are designed to alert you to the presence of carbon monoxide before an emergency, before most people would experience symptoms of carbon monoxide poisoning, giving you time to resolve the problem calmly.

HOW TO CARE FOR YOUR DETECTOR

To keep your detector in good working order, you must follow these simple steps:

DO:

- Test the detector once a week by pressing the Test/Reset button.
- Vacuum the detector cover once a month to remove accumulated dust. Use the soft brush attachment of your vacuum cleaner, and unplug the detector from the electrical outlet before vacuuming.
- Instruct children never to touch, unplug or otherwise interfere with the detector. Warn children of the dangers of CO poisoning.

DON'T:

- Never use detergents or solvents to clean the detector. Chemicals can permanently damage or temporarily contaminate the sensor.
- Avoid spraying air fresheners, hair spray, paint or other aerosols near the detector.
- Do not paint the detector. Paint will seal the vents and interfere with proper sensor operation.
- Do not mount the detector directly above or near a diaper pail, as high amounts of methane gas can cause temporary readings on the digital display.

Note: If you will be staining or stripping wood floors or furniture, painting, wall-papering, or using aerosols or adhesives for a do-it-yourself project or hobby, **before you begin, remove the detector to a remote location to prevent possible damage to or contamination of the sensor.** You may wish to unplug the detector and store in a plastic bag during the project.

The following is a list of substances that at high levels can affect the sensor and cause temporary readings on the digital display that are not carbon monoxide readings:

Methane, propane, iso-butane, ethylene, ethanol, alcohol, iso-propanol, benzene, toluene, ethyl acetate, hydrogen, hydrogen sulfide, sulfur dioxides.

Also most aerosol sprays, alcohol based products, paints, thinners, solvents, adhesives, hair sprays, after shaves, perfumes, auto exhaust (cold start) and some cleaning agents.

THE PEAK LEVEL MEMORY BUTTON

Located on the front of our CO detectors is another unique feature—the peak level memory button.

The main function of this button is to allow you to see the highest CO level recorded by the unit since it was last reset. This way, if the detector has been alarming for some time before you get to it (like if you were away), you simply press this button and it will display the highest level it recorded.

For instance: If the detector was displaying, say 20 ppm, and you press the peak level button and it shown 200 ppm, you know the problem was much worse before you got to the detector. Now you know exactly how big a problem you are dealing with and you can react accordingly.

The peak level memory button is also a big help to a service technician or fireman you may have called to investigate a CO problem. Because you should open windows and turn off appliances when the detector alarms, the CO level displayed on the detector will most likely be "0" (or at least much lower) by the time a technician arrives. With the touch of the peak level button, they too can see just how big a problem they're dealing with.

If you are going to call a service technician to investigate a CO problem, DO NOT reset the peak level memory before they arrive.

TO RESET THE PEAK LEVEL MEMORY

Note: Pressing the test/reset button alone does not reset the peak level memory. To do so, you must follow these two steps in this exact order:

Step 1. Press the peak level button.

Step 2. With the peak level button still pressed, press the test/reset button as well.

The number on the display will turn to "0". In a second or two, three bars will be displayed. The memory has now been cleared and the detector will begin monitoring for CO within a few minutes.

The only other way the peak level memory can be reset is if the detector is disconnected from its power source.

UNDERSTAND THE EFFECTS OF CARBON MONOXIDE EXPOSURE

Low Levels:

Generally 35 ppm and below.

Mid Levels:

Generally 35 ppm to 100 ppm.

High Levels:

Generally 100 ppm and above if no one is experiencing symptoms.

Dangerous Levels:

Generally 100 ppm and above if someone is experiencing symptoms.

Concentration of CO in Air (ppm = parts per million)	Approximate Inhalation Time and Symptoms Developed
50 ppm	The maximum allowable concentration for continuous exposure for healthy adults in any 8-hour period, according to OSHA.
200 ppm	Slight headache, fatigue, dizziness, nausea after 2-3 hours.
400 ppm	Frontal headaches within 1-2 hours, life threatening after 3 hours.
800 ppm	Dizziness, nausea and convulsions within 45 minutes. Unconsciousness within 2 hours. Death within 2-3 hours.
1,600 ppm	Headache, dizziness and nausea within 20 minutes. Death within 1 hour.
3,200 ppm	Headache, dizziness and nausea within 5-10 minutes. Death within 25-30 minutes.
6,400 ppm	Headache, dizziness and nausea within 1-2 minutes. Death within 5-10 minutes.
12,800 ppm	Death within 1-3 minutes.

WHAT TO DO WHEN THE ALARM SOUNDS

Determine if anyone in the household is experiencing symptoms of CO poisoning. The following symptoms are related to CARBON MONOXIDE POISONING and should be discussed with ALL members of the household:

Common Mild Exposure Symptoms:

Slight headache, nausea, vomiting, fatigue ("flu-like" symptoms).

Common Medium Exposure Symptoms:

Throbbing headache, drowsiness, confusion, fast heart rate.

Common Extreme Exposure Symptoms:

Convulsions, unconsciousness, heart and lung failure.
It can cause brain damage and death.

If you experience even mild symptoms of CO poisoning, consult your doctor immediately!

WARNING: Actuation of this device indicates the presence of carbon monoxide (CO) which can be fatal.

DANGEROUS LEVEL ALARMS

Unit reads 100 ppm or above and someone is experiencing symptoms of CO poisoning.

Emergency Procedure:

Follow if you suspect Co and anyone is experiencing symptoms of CO poisoning:

Gather your family and other members of the residence together and immediately evacuate the home. This is a potentially life-threatening EMERGENCY situation. Get everyone outside into fresh air. Call 911 or your local fire department from a telephone outside your home. Do not re-enter your home under any condition until help has arrived and the problem causing the CO has been corrected.

HIGH LEVEL ALARMS

Unit reads 100 ppm or above of carbon monoxide.

If no one is experiencing symptoms of carbon monoxide poisoning, write down the reading on the digital display, then press the reset button on the detector which will turn off the alarm. If the detector alarms again within six minutes, it is sensing high levels of CO and can quickly become a dangerous situation. If this happens, follow the **Emergency Procedure** from the previous page.

After pressing the reset button, turn off the fuel-burning appliances (kerosene or oil heaters, furnaces, gas ranges, wood-burning stoves, water heaters, or other fossil-fuel burning appliances). For furnaces, you can simply turn down the thermostat to its lowest setting. Open windows for ventilation.

Verify that the detector is in full alarm and not alerting you to a malfunction. Sometimes you can mistake the malfunction alert for a CO alarm.

Continue to ventilate the home, keep fuel-burning appliances in the "off" position.

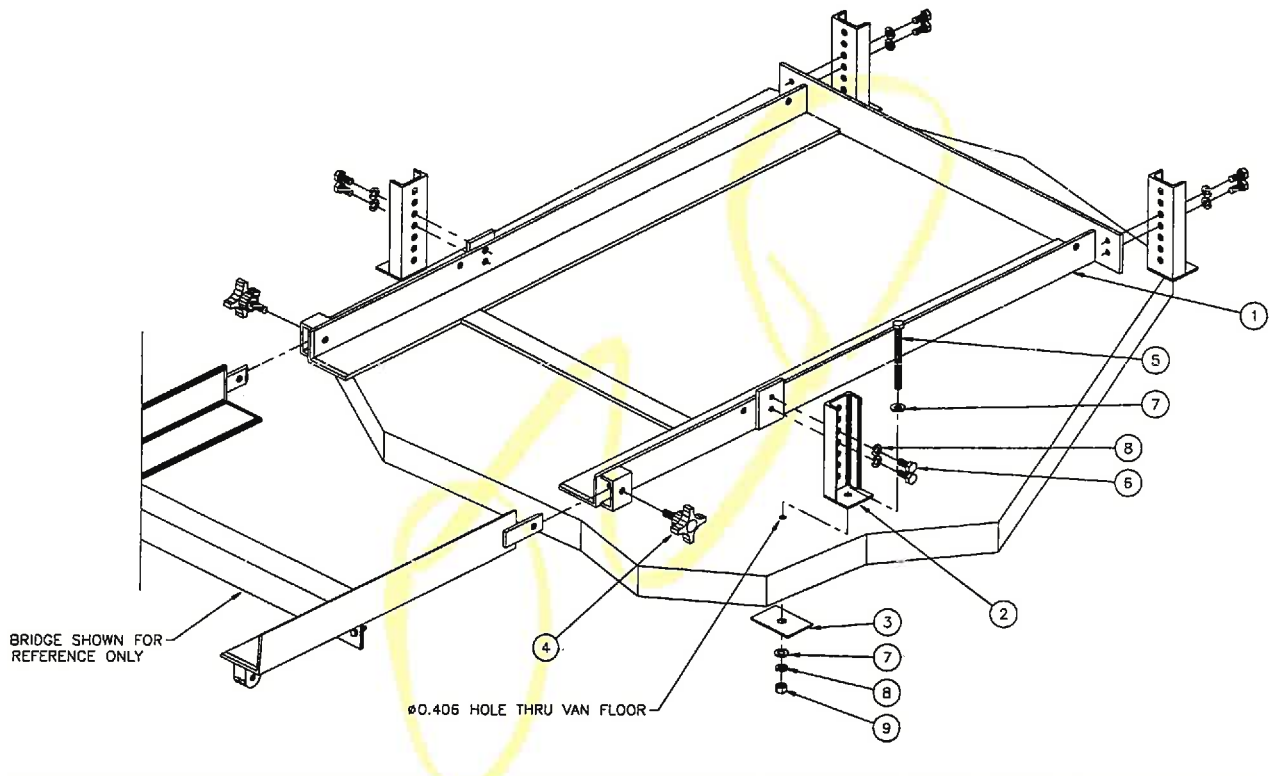
MID LEVEL ALARMS

Unit reads between 35 ppm and 100 ppm of carbon monoxide.

Alarms and/or readings in the mid-level range (35 ppm to 100 ppm) are cause for concern. Normally it would take a few hours at this level of exposure for a healthy adult to experience symptoms of CO poisoning. Individuals at high risk may be adversely affected by much shorter periods of exposure to these levels.

Follow the same procedure as given for Dangerous Level Alarms and High Level Alarms. This is not an emergency situation, but you should take action to find and fix the source of the CO and avoid prolonged exposure to these levels. Ventilate the premises and turn off fuel-burning appliances until the problem is fixed.

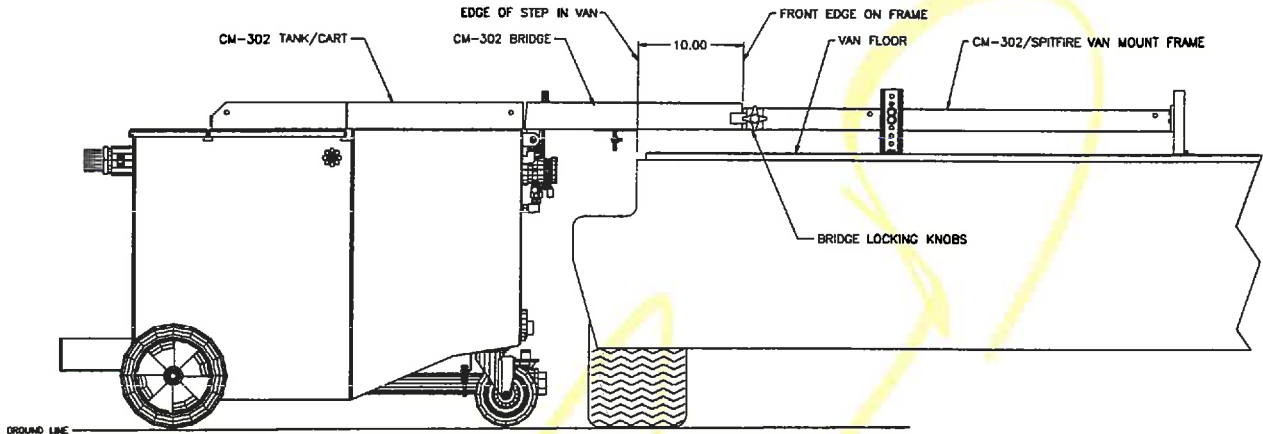
Figure 4-1: Van Mounting Frame Assembly



ITEM	PART NO	DESCRIPTION	QTY
1	000-015-291	Bracket, Truck Mounting	1
2	000-015-292	Bracket, Adjustable Frame	4
3	600-011-003	Tie Down Cleat Washer	4
4	000-061-106	Knob, 4 Flute Black with 3/8" Stud	2
5	000-143-150	Screw, 3/8 - 16 x 4" Hex Tap	4
6	000-143-017	Screw, 3/8 - 16 x 3/4" HHC	8
7	000-174-005	Washer, 3/8 Flat	8
8	000-174-021	Washer, 3/8 Lock	12
9	000-094-014	Nut, 3/8 - 16 Hex	4

Side Door

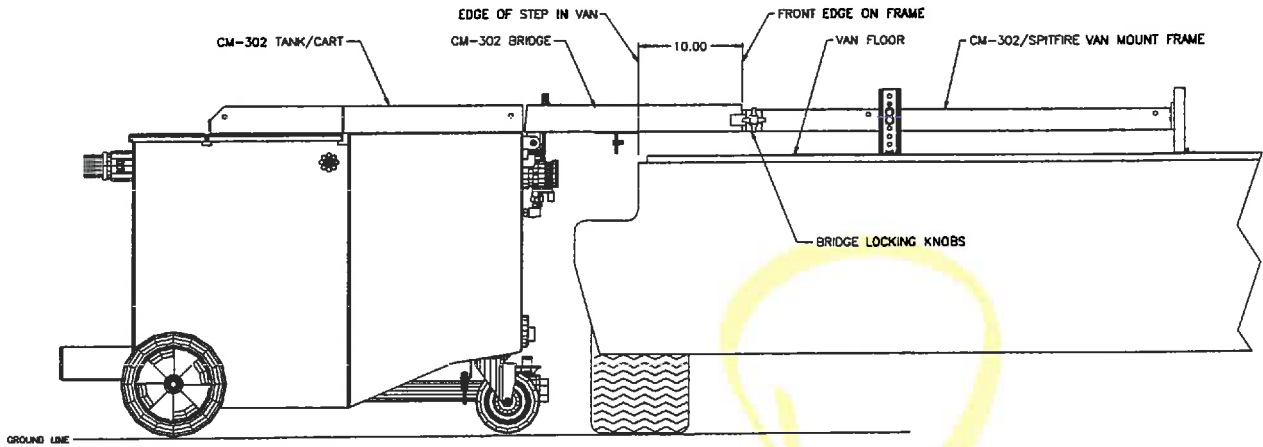
Figure 2-2: **Van Mounting Frame Installation**



◆ **WARNING** ◆

Ramp designed for use with unladen cart only. Empty tanks prior to loading or unloading. Do not walk on ramp.

Figure 4-2: Van Mounting Frame Installation



procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items."⁶

OSHA: Occupational Safety and Health Administration. A federal agency.

OSHA is a federal agency that creates safety standards for the Department of Labor. Most individual states have adopted the federal standards created by OSHA and it is the state that has the responsibility to enforce them. There are a few states, however that have chosen to add to the federal standards and thereby have created their own. Washington state has its own code of standards. The broad term used in referring to all Washington state codes is "Washington Administrative Code" or "WAC." The specific Washington state codes that we are concerned with are the "WISHA" or Washington Industrial Safety and Health Act rules. The state of California also has its own code of regulations, known as the "CCR" or "California Code of Regulations." Michigan has its own code of regulations. Most other states have adopted the federal code as their own and are termed "OSHA identical."

Applicable OSHA and WISHA Standards: The OSHA standard that is applicable to this project is Title 29, Part 1910 "Occupational Safety and Health Standards." OSHA 1910, subpart H, section 1910.110 deals with the storage and handling of liquefied petroleum gases (this is comparable to chapter 24, part F-1 of WISHA standards). OSHA 1910, subpart Z, section 1910.1000 deals air contaminants (this is comparable to chapter 62, part H of WISHA). OSHA 1910, subpart G, section 1910.95 deals with occupational noise exposure (this is comparable to chapter 62, part K of WISHA).

Portable Container: A container designed to be readily moved, as distinguished from containers designed for stationary installations. Portable containers,

designed for transportation, filled to their maximum filling density include "cylinders," "cargo tanks," and "portable tanks" all three of which are separately defined. Containers designed to be readily moved from one usage location to another, but substantially empty of product, are "portable storage containers" and are separately defined.⁷

Qualification of Personnel. In the interest of safety, all persons employed in handling LP-Gases shall be trained in proper handling and operating procedures which the employer shall document. Effective Jan 1, 1993, all employees shall carry written certification of their job qualification issued by the training agent or a written document issued by the authority having jurisdiction identifying the functions each person is authorized to perform.⁸

REGULATIONS AND STANDARDS

HydraMaster has considered the following regulations and standards in designing the CM 302 and used them as guides:

NFPA 58 "Standard for the storage and handling of liquefied petroleum gases," 1992 edition.

This standard deals with the safe storage and handling of liquefied petroleum gas (LPG or Propane).

NFPA 501C "Recreational vehicles."

This standard deals with the design of over the road vehicles that have propane systems installed in them. This standard was consulted for reference only.

NFPA 505 "Powered industrial trucks including type, areas of use, maintenance, and operation."

This standard deals with the use of industrial trucks (e.g. forklifts). This standard was consulted because of its

consideration of the use of Propane fuel indoors.

NOTE: The NFPA is a national association that established guidelines for fire safety procedures. This is not a federal agency. The NFPA has no authority to police or enforce compliance with its published guidelines. Most states however have adopted the NFPA standards as part of their own 'Code of Regulations.'

CFR 29 Federal Code of Regulations, "Occupational Safety and Health Administration" (OSHA).

The OSHA standard that is applicable to this equipment is Title 29, Part 1910, "Occupational Safety and Health Standards." Subpart H, section 1910.110 deals with the storage and handling of liquefied petroleum gases. Subpart Z, section 1910.1000 deals with air contaminants. Subpart G, section 1910.95 deals with occupational noise exposure.

NOTE: Most individual states have adopted the federal standards created by OSHA and it is the state that has the responsibility to enforce them. There are a few states, however that have chosen to add to the federal standards and thereby have created their own. Washington state has its own code of standards. The broad term used in referring to all Washington state codes is "Washington Administrative Code" or "WAC." The specific Washington state codes that we are concerned with are the "WISHA" or Washington Industrial Safety and Health Act rules. The state of California also has its own code of regulations, known as the CCR or California Code of Regulations. Michigan has its own code of regulations. Most other states have adopted the federal code as their own and are termed "OSHA identical."

CCR 13 California Code of Regulations, Sections 2400-2407, "Utility and Lawn and Garden Equipment Engines."

Chapter 9 of Title 13 deals with 'Off-Road Vehicles and Engine Pollution Control Devices'. This chapter establishes Exhaust Emission Standards for engines rated below 25 horsepower and sold in the state of California.

NOTE: The engine on this equipment has been Certified by the California Air Resources Board for sale in the state of California. The engine has also been Certified by the Environmental Protection Agency and given the Engine Family name of VHD480U1L2EA.

Loudness Levels of Familiar Noises⁹
 (Approximate Average Including Ear Network)

Approximate Noise Levels	Relative Intensities*	Decibles	Familiar Noises
Deafening	10^{13}	130	Threshold of painful feeling. Airplane and propeller at 10 feet.
	10^{12}	120	
	10^{11}	110	Train passing at high speed.
	10^{10}	100	Riveter at 30 feet, auto horn at 20 feet, pneumatic drill at 10 feet.
	10^9	90	Subway train, fire siren at 75 feet, noisy street, auto at 60 mph.
Noisy	10^8	80	Very noisy restaurant, auto at 40 mph, avg. stenographic room.
	10^7	70	Factories, auto at 20 mph, noisy office, average restaurant.
Average	10^6	60	Department store, average conversation at 3 feet.
	10^5	50	Average office, quiet street, noisy residence.
Quiet	10^4	40	Quiet restaurant, museum, average school, library reading rooms.
Very Quiet	10^3	30	Auditoriums, average whisper at 5 feet, very quiet residence.
	10^2	20	Broadcasting studio, zero of AIEE Scale 14 db.
Sound Proof Rooms	10	10	Zero of Original Scale 8.5 db.
		0	Threshold of audibility.

* Intensity above threshold = 10^{16} watts per sq. cm.

DESIGN CRITERIA

HydraMaster has used the following as design criteria:

Emission Control Limits

Carbon Monoxide (CO)

35 ppm (40 mg per cubic meter) TWA (OSHA)

50 ppm (55 mg per cubic meter) PEL w/ 200 ppm ceiling (OSHA)

NOTE: WISHA, (Washington state equivalent of OSHA) Chapter 62, Part H deals with air contaminants. The entire standard is listed as "PEL" and has only the one limit of 35 ppm.

300 grams per brake horsepower-hour (CARB)

Nitric Oxide (NOX)

25 ppm (30 mg per cubic meter) TWA (OSHA)

10 grams per brake horsepower-hour (CARB)

TWA: Time Weighted Average. Average exposure over an 8 hour period.

PEL: Permissible Exposure Limit. Exposure limit for any single test period.

(The OSHA limits deal with volume of contaminants in the atmosphere in which a person is occupying regardless of the source. The CARB limits deal with the specific volume of contaminants in the exhaust of a gas-powered engine.)

Noise Control Limits

At 85 decibels, a hearing conservation program is required by OSHA.

REFERENCES FOR THIS SECTION

1. *NFPA 58, Standard for the Storage and Handling of Liquefied Petroleum Gases, 1992 Edition, p. 9.*
2. *CO Emissions Controller, Increases Fuel Economy While Lowering Emissions, ADV-5209 0893, by Suburban Propane.*
3. *NFPA 58, Standard for the Storage and Handling of Liquefied Petroleum Gases, 1992 Edition, p. 10.*
4. *Ibid.*
5. *Ibid., p. 11.*
6. *Ibid., p. 9.*
7. *Ibid., p. 11.*
8. *Ibid., p. 8.*
9. By Paxton Products Inc., Santa Monica, California.

HYDRAMASTER

Corporation
11015 47th Avenue W, Mukilteo, WA 98275

CM 302 Installation Manual

Machine Serial Number _____

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HYDRAMASTER® Corporation
Mukilteo, Washington

182-302

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Revised August 21, 1997

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*CM 302
Installation Manual*

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Referenced Product Support Bulletins	

Responsibilities

CM 302

Section 1-1

PURCHASER'S RESPONSIBILITIES

The purchaser's responsibilities, prior to arrival of unit, are:

1. For van installation, to install $\frac{5}{8}$ " exterior plywood flooring in the vehicle and cover it with artificial turf.

◆ CAUTION ◆

In Dodge vans the fuel tanks are located directly against the floor. Caution must be used when drilling any holes through the floor. (See Product Support Bulletin 94062 at the end of this manual.)

2. To purchase group size CB16CL-B battery and have the battery "slow" charge if new.

◆ CAUTION ◆

If the battery is not fully charged, damage can occur to the engine charging regulator.

3. **To read the owner's manual!!** It is the purchaser's responsibility to read the unit operation manual and to familiarize himself with the information contained therein. *Special attention should be paid to all **Cautions and Warnings.***
4. To follow the safety awareness training provided by the sales representative.

SALES REP'S RESPONSIBILITIES

The sales representative's responsibilities are:

1. To accept the shipment.

If the unit shows any outward signs of damage, do not sign the delivery receipt until you have closely inspected the unit and noted any damage on the delivery receipt.

The salesperson from whom you purchased your unit is responsible for supervising the correct installation of the unit and thoroughly training you in its operation, maintenance and precautions.

2. To correctly install the unit.

- ▶ Vehicle of proper load carrying capacity (recommendation: ½ ton).
- ▶ Placing the unit and recovery tank in your vehicle and securing them with hardware supplied.
- ▶ Connecting the battery.
- ▶ Checking the pump, vacuum blower and engine oil levels prior to starting the unit.
- ▶ Starting the unit to check the engine and see that all systems function normally.
- ▶ Checking all hoses, wands, etc. for correct operation.

3. To train the purchaser in safety awareness.

- ▶ A thorough review of the operation manual with purchaser.
- ▶ Instruction and familiarization in: how to correctly start up and shut down the unit, how to correctly clean with the unit, where and how often to check and change component oil levels, how the unit's systems work, how to troubleshoot the unit, how to do basic repairs, safety precautions and their importance, freezing damage and how to

avoid it, hard water damage and how to avoid it.

- ▶ A thorough review of the unit warranty and warranty procedures.
- ▶ A review of regulations involved in the operation of propane powered equipment.
- ▶ A thorough review of hard water precautions and warnings.
- ▶ How to determine hard water areas.
- ▶ Use of water softening systems.

Vehicle Prep

CM 302

Section 2-1

When selecting a truck, remember the preferable vehicle for installation is a cargo van with a heavy-duty suspension package and a three quarter ton capacity. If a fresh water tank is added a 2,400 pound payload capacity is required.

TRUCK PREPARATION

The manufacturer recommends the installation of plywood flooring, covered with poly propylene backed astroturf (do not use rubber-backed), in the vehicle prior to installation of machine.

◆ CAUTION ◆

Be cautious when drilling any holes through the van floor. Many vans have critical components mounted directly below the van floor that could be damaged by a misplaced drill bit. (See Product Support Bulletins 92102, 94062 and 94063 at the end of this manual.)

This provides 'metal to wood' mounting rather than 'metal to metal', and provides insulation and makes an attractive van interior. Astroturf should be color keyed to the van interior.

Materials Needed:

1. 2 sheets 4x8x5/8" exterior plywood
2. 6'x12' piece of commercial astroturf
3. 16-1 1/2" sheet metal screws
4. 1 quart marine adhesive (optional)
5. 1 staple hammer with 1/2" staples

PLACEMENT OF UNIT IN VEHICLE

Ensure that the machine is well secured to the floor of the van with the hardware supplied. A sudden or crash stop will cause the machine to slide forward! Protect yourself and the machine. **SECURE IT!**

◆ **WARNING** ◆

It is recommended by the manufacturer that the exhaust from the front of the machine be vented down under the truck to prevent carbon monoxide from entering the job site. **Always park the truck so the exhaust is blowing away from the job site.**

The manufacturer also recommends the installation of aluminum vents in the truck roof to allow heat to escape.

◆ **WARNING** ◆

Never operate this machine with a portable gas can inside the truck. Doing so increases the risk of a fire or explosion.

Mount a fire extinguisher just inside the rear or side door for emergencies.

◆ **WARNING** ◆

Do not use a portable propane tank inside of the truck or van. It is dangerous and illegal in most states.

◆ **WARNING** ◆

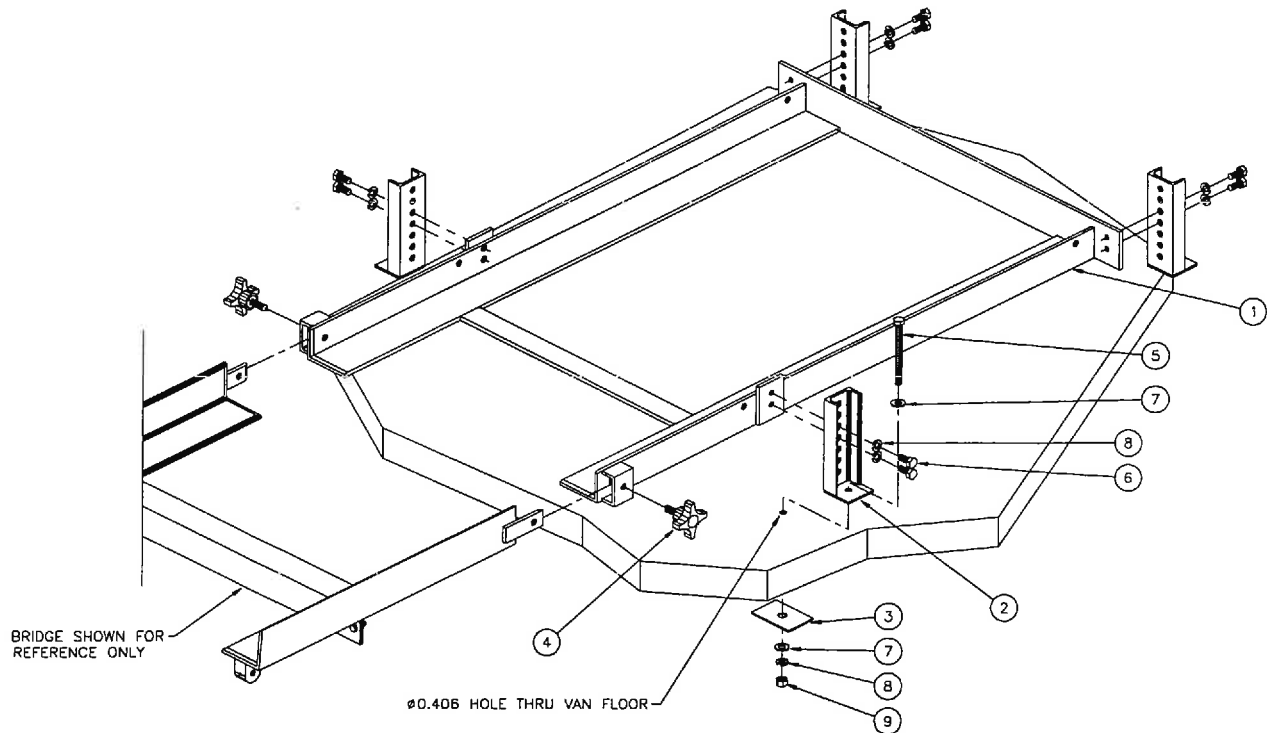
Transportation in a vehicle of any vented fuel container that presently has or has ever contained a flammable liquid is strictly forbidden by HydraMaster Corporation and by federal and state regulation.

◆ **WARNING** ◆

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Figure 2-1: Van Mounting Frame Assembly

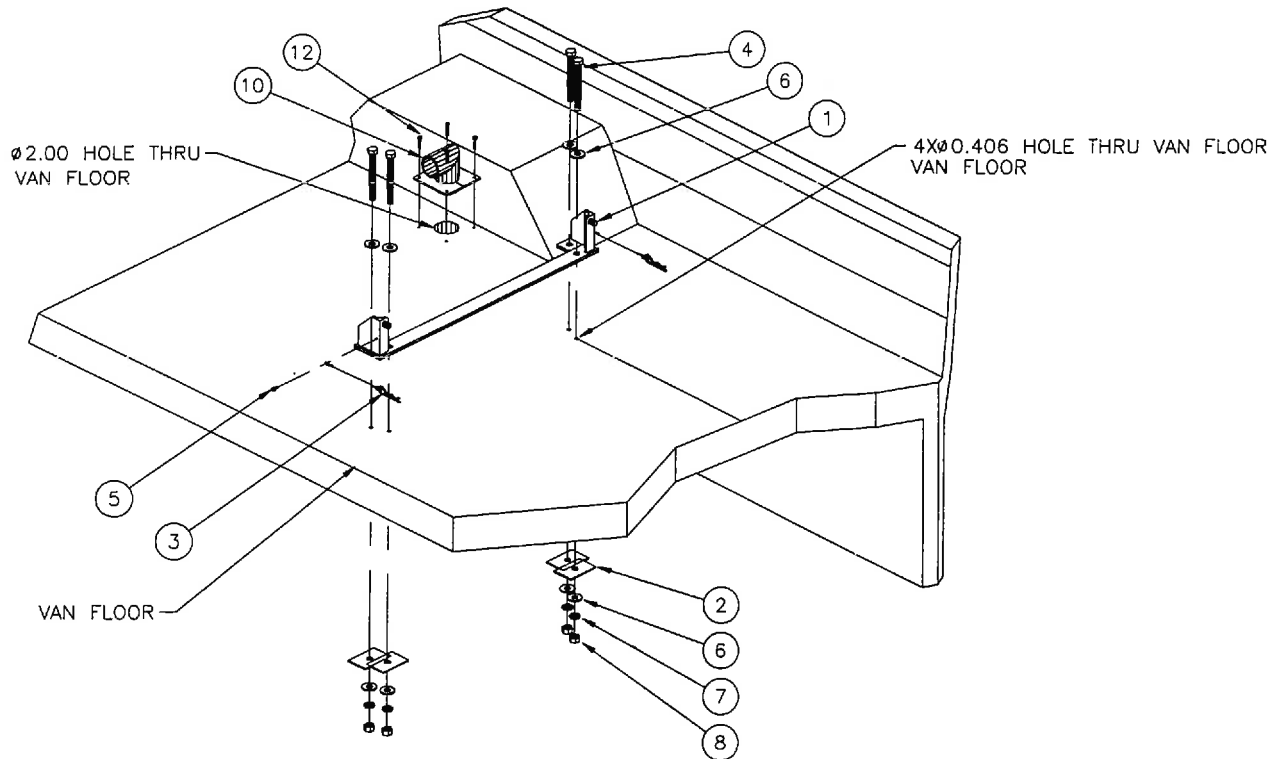
D3085



ITEM	PART NO	DESCRIPTION	QTY
1	000-015-291	Bracket, Truck Mounting	1
2	000-015-292	Bracket, Adjustable Frame	4
3	600-011-003	Tie Down Cleat Washer	4
4	000-061-106	Knob, 4 Flute Black with $\frac{3}{8}$ " Stud	2
5	000-143-150	Screw, $\frac{3}{8}$ - 16 x 4" Hex Tap	4
6	000-143-017	Screw, $\frac{3}{8}$ - 16 x $\frac{3}{4}$ " HHC	8
7	000-174-005	Washer, $\frac{3}{8}$ Flat	8
8	000-174-021	Washer, $\frac{3}{8}$ Lock	12
9	000-094-014	Nut, $\frac{3}{8}$ - 16 Hex	4

Figure 2-2: Tank Cart Hold-Down Bracket and Vent Adapter Install

D3492



ITEM	PART NO	DESCRIPTION	QTY
(See also Figure 4-4)			
1	000-015-343	Bracket, Tank/Cart to Truck - Hold Down	1
2	600-011-003	Tie Down Cleat Washer	4
3	000-103-026	Hitch Pin Assembly	2
4	000-143-150	Screw, 3/8 - 16 x 4" Hex Tap (All Thread)	4
5	000-143-166	Screw, 10 - 24 x 3/8" s/s HHC	2
6	000-174-005	Washer, 3/8 Flat	8
7	000-174-021	Washer, 3/8 Lock	8
8	000-094-014	Nut, 3/8 - 16 Hex	4
9	000-114-008	Rail Set, Loading Rt and Lt with Spacer	1
10	000-001-025	Adapter, 2" Thru Van Floor Vent	1
11	000-068-397	Hose Assembly, 2" Vapor Vent	1
12	000-143-536	Screw, #10 x 1" PH HD Sheet Metal	4

Figure 2-3: **Van Mounting Frame Install**
(Side Door View)

D3085

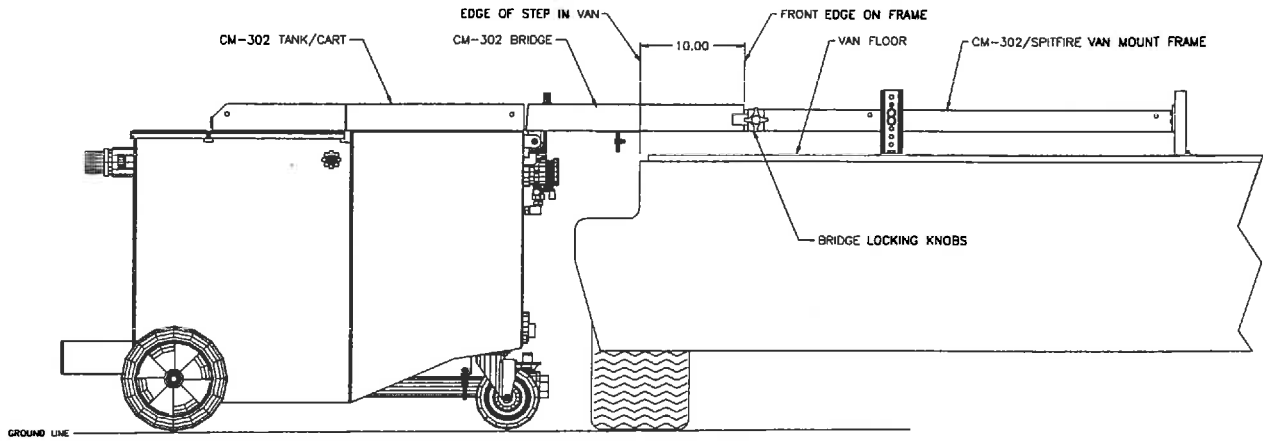


Figure 2-4: **Tank Cart in Hold-Down Position**

D3492

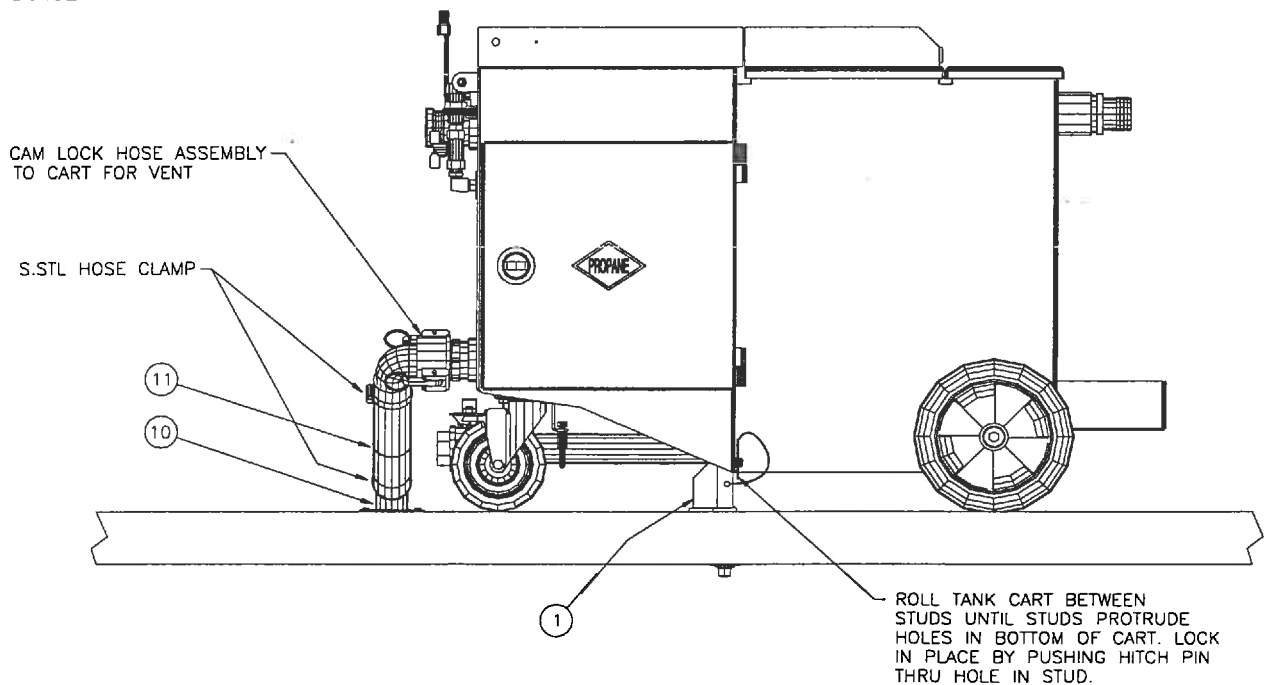
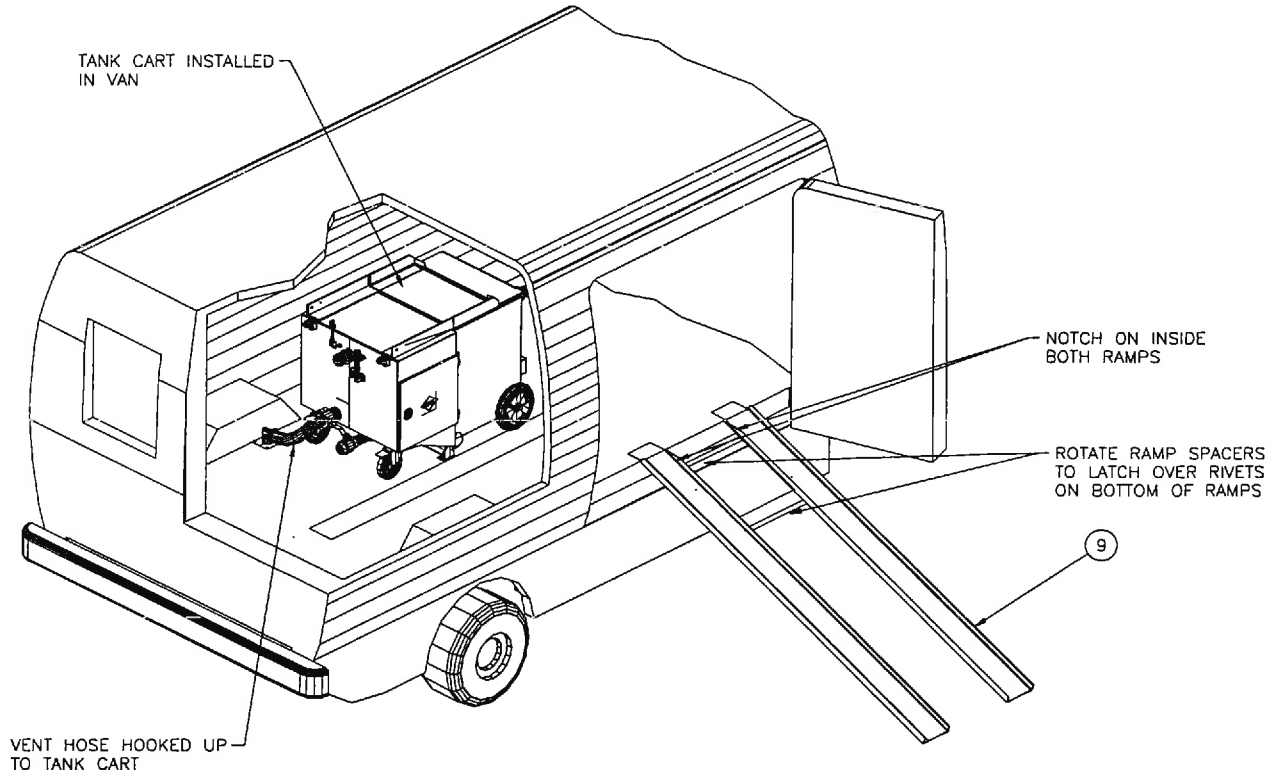


Figure 2-5: Tank Cart Loading Ramp

D3492

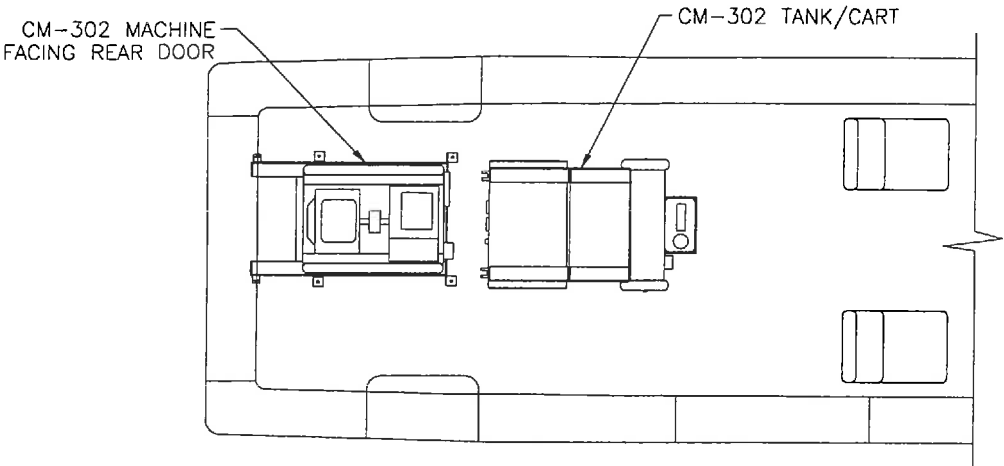


◆ WARNING ◆

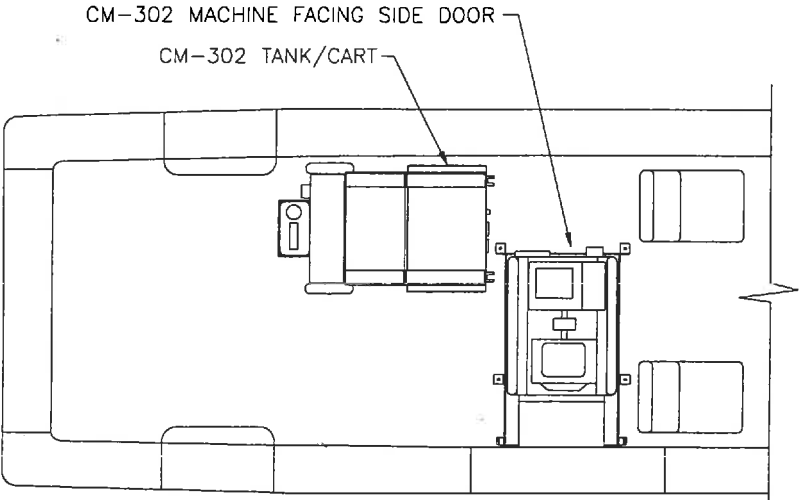
Ramp designed for use with unladen cart only. Empty tanks prior to loading or unloading. Do not walk on ramp.

Figure 2-6: CM 302 Installation Options

C3669



REAR DOOR INSTALLATION



SIDE DOOR INSTALLATION

Storage Recommendations

CM 302

Section 3-1

STORAGE OF CM 302

◆ CAUTION ◆

Do not store the CM 302 unit indoors with the propane cylinder installed. Remove the cylinder and store outdoors as indicated below.

The CM 302 may be stored safely in any enclosed area provided it does not block access to any building fire safety equipment, or block any area intended for the safe egress of people.

◆ WARNING ◆

Do not store the unit in an area that may experience freezing temperatures unless the "freeze guard" procedure has been done prior to placing the unit in storage.

STORAGE OF PROPANE CYLINDERS

Propane cylinders shall not be stored inside buildings frequented by the public.

Storage outdoors shall be in compliance with NFPA 58 5-4. In brief this states that portable containers shall be a minimum of 5 feet from doorways, windows, property lines, busy thoroughfares and sidewalks. The containers must be protected by industrial fencing or in a ventilated metal locker or rack that prevents tampering with valves and pilferage of the cylinders. The location must

also be protected from vehicular impact.

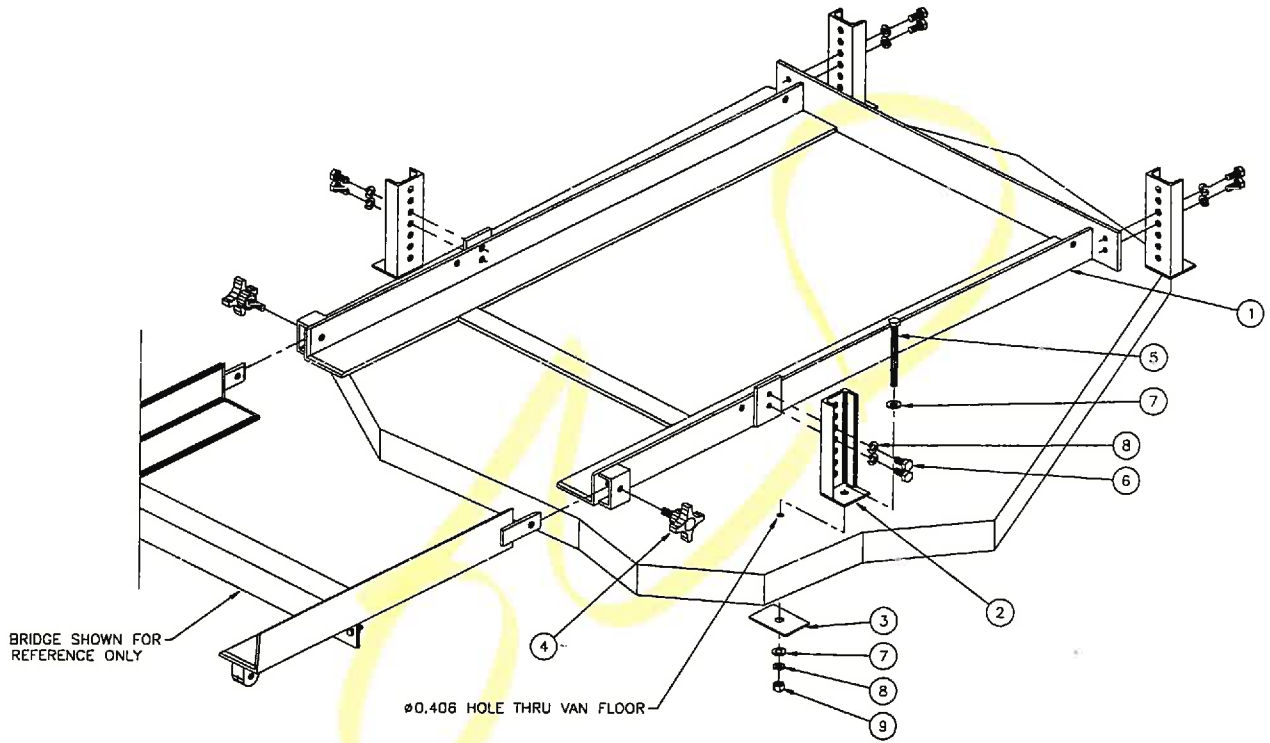
Storage locations are also required to have a fire extinguisher installed, with a minimum capacity of 18 lb. dry chemical with a B:C rating.

avoid it, hard water damage and how to avoid it.

- ▶ A thorough review of the unit warranty and warranty procedures.
- ▶ A review of regulations involved in the operation of propane powered equipment.

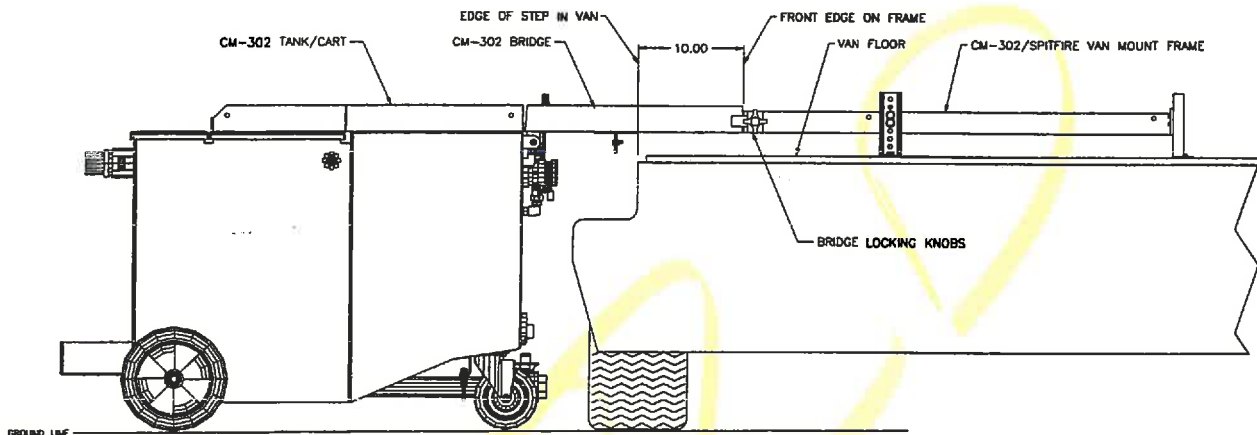


Figure 2-1: Van Mounting Frame Assembly



ITEM	PART NO	DESCRIPTION	QTY
1	000-015-291	Bracket, Truck Mounting	1
2	000-015-292	Bracket, Adjustable Frame	4
3	600-011-003	Tie Down Cleat Washer	4
4	000-061-106	Knob, 4 Flute Black with 3/8" Stud	2
5	000-143-150	Screw, 3/8 - 16 x 4" Hex Tap	4
6	000-143-017	Screw, 3/8 - 16 x 3/4" HHC	8
7	000-174-005	Washer, 3/8 Flat	8
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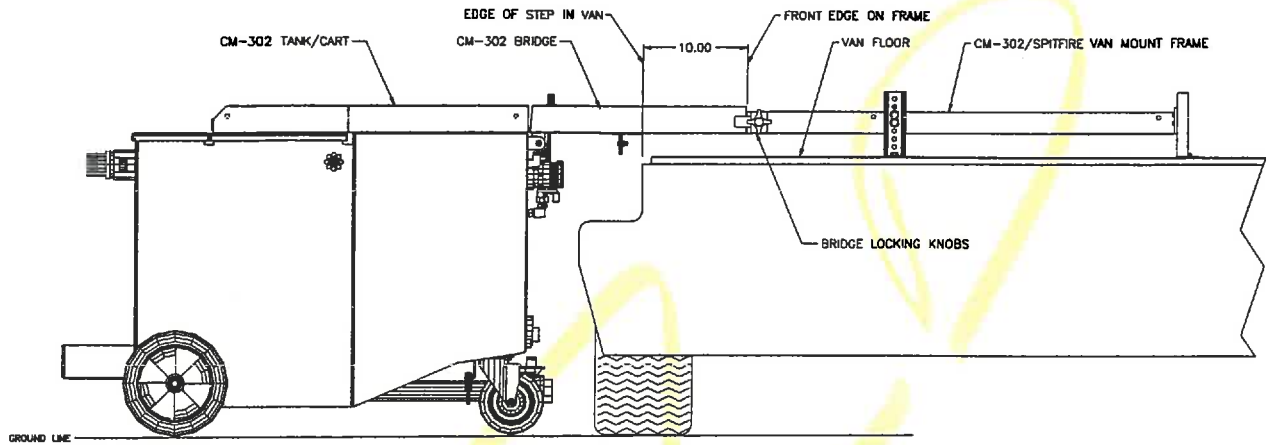
Figure 2-2: Van Mounting Frame Installation



◆ WARNING ◆

Ramp designed for use with unladen cart only. Empty tanks prior to loading or unloading. Do not walk on ramp.

Figure 2-2: Van Mounting Frame Installation



CM 302

Technician Training Form

This form must be completed and signed before an employee may operate the CM 302 machine. A copy of this form will be placed in the employee's personnel file.

I have read the "Technician's Safety Manual" and understand it. I understand the risk involved in operating equipment that produces carbon monoxide and also the symptoms of carbon monoxide poisoning.

Name _____ Date _____

I have demonstrated the following to my instructor or supervisor.

- How to prepare the CM 302 for operation. Instructor's Initials: _____
- How to operate the CM 302 machine. Instructor's Initials: _____

When this form is completed correctly, you may operate the CM 302.

Employee's Signature _____ Date _____

Supervisor's Signature _____ Date _____

CM 302

Technician Training Form

This form must be completed and signed before an employee may operate the CM 302 machine. A copy of this form will be placed in the employee's personnel file.

I have read the "Technician's Safety Manual" and understand it. I understand the risk involved in operating equipment that produces carbon monoxide and also the symptoms of carbon monoxide poisoning.

Name _____ Date _____

I have demonstrated the following to my instructor or supervisor.

- How to prepare the CM 302 for operation. Instructor's Initials: _____
- How to operate the CM 302 machine. Instructor's Initials: _____

When this form is completed correctly and returned to HydraMaster, you may operate the CM 302.

Employee's Signature _____ Date _____

Supervisor's Signature _____ Date _____

CM 302

Technician Training Form

This form must be completed and signed before an employee may operate the CM 302 machine. A copy of this form will be placed in the employee's personnel file.

I have read the "Technician's Safety Manual" and understand it. I understand the risk involved in operating equipment that produces carbon monoxide.

Name _____ Date _____

I have demonstrated the following to my instructor or supervisor.

- How to prepare the CM 302 for operation. Instructor's Initials: _____
- How to operate the CM 302 machine. Instructor's Initials: _____

When this form is completely correctly you may operate the CM 302.

Employee's Signature _____ Date _____

Supervisor's Signature _____ Date _____

HYDRAMASTER

Corporation
6323 204th Street SW, Lynnwood, WA 98036

PRODUCT SUPPORT BULLETIN

TO: All HydraMaster Distributors DATE: 14 Jun 1994
that Install Equipment

RE: Chevrolet CDS Installations PSB #: 94063

This is just a reminder...

When installing CDS or slide-in units in Chevrolet vans, caution must be used while drilling holes through the floor.

There are two areas in which to be cautious. The brake lines, which travel up over the transmission, are close to the blower mounting location. (See Product Support Bulletin 92102.) Also behind the passenger seat, below the floor, is the ABS control unit.

Please check below the van before drilling any holes. This will minimize costly mistakes.

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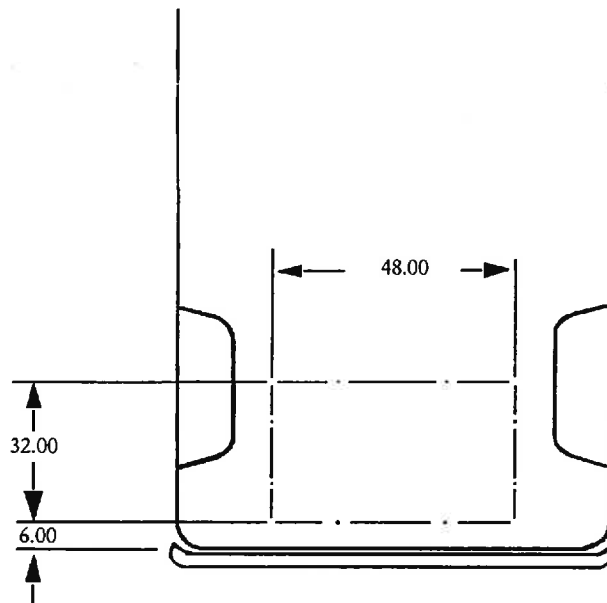
PRODUCT SUPPORT BULLETIN

TO: All HydraMaster Distributors DATE: 14 Jun 1994

RE: '93 Dodge Vans PSB #: 94062
Location of Fuel Tanks

It has come to our attention that the fuel tanks on 1993 and newer Dodge vans are located directly against the floor of the van. Caution must be used when drilling any holes through the floor. The attached illustration indicates the area in the rear of the van where no screws may penetrate the floor.

Anyone who has installed flooring in a 1993 or newer Dodge van may need to check to see that no damage was done to the fuel tank. The fuel tanks are rotationally molded polyethylene plastic. If any holes were made in the tank they can be easily sealed with a hot knife. Please do not use an open flame.



HYDRAMASTER

Corporation
6323 204th Street SW, Lynnwood, WA 98036

PRODUCT SUPPORT BULLETIN

TO: All CDS Installers

DATE: 27 Oct 1992

RE: 1993 Chev Brake Lines

PSB #: 92102

Chevrolet cargo vans for 1993 have a new routing for their brake lines. They now travel directly over top of the transmission.

Caution is required when drilling the mounting hole on the passenger side of the blower frame. The brake lines can be lowered out of the way by unbolting two (2) mounting brackets that hold the lines in position.

The blower mounting bolt for this foot should go in from the bottom. Then the brake lines can be reattached.