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Trash Pumps
Dewatering Pumps
Diaphragm Pumps

PT
PG
PD

REPAIR MANUAL

0 1 1 7 6 1 7

Operating / Parts Information

You must be familiar with the operation of this machine before you attempt to troubleshoot or make any repairs to it. Basic operating and maintenance procedures are described in the operator's / parts manual supplied with the machine. The operator's / parts manual should be kept with the machine. Use it to order replacement parts when needed. If this manual becomes lost, please contact WACKER Corporation to order a replacement.

Damage caused by misuse or neglect of the unit should be brought to the attention of the operator, to prevent similar occurrences from happening in the future.

This manual provides information and procedures to safely repair and maintain this WACKER model. For your own safety and protection from injury, carefully read, understand and observe the safety instructions described in this manual. THE INFORMATION CONTAINED IN THIS MANUAL WAS BASED ON MACHINES IN PRODUCTION PRIOR TO THE TIME OF PUBLICATION OF THIS MANUAL. WACKER CORPORATION RESERVES THE RIGHT TO CHANGE ANY PORTION OF THIS INFORMATION WITHOUT NOTICE.

Information Contained in This Manual

This repair manual is intended to provide information and procedures to safely operate, maintain and service the WACKER Model PT, PG and PD Series Pumps. Step-by-step instructions and illustrations are provided whenever possible. Refer to this repair manual and the owner's manual supplied with the unit whenever servicing this machine.

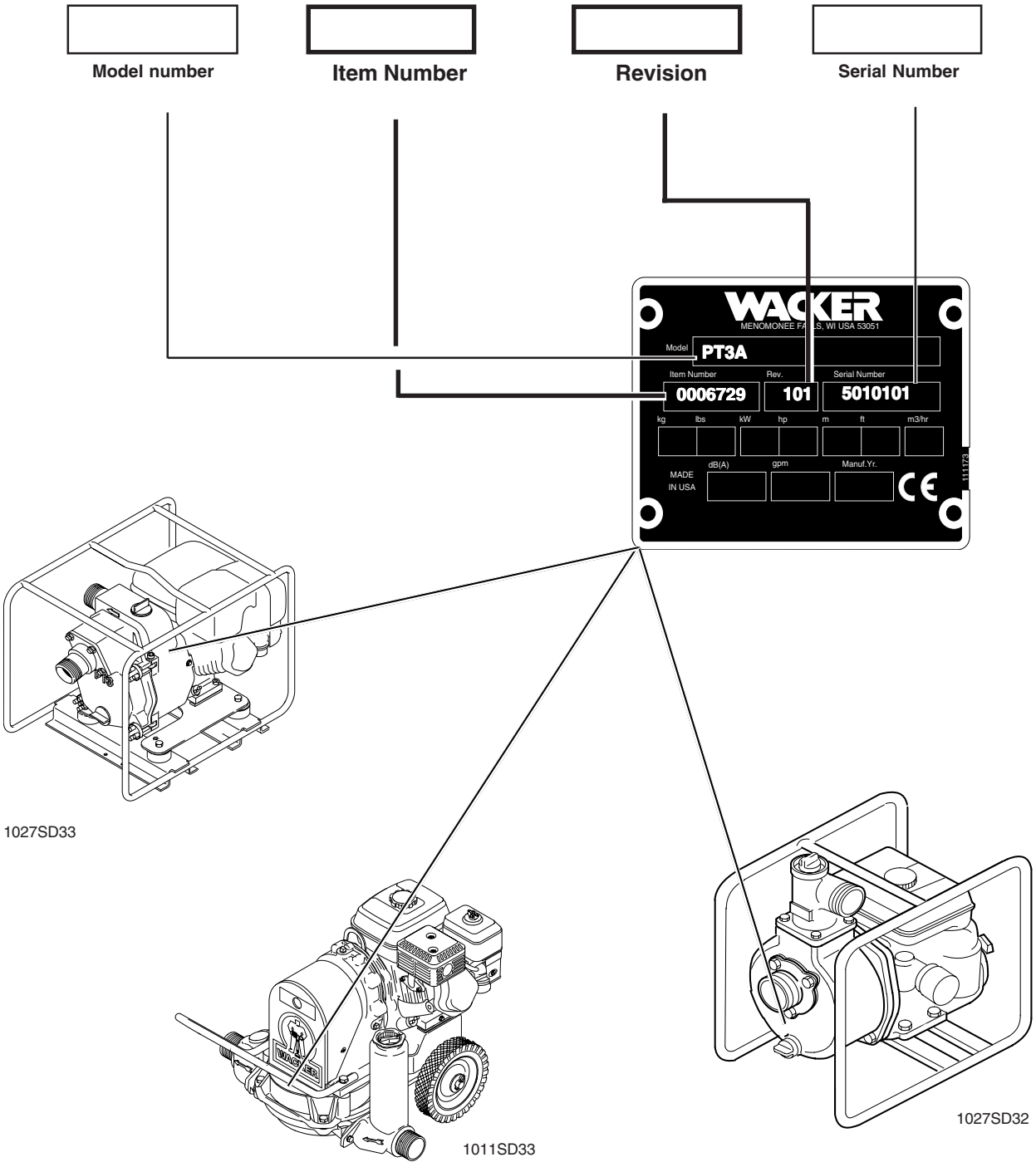
It is the responsibility of the individual servicing this equipment to familiarize himself with its operating characteristics and service procedures before attempting any repairs. Repairs caused by misuse or neglect of the unit should be brought to the attention of the operator, to prevent similar failures from happening in the future.

This manual covers pump models
PT, PG & PD
Refer to the following pages for machine serial numbers or item numbers.

Nameplate

A nameplate listing the Model Number, Item Number, Revision, and Serial Number is attached to each unit. Please record the information found on this plate so it will be available should the nameplate become lost or damaged. **When ordering parts or requesting service information, you will always be asked to specify the model, item number, revision number, and serial number of the unit.**

My machine's numbers are:



Pump Model by Item Number

Pump models and engine options are listed below in item number sequence.

Item Number	Model	Engine	
		Make	Model
4185	PT 4B	Briggs	326432
4186	PT 2B	Briggs	132232
4187	PT 2R	Robin	EY 18-3W
4188	PT 3B	Briggs	195432
4189	PT 3R	Robin	EY 27W
4193	PD 3B	Briggs	80252
4200	PT 4H	Hatz	E 785
4201	PT 2F	Farymann	15A430
4202	PT 3H	Hatz	E 79
5000	PT 2B	Briggs	132232
5001	PT 2R	Robin	EY 18-3W
5002	PT 2F	Farymann	15A430
5003	PT 3B	Briggs	195432
5004	PT 3R	Robin	EY 27W
5005	PT 3H	Hatz	E 79
5006	PT 4B	Briggs	326432
5007	PT 4H	Hatz	E 785
5014	PG 2	Honda	G 150
5015	PG 3	Honda	G 2
5016	PG 2	Honda	G150
5016 01151 & up	PG 2	Honda	GX 110
5017	PG 3	Honda	G 200
5017 01151 & up	PG 3	Honda	GX 140
5018	PD 3B	Briggs	81000
5018 01049 & up	PD 3B	Briggs	80252
5022	PT 2R	Robin	WI-185
5023	PT 2R	Robin	WI-185
5029	PT 3H	Hatz	E 79
5034	PTS 3H	Hatz	E 79
5035	PTS 3H	Hatz	E 79
5036	PT 4H	Hatz	E 785
5037	PTS 4H	Hatz	E 785
5037 01017 & up	PTS 4H	Hatz	E 786
5038	PTS 4H	Hatz	E 785
5038 01009 & up	PTS 4H	Hatz	E 786
5039	PT 4B	Briggs	326432
5040	PTS 4H	Hatz	E 785
5043	PT 3R	Robin	EY 27W
5044	PT 3B	Briggs	195432
5045	PTS 3H	Hatz	E 79
5046	PT 3R	Robin	WI-185
5047	PT 2F	Farymann	15A430
5048	PT 2B	Briggs	132232
5057	PT 2H	Hatz	E 673
5058	PT 2H	Hatz	E 673
5059	PT 2H	Hatz	E 673
5061	PD 3H	Hatz	E 673
5063	PD 3H	Hatz	E 673
5066	PT 2A	Honda	GX 140
5067	PT 2A	Honda	GX 140
5068	PT 3A	Honda	G 300
5068 01581 & up	PT 3A	Honda	GX 240
5069	PT 3A	Honda	G 300
5069 01026 & up	PT 3A	Honda	GX 240
5794	PD 2B	Briggs	80252

Item Number	Model	Engine	
		Make	Model
5795	PD 2B	Briggs	80252
5825	PD 3B	Briggs	132212
5826	PD 3B	Briggs	132212
6216	PD 3A	Honda	GX 110
6217	PD 3A	Honda	GX 110
6246	PT 3R	Robin	WI-280
6247	PT 3R	Robin	WI-280
6248	PT 3R	Robin	WI-280
6292	PT 2B	Briggs	132232
6294	PT 2B	Briggs	132232
6303	PT 2R	Robin	WI-185
6532	PT 2A	Honda	GX 140
6533	PT 2A	Honda	GX 140
6534	PT 2B	Briggs	132232
6535	PT 2B	Briggs	132232
6536	PT 2R	Robin	WI-185
6537	PT 2R	Robin	WI-185
6557	PT 4B	Briggs	326432
6558	PT 4H	Hatz	E 785
6574	PT 3A	Honda	GX 240
6575	PT 3B	Briggs	195432
6576	PT 3B	Briggs	195432
6577	PT 3H	Hatz	ES 79
6578	PT 3R	Robin	WI-280
6579	PT 3R	Robin	WI-280
6580	PT 2H	Hatz	673 LS
6586	PT 3V	Vanguard	161432
6587	PT 3V	Vanguard	161432
6720	PT 2A	Honda	GX 160
6721	PT 2A	Honda	GX 160
6722	PT 2B	Briggs	132232
6724	PT 2R	Robin	WI-185
6725	PT 2R	Robin	WI-185
6726	PT 2R	Robin	WI-185
6729	PT 3A	Honda	GX 240
6730	PT 3A	Honda	GX 240
6731	PT 3B	Briggs	195432
6732	PT 3B	Briggs	195432
6733	PT 3H	Hatz	ES 79
6734	PT 3R	Robin	WI-280
6735	PT 3R	Robin	WI-280
6772	PT 2R	Robin	WI-185
6788	PT 2R	Robin	W01-170
6789	PT 2R	Robin	W01-170
6801	PD 3B	Briggs	133412
7116	PT 2Y	Yanmar	L48AE-D
7117	PT 2Y	Yanmar	L48AE-D
7118	PT 3Y	Yanmar	L70AE-D
7119	PT 3Y	Yanmar	L70AE-D
7120	PD 2B	Briggs	80212
7121	PD 2B	Briggs	80212
7160	PT 2R	Robin	W01-170
7163	PT 3A	Honda	GX240
7171	PT 3V	Vanguard	185432
7610	PDT 2A	Honda	GX120

Item Number	Model	Engine	
		Make	Model
7611	PDT2A(I)	Honda	GX120
7614	PDT 3A	Honda	GX120
7615	PDT3A(I)	Honda	GX120
7616	PDT3A	Honda	GX120
7619	PDT3 (I)	n/a	n/a
7624	PDI 2A	Honda	GX120
7625	PDI2A(I)	Honda	GX120
7628	PDI 3A	Honda	GX120
7629	PDI3A(I)	Honda	GX120
7633	PDT 2	n/a	n/a
7658	PG 2	Honda	GX120
7659	PG 3	Honda	GX160
7683	PTS 4V	Vanguard	303447
7691	PTS4V(I)	Vanguard	303447
8023	PT3V(I)	Vanguard	185432

Item Number	Model	Engine	
		Make	Model

Table of Contents

1.1 Safety Notes

This manual contains NOTES, CAUTIONS, and WARNINGS which must be followed to prevent the possibility of improper service, damage to the equipment, or personal injury.

Notes: *Notes appear in italics and contain additional information important to a procedure.*

CAUTION: Cautions provide information important to prevent errors which could damage machine or components.

WARNING

Warnings warn of conditions or practices which could lead to personal injury or death!

1.2 Laws Pertaining to Spark Arresters

Notice: Some states require that in certain locations, spark arresters be used on internal combustion engines. A spark arrester is a device designed to prevent the discharge of sparks or flames from the engine exhaust. It is often required when operating equipment on forested land to reduce the risk of fires. Consult the engine distributor or local authorities and make sure you comply with regulations regarding spark arresters.

1.3 Tools

Since all possible problems encountered while repairing the equipment cannot be anticipated, it is up to the mechanic to use common sense and good judgment in tool selection.

The use of any special tools is recommended only for those operations where the use of conventional tools proves inadequate.

Before substituting another tool or procedure, you should be satisfied that neither personal injury nor damage to the component will result.

1.4 Reference Numbers ( )

Repair procedures contain reference numbers enclosed in parentheses ( ). These numbers refer to the item numbers shown on the appropriate assembly drawings and other detailed drawings. They are included to aid the mechanic in identifying parts and assembling components.

1.5 Ordering Parts

The repair procedures contained in this manual do not include part numbers. For parts replacement information, refer to the Parts Manual originally supplied with the unit.

If the original Parts Manual has been lost, a replacement manual may be ordered from WACKER Corporation. When ordering a replacement Parts Manual, please list model number, item number, revision number, and serial number of machine.

1.6 Application

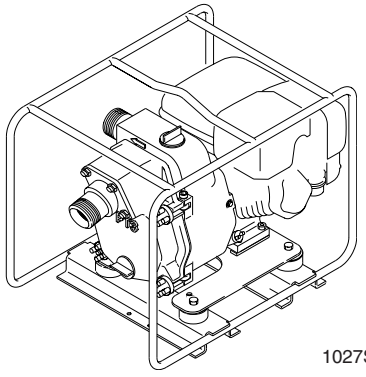
PT Series

The WACKER PT Series Trash Pumps are high capacity, centrifugal pumps designed for pumping wastewater. Their heavy duty construction allows them to handle solid particles and debris suspended in the water. Refer to "Technical Data" for maximum solid size.

Close internal tolerances provide suction lifts up to 25' (7.6m) and high discharge capacities.

These pumps are desirable in applications where large volumes of water must be pumped or high discharge pressures are required.

CAUTION: These pumps are not intended for the pumping of heavy sludges or slurries, mud, corrosive or volatile liquids. **DO NOT** pump gasoline, diesel fuel, oil or corrosive chemicals.



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PG Series

The WACKER PG Series Dewatering Pumps are high capacity, centrifugal pumps similar in operation to the PT Series. The centrifugal design gives them the same high performance characteristics found in the PT Pumps.

The PG Pump can handle small particles up to 0.25" (6.5mm) in diameter. They are not designed to handle large solids or debris particles which may occur in certain applications. Refer to "Technical Data" for maximum solid size.

These pumps should only be used in applications where relatively clean water is being pumped. Pumping volume is less than similar size PT Pumps.

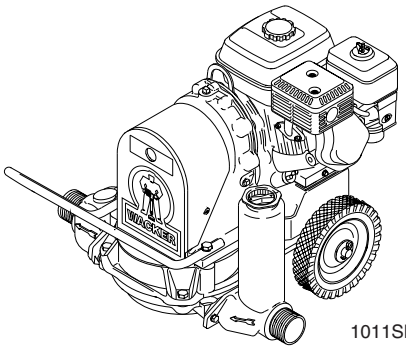
CAUTION: These pumps are not intended for the pumping of heavy sludges or slurries, mud, corrosive or volatile liquids. **DO NOT** pump gasoline, diesel fuel, oil or corrosive chemicals.

PD Series

The WACKER PD Series Diaphragm Pumps are ideal for pumping seepage water, mud and slurries from excavations, trenches, industrial sumps, septic tanks or holding ponds. Their heavy duty construction allows them to handle solid particles and debris suspended in the water. Refer to "Technical Data" for maximum solid size.

The PD diaphragm design, while capable of providing suction lifts up to 25' (7.6m), cannot achieve the high discharge capacities and pressures produced by PT and PG Series centrifugal type pumps. Discharge head is limited to 25' (7.6m).

CAUTION: **DO NOT** pump gasoline, diesel fuel, oil or other volatile or corrosive chemicals.



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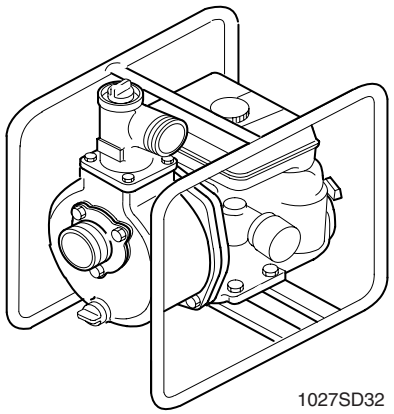

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1.7 Operating Safety

Familiarity and proper training are required for the safe operation of equipment! Equipment operated improperly or by untrained personnel can be dangerous! Read the operating instructions contained in both this manual and the engine manual and familiarize yourself with the location and proper use of all controls.

WARNING

NEVER allow improperly trained people to operate this equipment. People operating this equipment must be familiar with the potential risks and hazards associated with it.

NEVER touch engine or muffler while pump is operating or immediately after it has been turned off. These areas get hot and may cause burns.

NEVER use accessories or attachments which are not recommended by WACKER for this equipment. Damage to equipment and/or injury to user may result.

NEVER pump volatile, flammable or low flash point fluids. These fluids could ignite or explode.

NEVER pump corrosive chemicals or water containing toxic substances. These fluids could create serious health and environmental hazards. Contact local authorities for assistance.

NEVER open priming plug when pump is hot. Never loosen or remove inlet or discharge hose fittings when pump is hot. Hot water inside could be pressurized much like the radiator on an automobile. Allow pump to cool to the touch before loosening plug and before loosening or removing inlet or discharge hose fittings.

NEVER open pump housing cover while pump is operating or start pump with the cover off. The rotating impeller inside the pump can cut or sever objects caught in it.

NEVER block or restrict flow from inlet line or discharge line. Remove kinks from discharge line before starting pump. Operation with a blocked inlet line or discharge line can cause water inside pump to overheat.

ALWAYS read, understand, and follow procedures in Operator's Manual before attempting to operate equipment.

ALWAYS be sure operator is familiar with proper safety precautions and operation techniques before using pump.

ALWAYS be sure pump is on a firm, level surface and will not tip, roll, slide, or fall while operating.

ALWAYS close fuel valve on engines equipped with one, when pump is not being operated.

ALWAYS store equipment properly when it is not being used. Equipment should be stored in a clean, dry location out of the reach of children.

1.8 Operator Safety while using Internal Combustion Engines

Internal combustion engines present special hazards during operation and fueling! Failure to follow the safety guidelines described below could result in severe injury or death.

WARNING

DO NOT smoke while operating pump.

DO NOT smoke when refueling engine.

DO NOT refuel hot or running engine.

DO NOT refuel engine near open flame.

DO NOT spill fuel when refueling engine.

DO NOT operate near open flames.

ALWAYS refill fuel tank in well-ventilated area.

ALWAYS replace fuel tank cap after refueling.

1.9 Service Safety

Poorly maintained equipment can become a safety hazard! In order for the equipment to operate safely and properly over a long period of time, periodic maintenance and occasional repairs are necessary.

WARNING

DO NOT attempt to clean or service pump while it is running. Rotating parts can cause severe injury.

DO NOT crank a flooded engine with the spark plug removed on gasoline-powered engines. Fuel trapped in the cylinder will squirt out the spark plug opening.

DO NOT test for spark on gasoline-powered engines, if engine is flooded or the smell of gasoline is present. A stray spark could ignite fumes.

DO NOT use gasoline or other types of fuels or flammable solvents to clean parts, especially in enclosed areas. Fumes from fuels and solvents can accumulate and become explosive.

ALWAYS operate pump with all safety devices and guards in place and in working order.

ALWAYS keep area around muffler free of debris such as leaves, paper, cartons, etc. A hot muffler could ignite them, starting a fire.

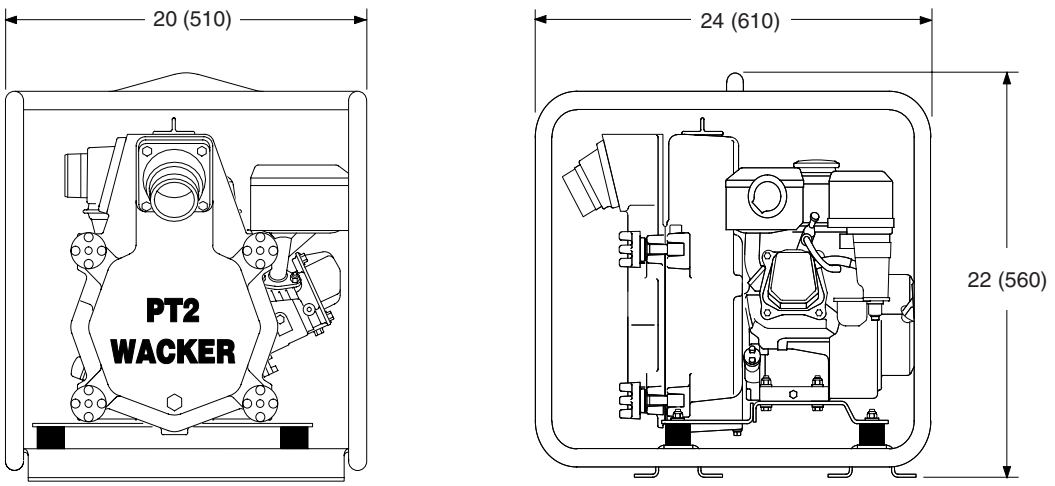
ALWAYS replace worn or damaged components with spare parts designed and recommended by WACKER for servicing this machine.

ALWAYS remove or disconnect spark plug on pumps equipped with gasoline engines, before servicing pump, to avoid accidental start-up.

ALWAYS handle impeller carefully. The impeller can develop sharp edges which can cut.

1.10 Technical Data (PT2)

in. (mm)



Sound Measurements

The required sound specifications, per Appendix 1, Paragraph 1.7.4.f of the EC-Machine Regulations, are:

		PT2A	PT2B	PT2R	PT2Y
Sound pressure level at operator's location	(L_{pA})	86 dB (A)	86 dB (A)	84 dB (A)	83 dB (A)
Sound power level	(L_{WA})	97 dB (A)	97 dB (A)	94 dB (A)	96 dB (A)

These sound values were determined according to ISO 3744 for the sound power level (L_{WA}) and ISO 6081 for the sound pressure level (L_{pA}) at the operator's location.

The sound measurements were obtained with the unit operating on pavement at nominal speed.

1.10 Technical Data (PT2) cont.

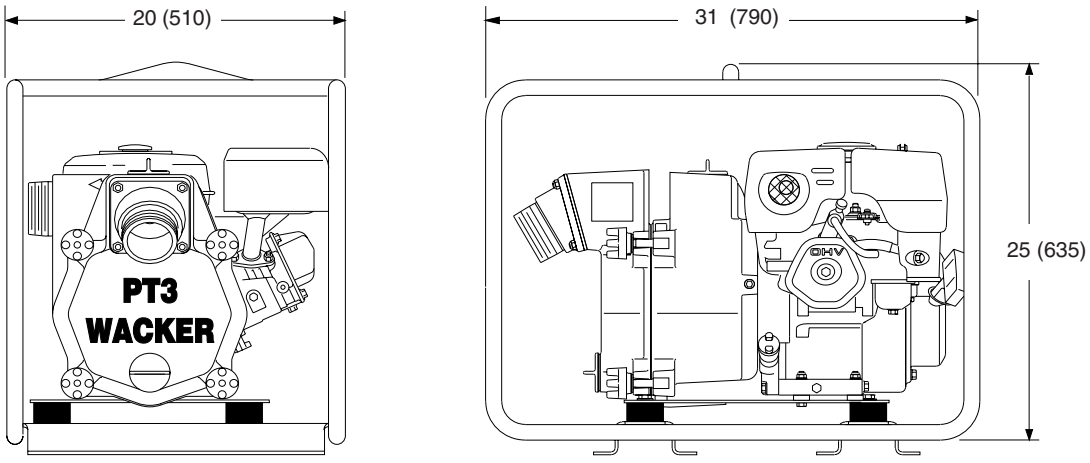
Engine		PT2A	PT2B	PT2R	PT2Y
Engine Make		Honda	Briggs	Robin	Yanmar
Engine Model		GX 160 K1 QX	132232, 133232	WO1-170	L48AE-D
Rated Power	Hp (kW)	5.5 (4.1)	5.0 (3.7)	5.0 (3.7)	5.0 (3.7)
Spark Plug	type	(NGK) BPR 6ES BOSCH WR 7DC	CHAMPION RCJ8	(NGK) B6HS or CHAMPION L86C	—
Electrode Gap	in. (mm)	0.028–0.031 (0.7–0.8)	0.030 (0.76)	0.024–0.028 (0.6–0.7)	—
Engine Speed - full load	rpm	3500 ± 100	3500 ± 100	3500 ± 200	3400 ± 100
Engine Speed - idle	rpm	1600 ± 100	1600 ± 100	1600 ± 100	1600 ± 100
Air Cleaner	type	Dual element	Dry type, paper element w/foam precleaner	Dual element	Dry type, paper element w/foam precleaner
Engine Lubrication	oil grade service class	SAE 10W30 SF, SE, SD, SC	SAE 10W30 SF, SE, SD, SC	SAE 10W30 SF, SE, SD, SC	SAE 10W30 SAE 20W40
Engine Oil Capacity	oz. (ml)	20 (600)	20 (600)	21 (650)	27 (800)
Fuel	type	Regular Unleaded Gasoline			No. 2 Diesel - cetane > 45
Fuel Tank Capacity	qts. (l)	4.0 (3.8)	3.0 (2.8)	3.8 (3.6)	2.6 (2.5)

Pump					
Weight	lbs. (kg)	134 (61)	133 (60)	134 (61)	145 (66)
*Max. Suction Lift	ft. (m)	*25 (7.5)	*25 (7.5)	*25 (7.5)	*25 (7.5)
Max. Total Head	ft. (m)	100 (30)	100 (30)	100 (30)	89 (27)
Mechanical Seal Lubrication	oil grade oz. (ml)	SAE 30 Approx. 4 (120)	SAE 30 Approx. 4 (120)	SAE 30 Approx. 4 (120)	SAE 30 Approx. 4 (120)
Suction / Discharge Dia.	in. (mm)	2 (50)	2 (50)	2 (50)	2 (50)
Max. Solid Size	in (mm)	1 (25)	1 (25)	1 (25)	1 (25)

* Based on pump operating at sea level. Maximum suction lift will be less at higher altitudes.

1.11 Technical Data (PT3)

in. (mm)



Sound Measurements

The required sound specifications, per Appendix 1, Paragraph 1.7.4.f of the EC-Machine Regulations, are:

		PT3A	PT3V	PT3Y
Sound pressure level at operator's location	(L_{pA})	86 dB (A)		
Sound power level	(L_{WA})	97 dB (A)		

These sound values were determined according to ISO 3744 for the sound power level (L_{WA}) and ISO 6081 for the sound pressure level (L_{pA}) at the operator's location.

The sound measurements were obtained with the unit operating on pavement at nominal speed.

1.11 Technical Data (PT3) cont.

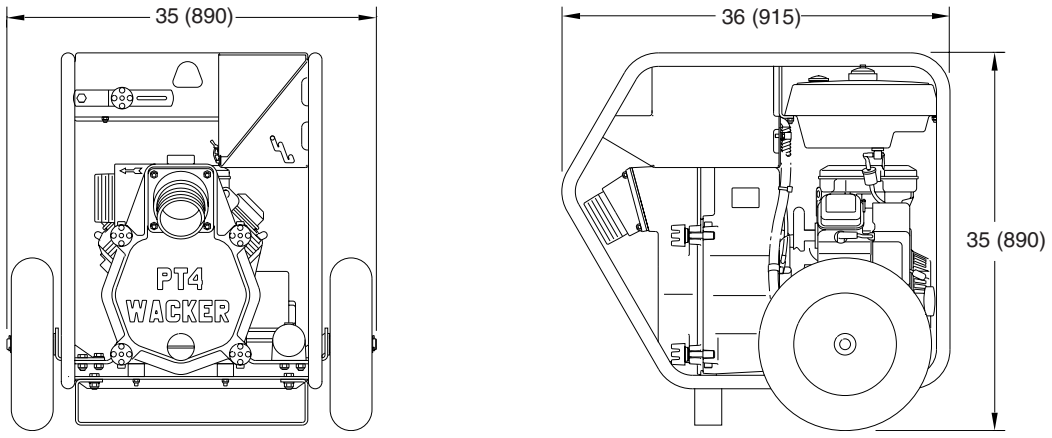
Engine		PT3A	PT3V	PT3Y
Engine Make		Honda	Vanguard	Yanmar
Engine Model		GX 240 K1 QA	185432	L70AE-D
Rated Power	Hp (kW)	8.0 (6.0)	9.0 (7.0)	7.0 (5.0)
Spark Plug	type	(NGk) BPR 6ES BOSCH WR 7DC	CHAMPION RC12YC	—
Electrode Gap	in. (mm)	0.028–0.031 (0.7–0.8)	0.030 (0.76)	—
Engine Speed - full load	rpm	3500 ± 100	3500 ± 100	3400 ± 100
Engine Speed - idle	rpm	1600 ± 100	1600 ± 100	1600 ± 100
Air Cleaner	type	Dual element	Dual element	Dry type, paper element w/foam precleaner
Engine Lubrication	oil grade service class	SAE 10W30 SF, SE, SD, SC	SAE 10W30 SF, SE, SD, SC	SAE 10W30 SAE 20W40
Engine Oil Capacity	oz. (ml)	37 (1100)	41 (1200)	37 (1100)
Fuel	type	Regular Unleaded Gasoline	Regular Unleaded Gasoline	No. 2 Diesel - cetane > 45
Fuel Tank Capacity	qts. (l)	6.4 (6.1)	6.3 (6.0)	3.6 (3.5)

Pump				
Weight	lbs. (kg)	164 (74)	177 (80)	187 (85)
*Max. Suction Lift	ft. (m)	*25 (7.5)	*25 (7.5)	*25 (7.5)
Max. Total Head	ft. (m)	95 (29)	95 (29)	82 (25)
Mechanical Seal Lubrication	oil grade oz.	SAE 30 Approx. 4 (120)	SAE 30 Approx. 4 (120)	SAE 30 Approx. 4 (120)
Suction / Discharge Dia.	in. (mm)	3 (75)	3 (75)	3 (75)
Max. Solid Size	in. (mm)	1.5 (38)	1.5 (38)	1.5 (38)

* Based on pump operating at sea level. Maximum suction lift will be less at higher altitudes.

1.12 Technical Data (PTS4)

in. (mm)



Sound Measurements

The required sound specifications, per Appendix 1, Paragraph 1.7.4.f of the EC-Machine Regulations, are:

		PTS4V
Sound pressure level at operator's location	(L_{pA})	—
Sound power level	(L_{WA})	103 dB (A)

These sound values were determined according to ISO 3744 for the sound power level (L_{WA}) and ISO 6081 for the sound pressure level (L_{pA}) at the operator's location.

The sound measurements were obtained with the unit operating on pavement at nominal speed.

1.12 Technical Data (PTS4) cont.

Engine		PTS4V
Engine Make		Vanguard
Engine Model		303447
Rated Power	Hp (kW)	16 (12)
Spark Plug	type	Champion RC12YC
Electrode Gap	in. (mm)	0.030 (0.76)
Engine Speed - full load	rpm	3600 ± 100
Air Cleaner	type	Dual element
Engine Lubrication	oil grade service class	SAE 10W30 ⇓40°F (5°C) or SAE 30W ⇑40°F (5°C) SF, SE, SG
Engine Oil Capacity	oz. (ml)	48 (1400)
Fuel	type	Regular Unleaded Gasoline
Fuel Tank Capacity	qts. (l)	3.7 (14)
Battery	Volt / CCA amp-hour / size	12 / 230 32 / 22NF

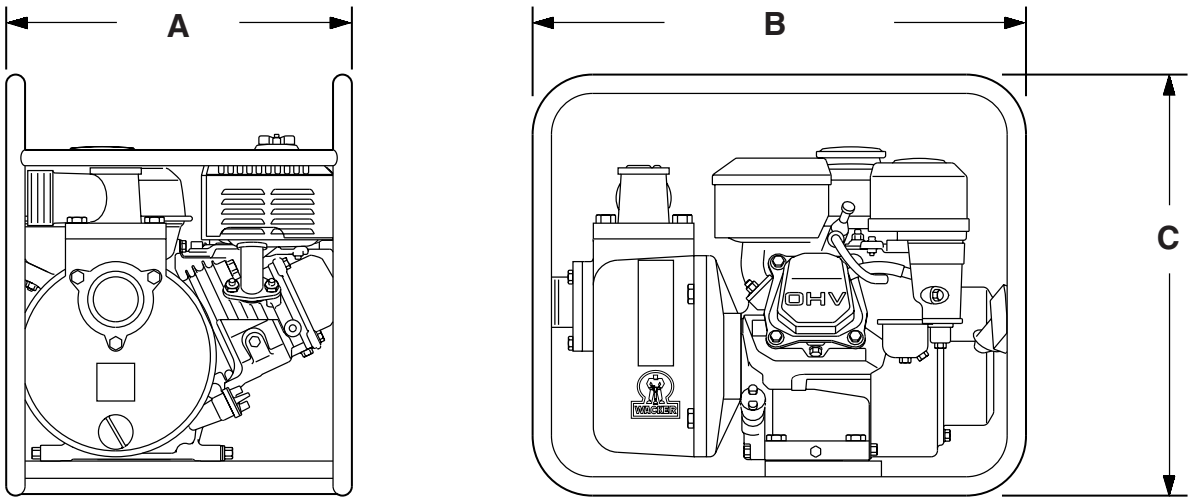
Pump

Weight	lbs. (kg)	360 (163)
*Max. Suction Lift	ft. (m)	*25 (7.5)
Max. Total Head	ft. (m)	106 (32)
Mechanical Seal Lubrication	oil grade oz. (ml)	SAE 30 5 (150)
Suction / Discharge Diameter	in. (mm)	4 (100)
Max. Solid Size	in. (mm)	2 (50)

* Based on pump operating at sea level. Maximum suction lift will be less at higher altitudes.

1.13 Technical Data (PG2 / PG3)

in. (mm)



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		PG2	PG3
A	in. (mm)	13.7 (350)	14.7 (375)
B	in. (mm)	18.5 (470)	20.0 (505)
C	in. (mm)	14.0 (360)	17.7 (450)

Sound Measurements

The required sound specifications, per Appendix 1, Paragraph 1.7.4.f of the EC-Machine Regulations, are:

		PG2	PG3
Sound pressure level at operator's location	(L_{pA})	84 dB (A)	87 dB (A)
Sound power level	(L_{WA})	94 dB (A)	97 dB (A)

These sound values were determined according to ISO 3744 for the sound power level (L_{WA}) and ISO 6081 for the sound pressure level (L_{pA}) at the operator's location.

The sound and vibration specifications were obtained with the unit operating on pavement at nominal engine speed.

1.13 Technical Data (PG2 / PG3) cont.

Engine		PG2	PG3
Engine Make		Honda	Honda
Engine Model		GX 120 W1 B4	GX 160 W1 C2
Rated Power	Hp (kW)	4.0 (3.0)	5.5 (4.1)
Spark Plug	type	(NGK) BPR 6ES	(NGK) BPR 6ES
Electrode Gap	in. (mm)	0.028–0.031 (0.7–0.8)	0.028–0.031 (0.7–0.8)
Engine Speed - full load	rpm	3000 ± 100	3000 ± 100
Engine Speed - idle	rpm	1600 ± 100	1600 ± 100
Air Cleaner	type	Single element	Single element
Engine Lubrication	oil grade service class	SAE 10W30 SF, SG	SAE 10W30 SF, SG
Engine Oil Capacity	oz. (ml)	20 (600)	20 (600)
Fuel	type	Regular Unleaded Gasoline	Regular Unleaded Gasoline
Fuel Tank Capacity	qts. (l)	2.6 (2.5)	4.0 (3.8)
Valve Clearance	in. (mm)	Inlet: 0.006 (0.15) Outlet: 0.008 (0.20)	Inlet: 0.006 (0.15) Outlet: 0.008 (0.20)

Pump

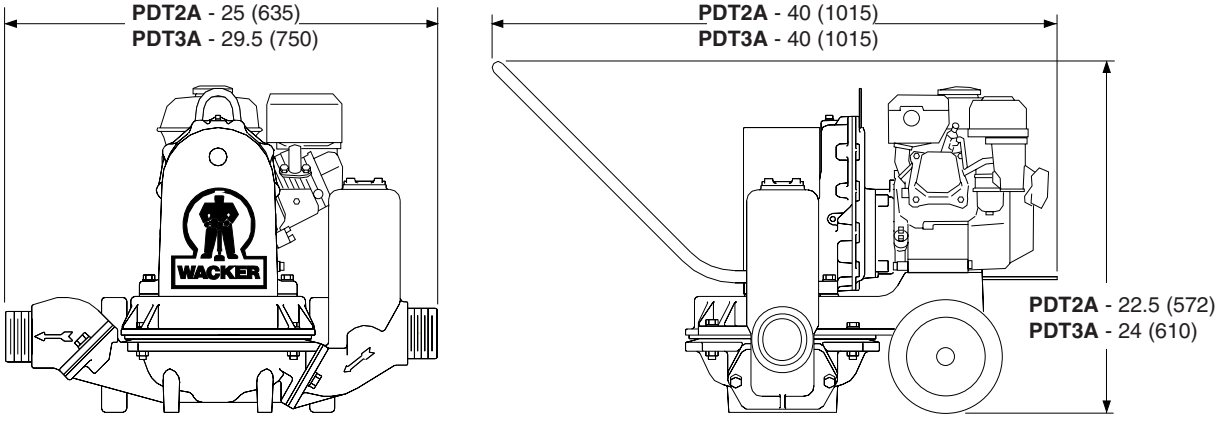
Weight	lbs. (kg)	60 (27)	73 (33)
*Max. Suction Lift	ft. (m)	25 (7.5)	25 (7.5)
Max. Total Head	ft. (m)	98 (30)	98 (30)
Suction / Discharge Dia.	in. (mm)	2 (50)	2 (50)
Max. Solid Size	in. (mm)	0.25 (6)	0.25 (6)

* Based on pump operating at sea level. Maximum suction lift will be less at higher altitudes.

1.14 Technical Data (PD2 / PD3)

in. (mm)

PDT 2A/3A



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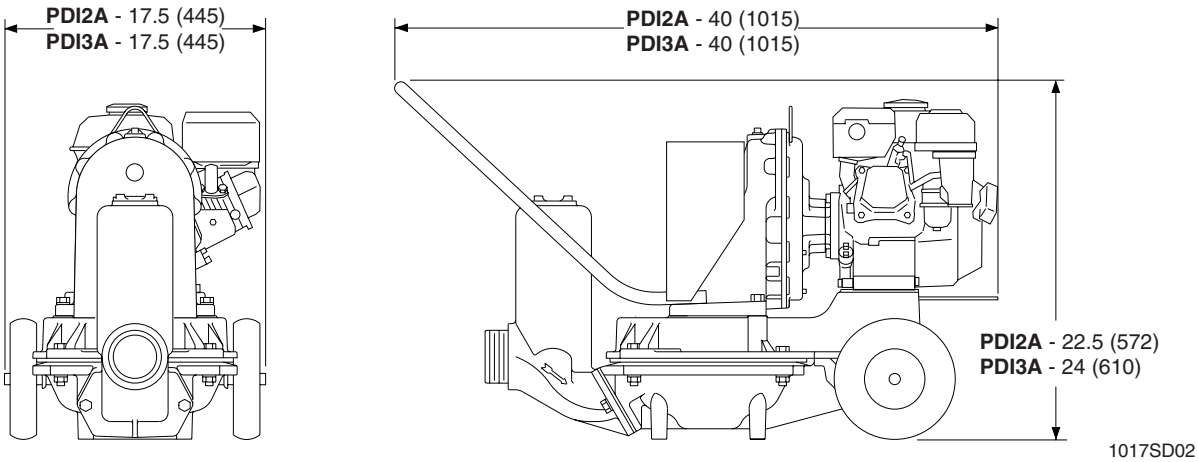
PDI 2A/3A



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Sound Measurements

The required sound specifications, per Appendix 1, Paragraph 1.7.4.f of the EC-Machine Regulations, are:

		PD2	PD3
Sound pressure level at operator's location	(L_{pA})	82 dB (A)	
Sound power level	(L_{WA})	92 dB (A)	

These sound values were determined according to ISO 3744 for the sound power level (L_{WA}) and ISO 6081 for the sound pressure level (L_{pA}) at the operator's location.

The sound measurements were obtained with the unit operating on pavement at nominal speed.

1.14 Technical Data (PD2 / PD3) cont.

Engine		PD2A	PD3A
Engine Make		Honda	
Engine Model		GX 120 K1 QX	
Rated Power	Hp (kW)	4.0 (3.0)	
Spark Plug	type	(NGK) BPR 6ES BOSCH WR 7DC	
Electrode Gap	in. (mm)	0.028–0.031 (0.7–0.8)	
Engine Speed - full load	rpm	3000 ± 100	
Engine Speed - idle	rpm	1600 ± 100	
Air Cleaner	type	Dual element	
Engine Lubrication	oil grade service class	SAE 10W30 SF, SE, SD, SC	
Engine Oil Capacity	oz. (ml)	20 (600)	
Fuel	type	Regular Unleaded Gasoline	
Fuel Tank Capacity	qts. (l)	2.6 (2.5)	

Pump		PDT / PDI 2A	PDT / PDI 3A
Weight	lbs. (kg)	114 (52)	138 (63)
*Max. Suction Lift	ft. (m)	25 (7.5)	25 (7.5)
Max. Discharge Head	ft. (m)	25 (7.5)	25 (7.5)
Max. Total Head	ft. (m)	50 (15)	50 (15)
Max. Discharge	gpm (m^3h)	50 (11)	88 (20
Gear Case Lubrication	oil grade oz. (ml)	SAE 30 32 (1000)	SAE 30 32 (1000)
Suction / Discharge Dia.	in. (mm)	2 (50)	3 (75)
Max. Solid Size	in. (mm)	1.25 (30)	1.75 (45)

* Based on pump operating at sea level. Maximum suction lift will be less at higher altitudes.

1.15 Performance Curves

These values are average values based on pumps operating at sea level. To determine accurate values for pump capacity, altitude and other factors affecting suction lift and discharge head must be considered. Consult WACKER Corporation for additional information.

PT Pumps

Top curve - Gasoline powered pumps
Bottom curve - Diesel powered pumps

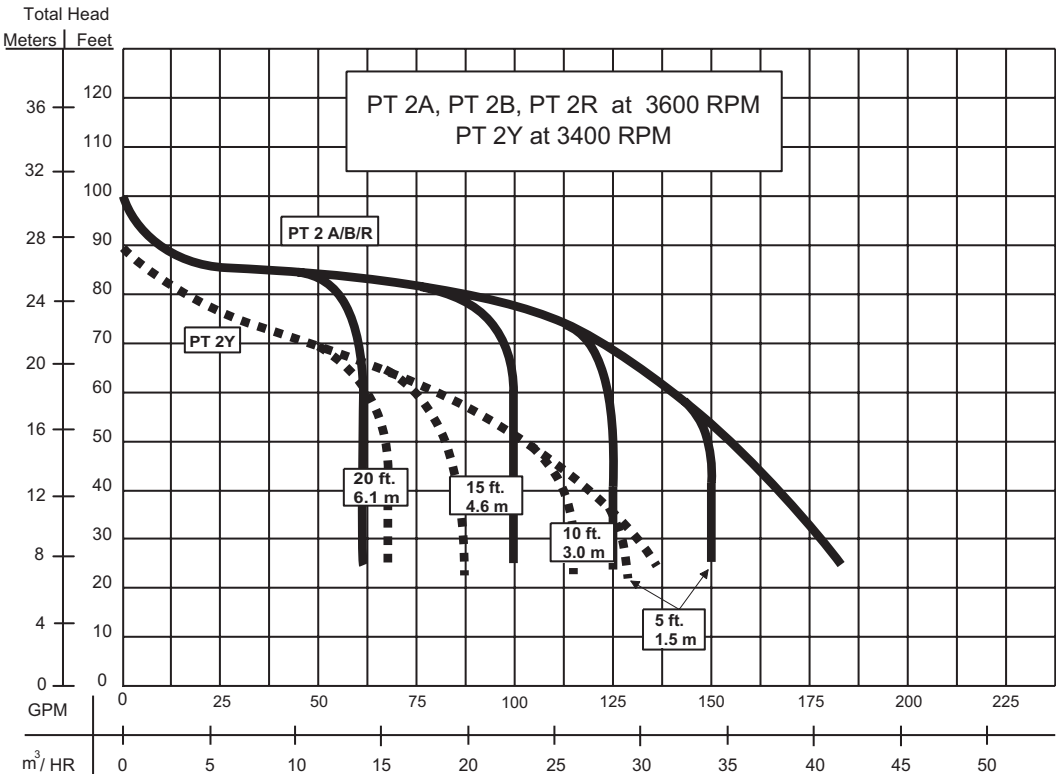
On the PT Series, diesel powered pumps operate at lower engine speeds than those driven by gasoline powered engines. This reduces the amount of water which they can displace and also lowers the discharge pressure, resulting in a slightly lower performance curve.

TO READ PUMP CAPACITY: first, determine the total head being applied to the pump and read across to the curve representing the correct engine type and suction lift.

Note: *Each leg on the curve indicates a different suction lift.*

After locating this point on the curve, read down to find the approximate capacity for the pump.

PT2



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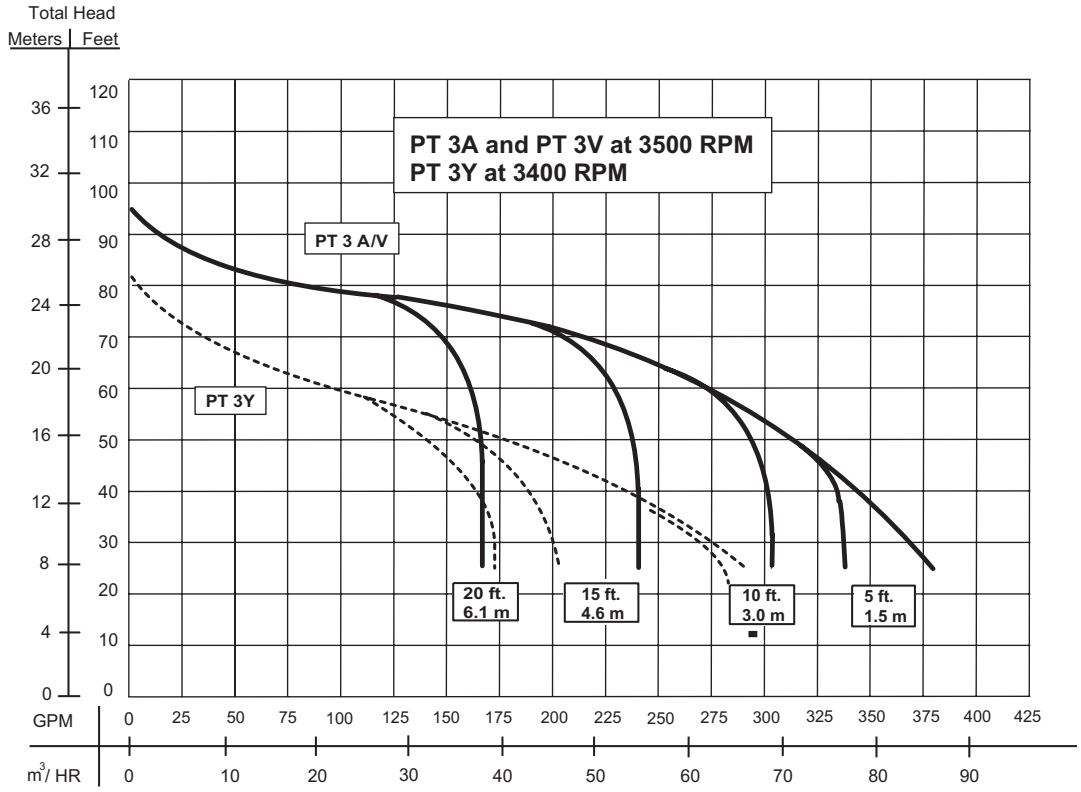
1.15 Performance Curves (cont.)

PT3



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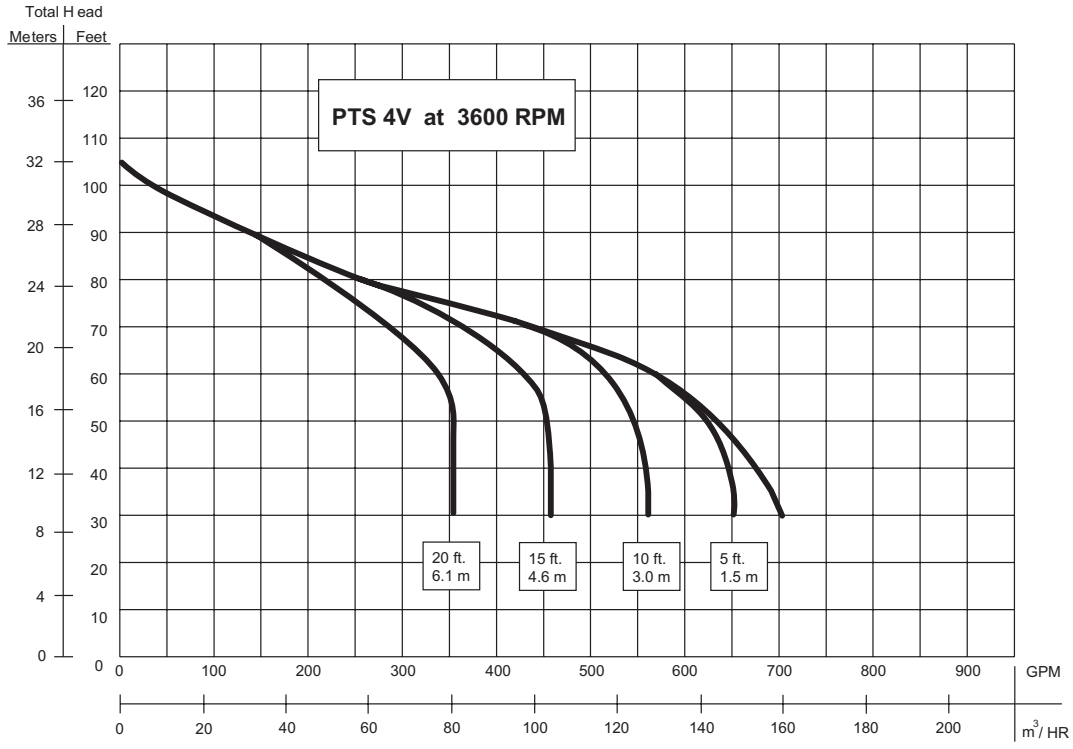
PTS4



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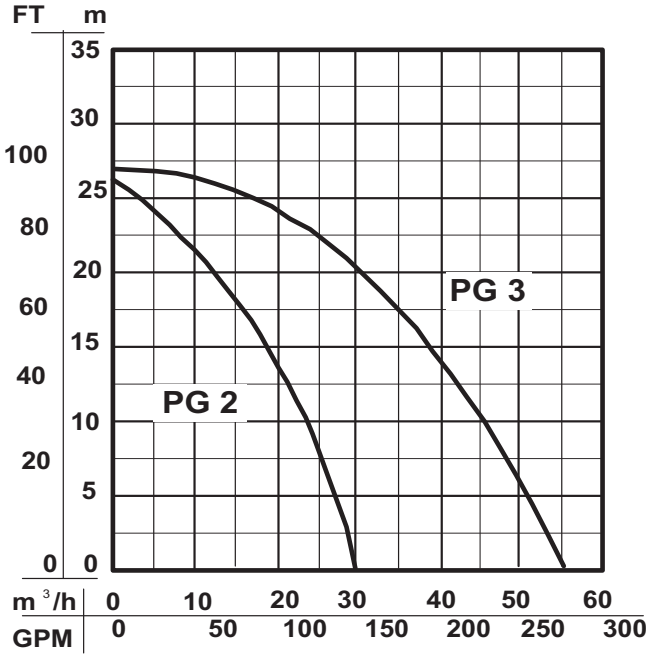
1.15 Performance Curves (cont.)

PG Pumps

Curves show maximum capacities with pump operating at minimum suction lift only.

Engine operating speed of 3600 RPM.

PG2 / PG3



1033SD92

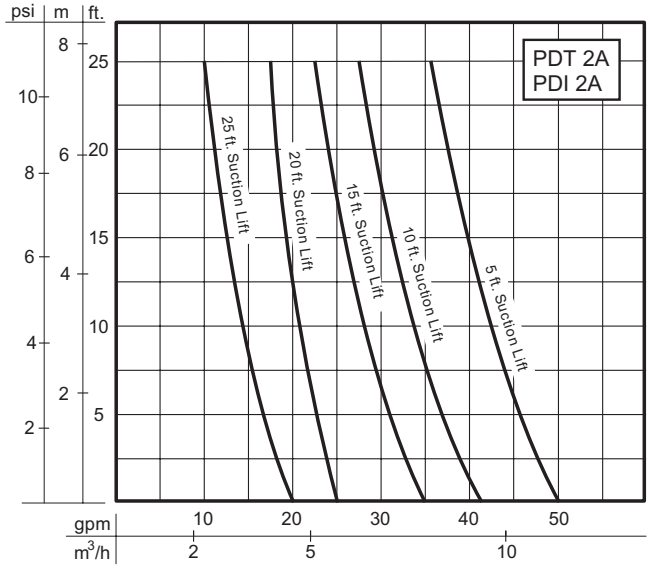
PD Pumps

Both Suction Lift and Discharge head limited to 25' (7.6m) maximum.

Total head cannot exceed 50' (15.2m).

Engine operating speed of 3600 RPM.

PD2



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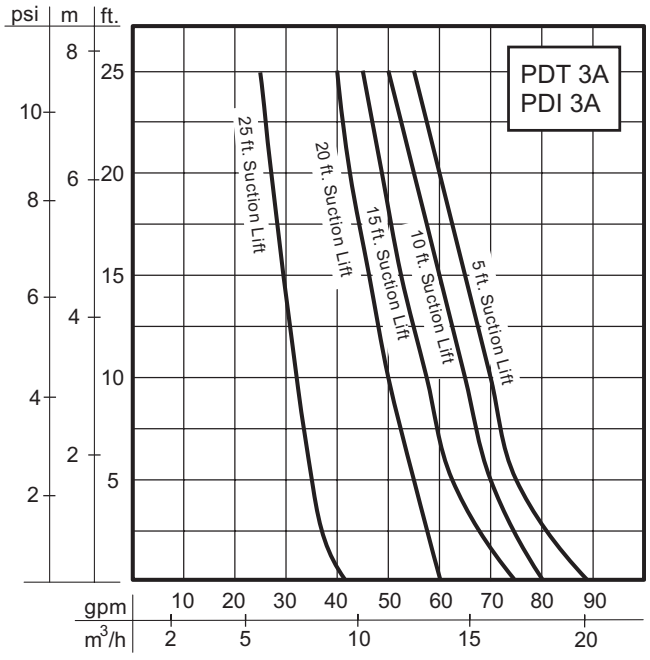
PD3



1033SD94

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2.1 Factors Affecting Pump Performance

Certain conditions outside the pump will influence the pump's output and ability to lift water. These factors can be critical if the pump is operating near its maximum limits.

Before servicing a pump, review the current application and conditions under which it is operating.

Suction Lift

As the height of the pump above the water increases, pump output decreases. Always locate the pump as close to the water as possible. See Section *1.15 Performance Curves*

Total Head / Discharge Head

Discharge head is the height of the discharge hose above the pump.

Total head is a measure of the vertical distance the pump must lift water.
TOTAL HEAD = Suction Lift + Discharge Head + Frictional losses.

Pump output decreases as the discharge head or total head increases. See Section *1.15 Performance Curves*

Altitude

Atmospheric pressure varies above or below sea level. At altitudes above sea level the maximum practical suction lift is reduced. See Section *2.2 High Altitude Operation.*

Frictional Loss

The friction created by the liquid as it flows through a hose, pipe, strainer or fitting creates a resistance that the pump must overcome. These losses increase with the length of the hose, number of fittings and amount of water (GPM) flow. Frictional losses occur in both suction and discharge lines. In long hoses, these losses will accumulate to reduce pump output.

Suspended Soils

Suspended soils, such as sand or dirt, may add to the weight of the water, reducing the maximum practical suction lift. This condition would most often be observed in diaphragm type pumps operating at high lifts and pumping heavy sludges and mud mixtures.

Water Temperature

As water temperature increases above 65°F (180°C) the maximum practical suction lift will decrease. For most normal operating temperatures pump performance is not greatly affected.

However, certain conditions may arise where water temperature could be a factor. Allowing the prime water to sit in the pump housing on a warm day could raise the water temperature inside the pump case to the point where the pump is unable to create sufficient vacuum to pull the water up to it when started. Replace the water in the pump case with fresh cold water.

While performing a SUCTION TEST the water may heat up sufficiently to give a faulty gauge reading. Complete testing within 3–4 minutes or stop engine and refill pump case with cold water. If possible, run continuous stream of cold water into pump case during testing.

2.2 High Altitude Operation

When a pump is operated at elevations above sea level, the lower atmospheric pressure has a double effect on pump performance.

1. The lower atmospheric pressures cannot support as high a column of water, so the maximum suction lift decreases.

2. The lower atmospheric pressure reduces the horsepower output of the gas engine, causing it to lose speed. This often results in a loss of capacity and discharge head of the pump.

At elevations above sea level, the maximum rated suction lift of the pump should be reduced.

On pumps driven by internal combustion engines, a power loss of approximately 3% for every 1000 ft. (250m) of elevation occurs and pump capacity and discharge head should be reduced accordingly.

Maximum suction lifts at higher elevations

ALTITUDE ft. (m)	MAXIMUM SUCTION LIFT ft. (m)
Sea Level	25.0 (7.6)
2000 (600)	22.0 (6.7)
4000 (1200)	19.5 (5.9)
6000 (1800)	17.3 (5.3)
8000 (2400)	15.5 (4.7)
10000 (3000)	14.3 (4.4)

Loss of performance at higher elevations

ALTITUDE ft. (m)	DISCHARGE CAPACITY	DISCHARGE HEAD
Sea Level	100%	100%
2000 (600)	97%	95%
4000 (1200)	95%	91%
6000 (1800)	93%	87%
8000 (2400)	91%	83%
10000 (3000)	88%	78%

2.3 Before Starting

PT & PG Series

1. Read safety instructions at the beginning of manual.

2. Place pump as near to water as possible, on a firm, flat, level surface.

3. To prime a PT or PG Series pump, remove priming plug **(a)** and fill pump case with water. If the pump case is not filled with water before starting, it will not begin pumping.

⚠ WARNING

DO NOT open priming plug or loosen hose fittings if pump is hot! Water or vapor inside pump may be under pressure.

4. Check for leaks between pump and engine. If water is leaking, the seal inside pump is worn or damaged. Continued operation may cause water damage to engine.

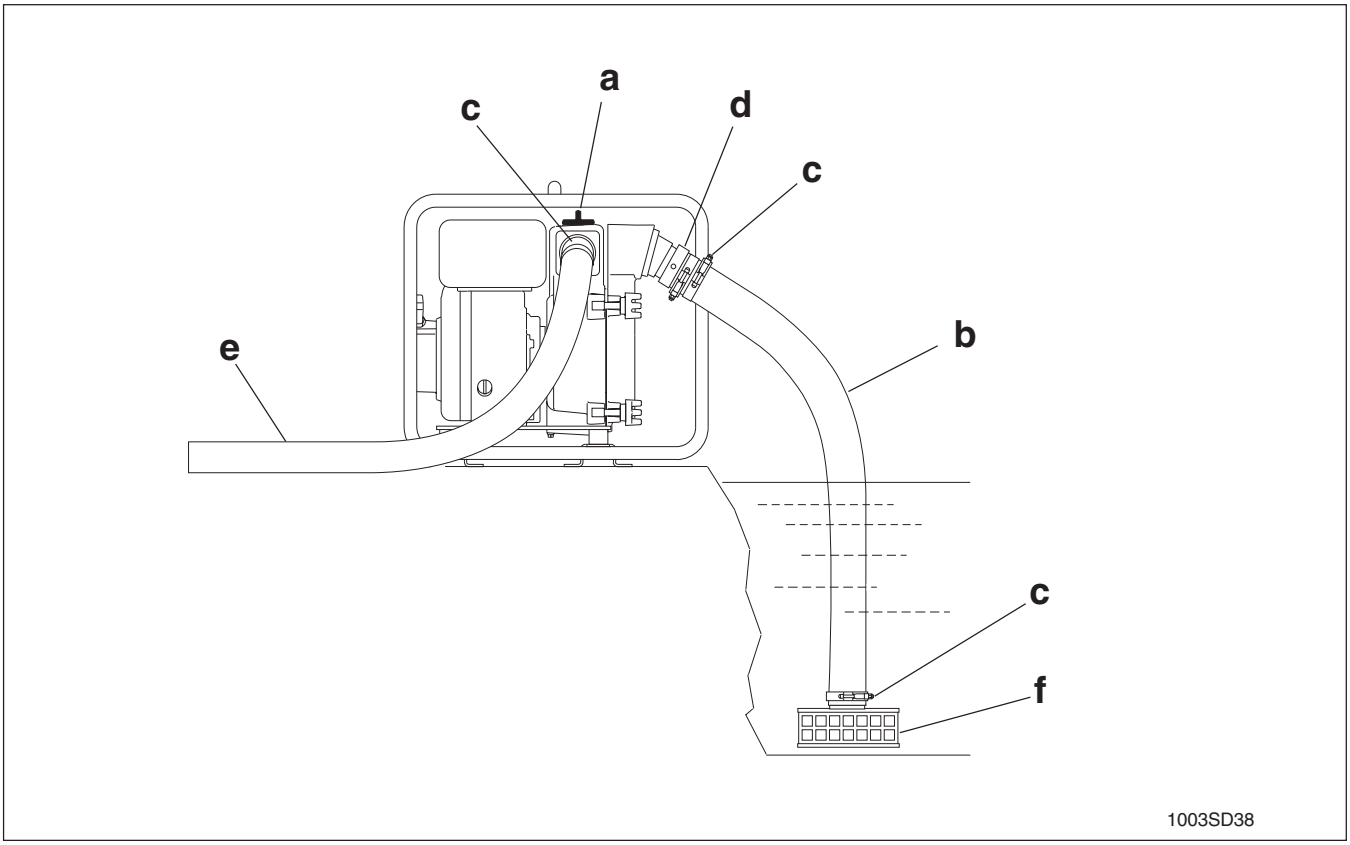
5. Check that hoses are securely attached to pump. Suction hose **(b)** must not have any air leaks. Tighten hose clamps **(c)** and coupling **(d)**.

   Check that discharge hose **(e)** is not restricted. Lay hose out as straight as possible. Remove any twists or sharp bends from hose which may block the flow of water.

6. Make sure suction strainer **(f)** is clean and securely attached to end of hose. The strainer is designed to protect the pump by preventing large objects from being pulled into the pump.

   CAUTION: Strainer should be positioned so it will remain completely under water. Running the pump with the strainer above water for long periods can damage the pump.

7. Check fuel level, engine oil level, and condition of air cleaner.



2.3 Before Starting (cont.)

PD Series

Diaphragm pumps are self priming and seldom need to have water added to them before starting. However, if the pump has not been used for several weeks and the rubber valves inside it are dry, adding water through the surge chamber **(g)** will help the valves seal and shorten the amount of time required for the pump to prime.

1. Read safety instructions at the beginning of manual.

2. Place pump as near to water as possible, on a firm, flat, level surface.

3. Check that hoses are securely attached to pump. Suction hose **(h)** must not have any air leaks. Check that all hose clamps **(j)** and couplings **(k)** are tight. Check that cap on surge chamber **(g)** is tight.

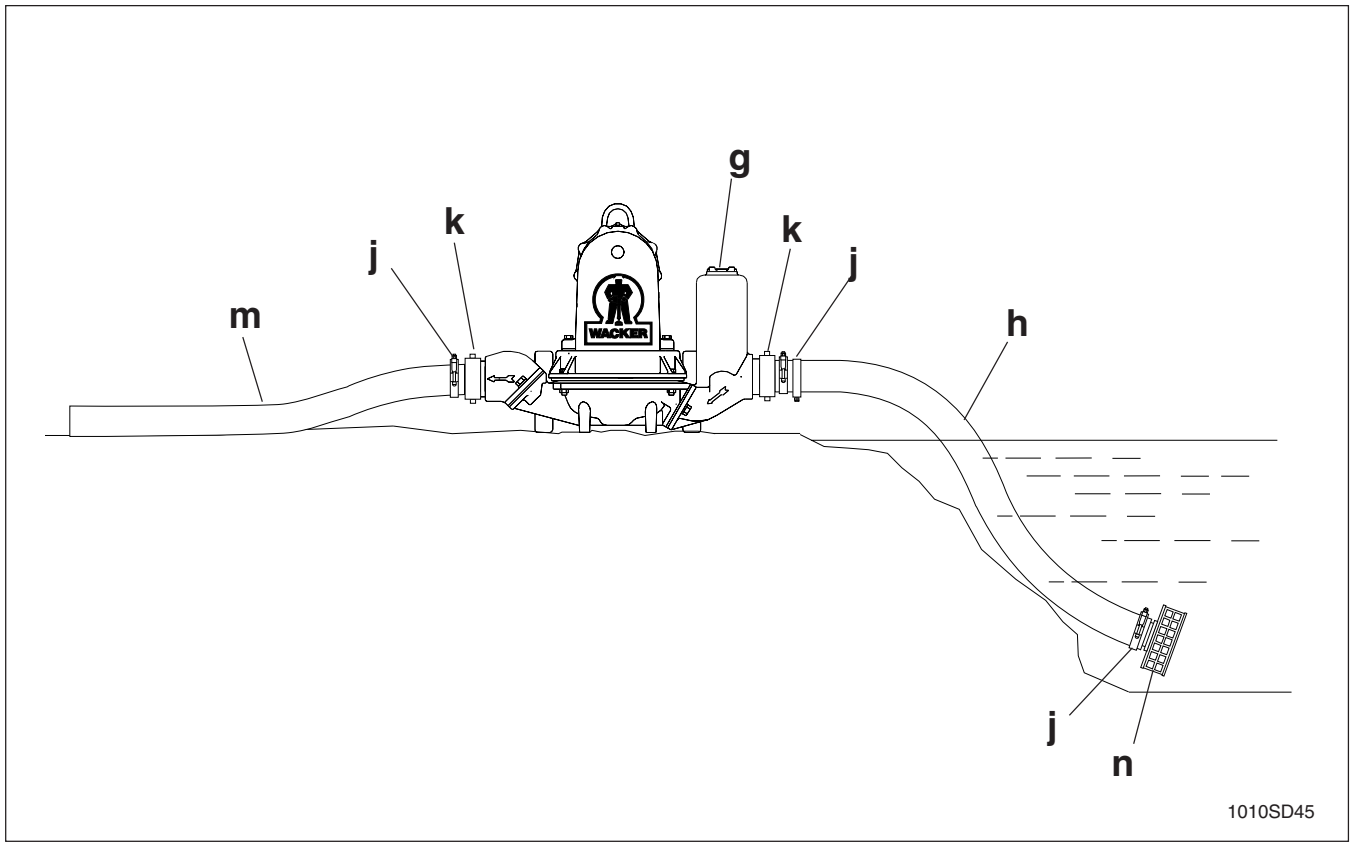
4. Check that discharge hose **(m)** is not blocked. Lay hose out as straight as possible. Remove any twists or sharp bends from hose which may block the flow of water.

   Note: *Operating the pump with any part of the discharge line positioned higher than 25' (7.5 m) above the pump can cause backflow into the pump and damage pump components.*

5. Make sure suction strainer **(n)** is clean and securely attached to end of hose. The strainer is designed to protect the pump by preventing large objects from being pulled into the pump.

   Position strainer so it will remain under water as water level drops.

6. Check fuel level, engine oil level, and condition of air cleaner.



2.4 Starting / Stopping

PT2A / PT3A / PG2 / PG3 / PD2A / PD3A

1. Open fuel valve by moving lever to the right **(a_1)**.

   Note: *If engine is cold, move choke lever to close position **(b_1)**. If engine is hot, set choke to open position **(b_2)**.*

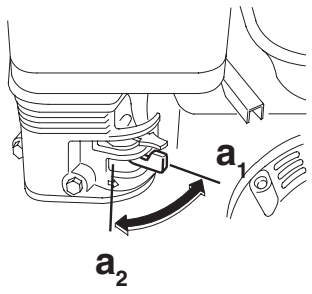
2. Turn engine switch to "ON" **(c_1)**.
3. Open throttle by moving it slightly to left **(d_1)**.
4. Pull starter rope **(e).**

   Note: *If the oil level in the engine is low, the engine will not start. If this happens, add oil to engine. Some engines are equipped with an oil alert light **(f)** that will come on while pulling the starter rope.*

5. Open choke as engine warms **(b_2)**.
6. Open throttle fully to operate pump.

To Stop

1. Reduce engine RPM to idle by moving throttle completely to right **(d_2)**.
2. Turn engine switch to "OFF" **(c_2)**.
3. Close fuel valve by moving lever to the left **(a_2)**.



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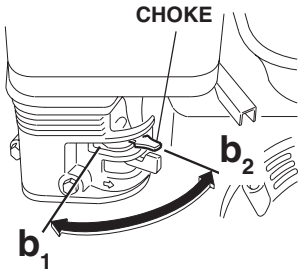

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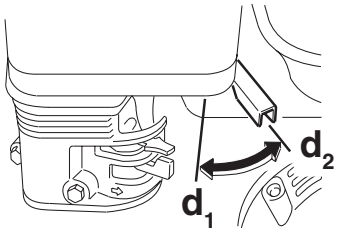

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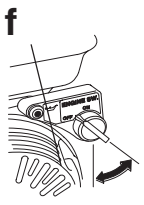

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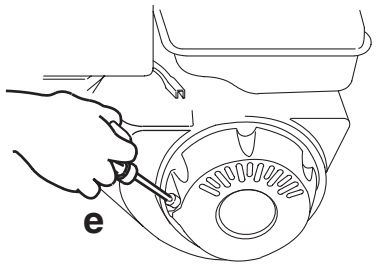

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2.4 Starting / Stopping (cont.)

PT2B

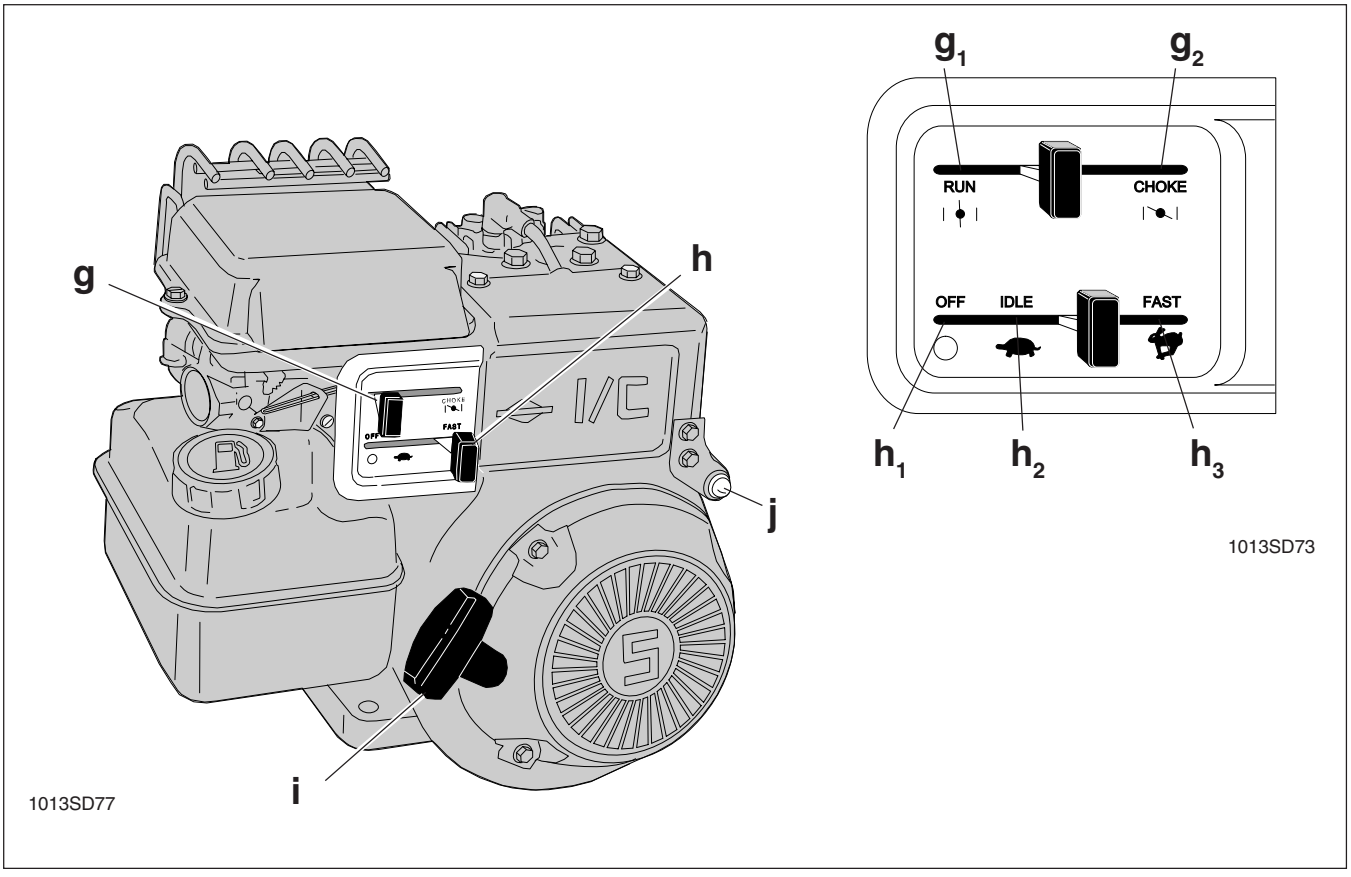
1. Move choke lever **(g)** to "CHOKE" position **(g_2)**.
2. Move throttle control **(h)** to "FAST" position **(h_3)**.
3. Pull starter rope **(i).**

   Note: *Some engines are equipped with an oil alert light* **(j)** *that will flash while pulling the starter rope. If this happens, the oil level is too low and the engine will not start. Replenish oil supply before attempting to start engine.*
4. When engine starts, move throttle control to "IDLE" position **(h_2)** and allow engine to warm up a few minutes.
5. Move choke lever to "RUN" position **(g_1)** when engine is warm.
6. Move throttle control to "FAST" position **(h_3)** to operate pump.

To Stop

1. Move throttle control to "OFF" position **(h_1)**.

CAUTION: Do not move choke lever to "CHOKE" position to stop engine. Backfire or engine damage may occur.



2.4 Starting / Stopping (cont.)

PT2Y / PT3Y

1. Open fuel valve **(a_2)**.
2. Push the engine throttle lever to "run" **(b_2)**.
3. Pull out starter handle until you feel strong resistance, then let it return slowly.
4. Push down decompression lever **(c)**.

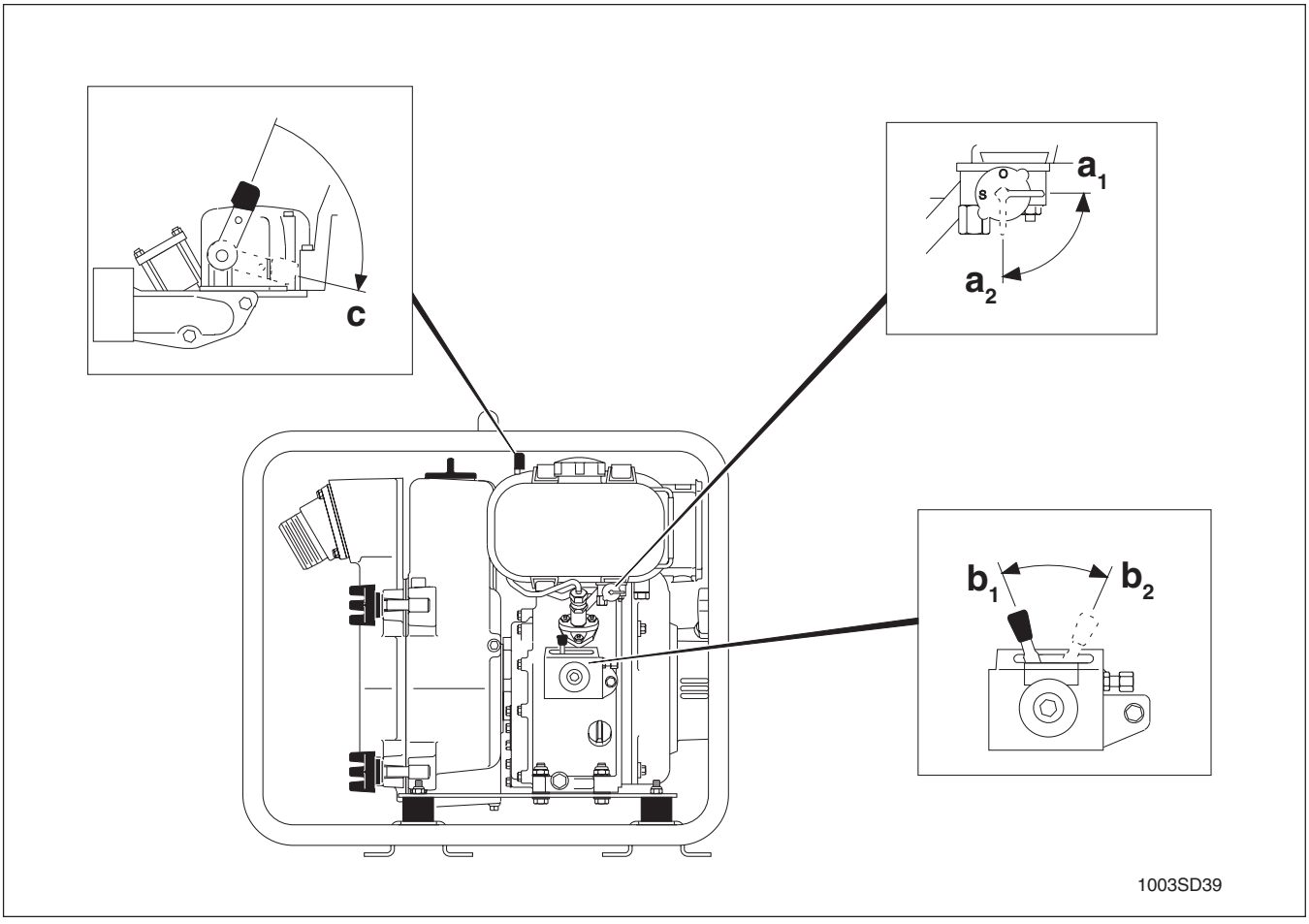
   Note: *Lever will return automatically when the starter is pulled.*
5. Pull starter handle to start engine. If engine does not start, repeat steps 3 and 4.

CAUTION: **NEVER** operate engine without air cleaner. Engine will be damaged.

To Stop

Place the engine throttle in the "Stop" position **(b_1)**. If engine keeps running, stop engine by closing fuel valve **(a_1)**.

DO NOT stop engine using the decompression lever.



2.4 Starting / Stopping (cont.)

PT3V

1. Open fuel valve. **(d_1)**.

   If engine is cold, move choke lever to the “CHOKE” position **(e_1)**. If engine is hot, set choke to the “RUN” position **(e_2)**.

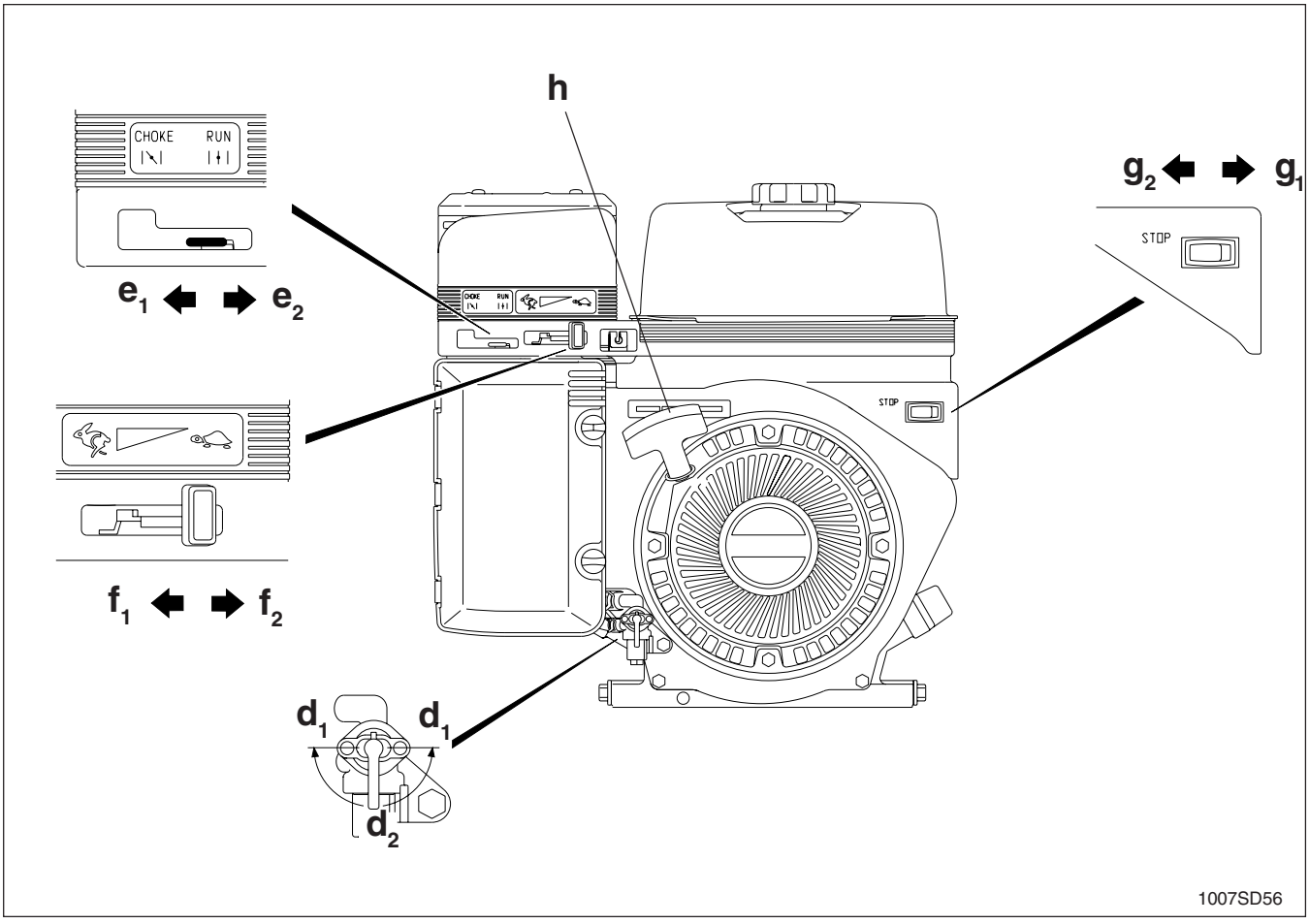
2. Move throttle control to the fast (🐇) position. **(f_1)**.
3. Press stop switch to the on position. **(g_1)**.
4. Pull starter rope **(h)**.

   The engine is equipped with a low oil protection system. If the oil level is low, the engine will not start and the stop switch will flicker while the starter rope is pulled. If this happens, add oil to the engine.

5. Open choke to “RUN” position as engine warms **(e_2)**.
6. Keep engine throttle in the fast position (🐇) while operating pump.

To Stop

1. Reduce engine RPM by moving throttle completely to the idle (🐢) position **(f_2)**.
2. Press engine switch to STOP **(g_2)**.
3. Close fuel valve **(d_2)**.



2.4 Starting / Stopping (cont.)

PTS4V

1. Open fuel valve **(a_1)**.
2. If engine is cold, pull choke control out **(b_1)**. If engine is hot, push choke control in **(b_2)**.
3. Move throttle control to the fast position **(c_1)**.
4. Turn key switch to the start position **(d_3)** and hold until engine starts.

CAUTION: Do not crank engine longer than 15 seconds at a time. Extended cranking can damage starter motor.

5. To start engine using manual start: Turn key switch to the run position **(d_2)**. Pull starter rope **(e)** rapidly to start engine.

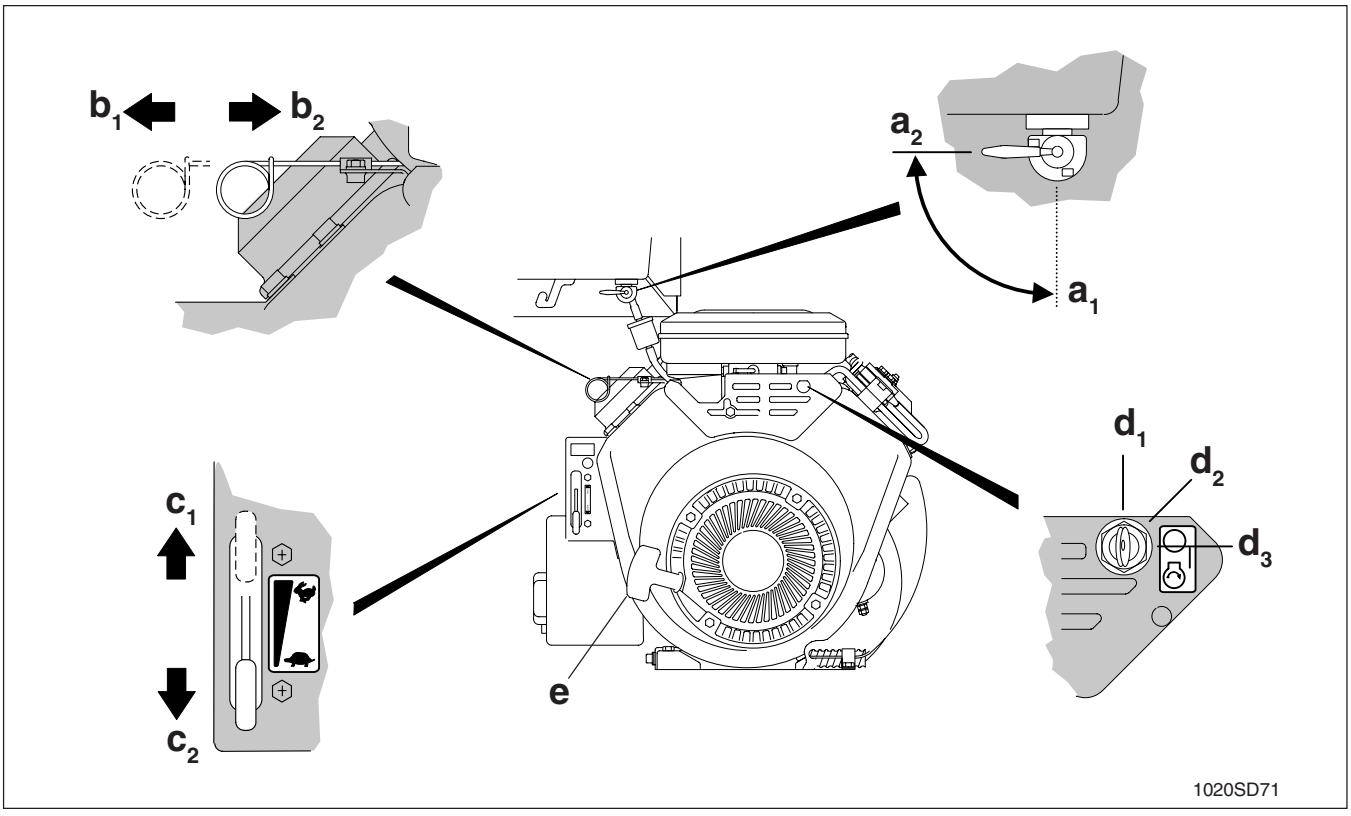
   Leave key in run position **(d_2)** while engine is running.

Note: *The engine is equipped with a low oil protection system. If the oil level is low, the engine will not start. Check engine oil level if engine does not start.*

6. Push choke in as engine warms **(b_2)**.
7. Keep engine throttle in the fast position while operating pump.

To Stop

1. Reduce engine RPM by moving throttle completely to the idle position **(c_2)**.
2. Turn engine switch to the stop position **(d_1)**.
3. Close fuel valve **(a_2)**.



2.5 Hoses and Clamps

Suction Hose

Suction hoses **(f)** must be rigid enough not to collapse when pump is operating.

Discharge Hose

Discharge hoses **(g)** are usually thin-walled collapsible hoses. Rigid hoses similar to those used as suction hoses may also be used as discharge hoses.

Note: *Suction and discharge hoses are available from WACKER. Contact your nearest dealer for more information.*

Suction Hose to Inlet Coupling

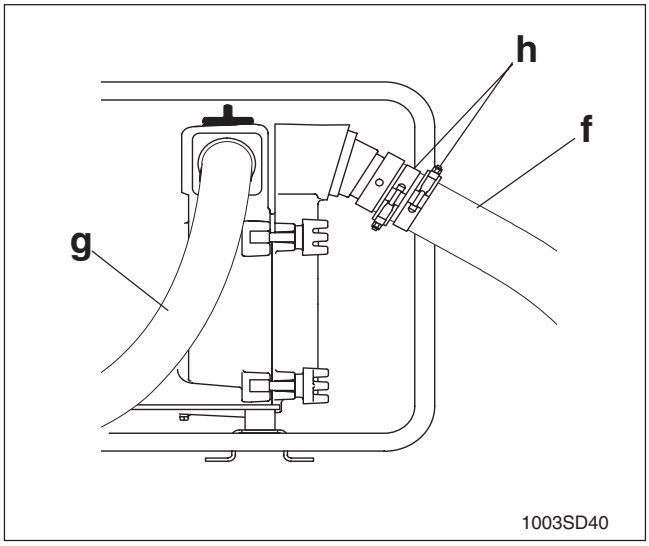
Two clamps **(h)** are recommended for connection of suction hoses to inlet coupling.

Note: *This connection is important. Even a small air leak on the suction side of pump will prevent the pump from priming.*

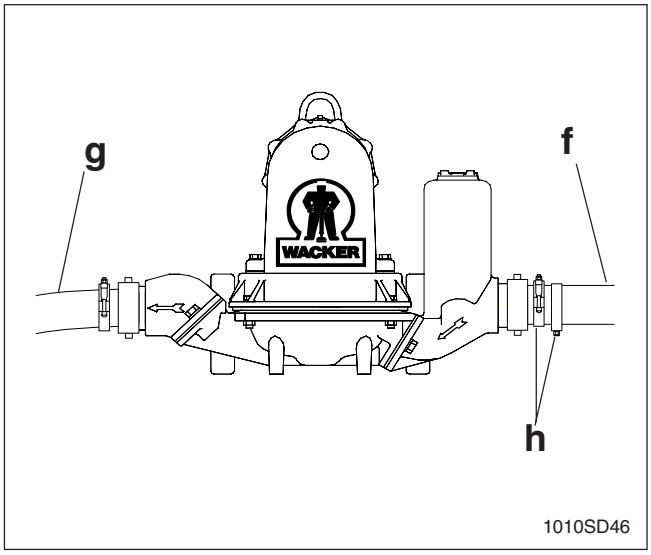
Other Hose Connections

For other hose connections, one T-bolt or worm-gear type clamp is usually sufficient to hold hoses in place. In some cases, slight variances in hose diameters may make it necessary to add more clamps in order to maintain tight connections.

PT / PG Series



PD Series

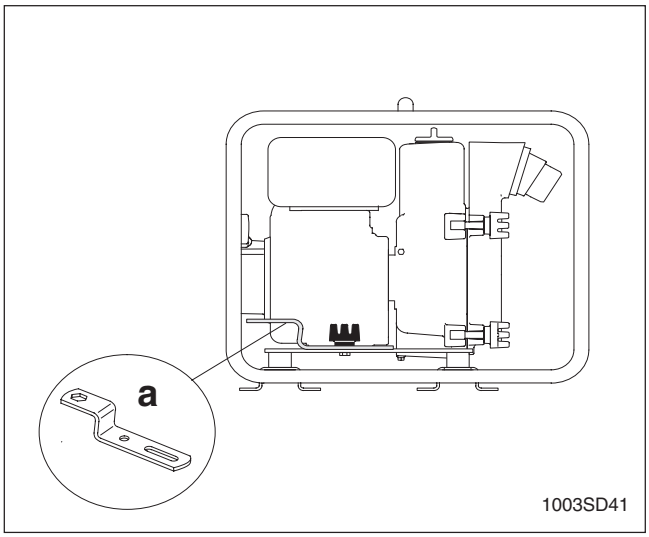


2.6 Pump Wrench

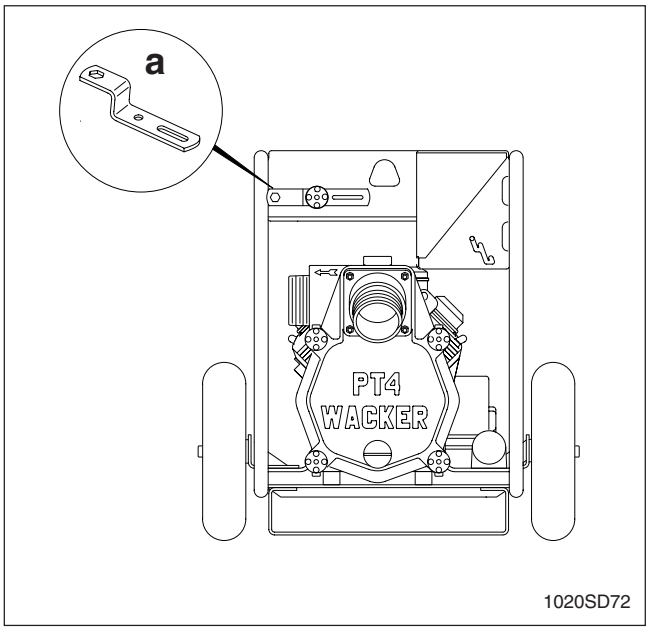
The wrench **(a)** supplied with the pump can be used to loosen and tighten: hose couplings, knobs on pump cover, priming plug, and drain plug on front cover.

Store wrench on pump frame.

PT2 / PT3 Series



PTS4 Series



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3.1 Description and Operation

PT Series Pumps use an impeller **(1)** and volute **(2)** to create the suction and discharge pressures required for pump operation.

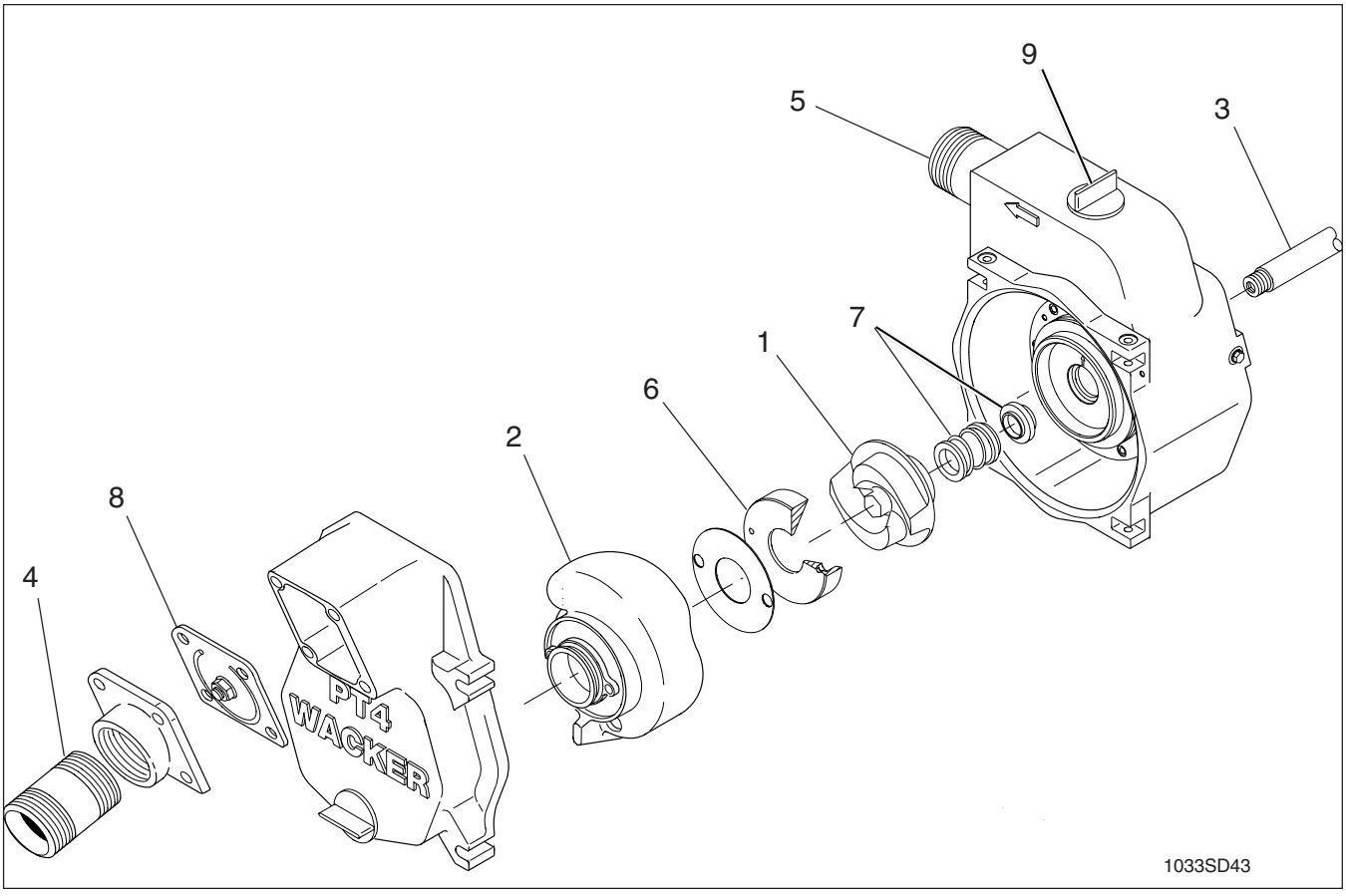
The impeller is bolted directly to the engine drive shaft **(3)** and rotates inside the volute casing. Water is drawn into the pump inlet **(4)** by the low pressure area created at the eye of the impeller. Vanes on the impeller move the liquid into the volute where it is gathered and directed to the discharge port **(5)**.

A moveable tapered ring **(6)** set inside the volute, can be shimmed to maintain close tolerances between the volute and impeller to maintain pump efficiency.

A mechanical seal **(7)** mounted behind the impeller, prevents water from following the engine drive shaft and seals the rear of the pump housing to prevent leakage. An oil cavity in the pump case holds the seal lubricant, reducing wear to seal surfaces.

The flapper valve **(8)** at the pump inlet, closes when the pump stops. This valve seals the inlet port and prevents the prime water in the suction hose from being lost.

Pump case is easily filled with water by removing the priming plug **(9)**.



3.2 Periodic Maintenance Schedule

The chart below lists basic pump and engine maintenance. Refer to engine manufacturer's Operation Manual for additional information on engine maintenance. A copy of the engine Operator's Manual was supplied with the machine when it was shipped.

	PT2				PT3			PT4
	PT 2A	PT 2B	PT 2R	PT 2Y	PT 3A	PT 3V	PT 3Y	PTS 4V
DAILY (Before Starting)								
Check fluid level.	•	•	•	•	•	•	•	•
Check engine oil level.	•	•	•	•	•	•	•	•
Inspect for leaks between pump and engine.	•	•	•	•	•	•	•	•
Inspect air cleaner. Clean as needed.	•	•	•	•	•	•	•	•
Check and tighten external hardware.	•	•	•	•	•	•	•	•
NEW ENGINE BREAK-IN (First 20 hrs.)								
Change engine oil and replace filter.	•	•	•	•	•	•	•	•
Check and adjust valve clearances.				•			•	
EVERY 2 WEEKS (50 hrs.)								
Inspect shockmounts for damage.	•	•	•	•	•	•	•	•
Change oil in pump housing.	•	•	•	•	•	•	•	•
Change engine oil and replace filter.		•	•			•		•
Clean air cleaner.	•	•	•		•	•		
EVERY MONTH (100 hrs.)								
Check and clean spark plug.	•	•	•		•	•		•
Replace air cleaner.	•							•
Change engine oil and replace filter.	•			•	•		•	
Clean cooling system.		•						
Clean combustion chamber.		•						
Clean fuel filter.			•			•		
EVERY 3 MONTHS (300 hrs.)								
Check and adjust valve clearances.	•				•			
EVERY 6 MONTHS (500 hrs.)								
Check and adjust valve clearances.		•	•	•			•	
Clean cylinder head.			•					
Replace air cleaner.				•			•	
Replace in-line fuel filter.				•			•	•
EVERY YEAR								
Check and adjust valve clearances.	•					•		•

3.3 Engine Oil

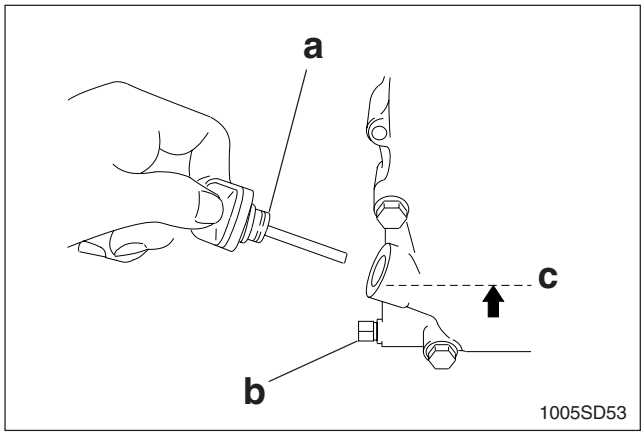
PT2A / PT2R / PT3A / PT3V

Drain oil while engine is still warm.

1. Remove oil fill plug **(a)** and drain plug **(b)** to drain oil.
2. Install drain plug.
3. Fill engine crankcase with recommended oil up to level of plug opening **(c)**.

   PT2A / PT2R Oil capacity: 21 oz. (0.6 liters)
   PT3A Oil capacity: 37 oz. (1.1 liters)
   PT3V Oil capacity: 41 oz. (1.2 liters)

4. Install oil filler plug.



PT2B

Drain oil while engine is still warm.

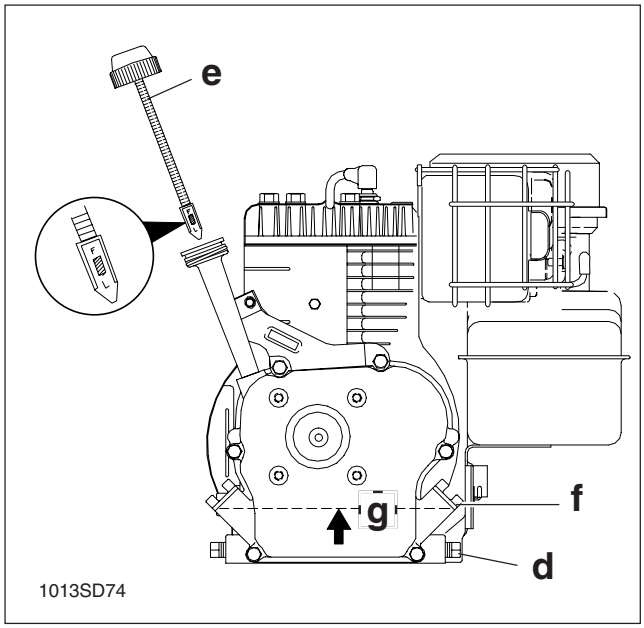
1. Remove oil drain plug **(d)** and drain oil.
2. Re-install drain plug.
3. To add oil do one of the following:
   Remove dipstick **(e)** and add oil through filler tube. Fill to full mark on dipstick.

   or

   Remove filler plug **(f)** and fill engine crankcase through oil filler opening with recommended oil, up to level of plug opening **(g)**.

   Oil capacity: 20 oz. (0.6 liters).

4. When full, re-install filler plug and dipstick.

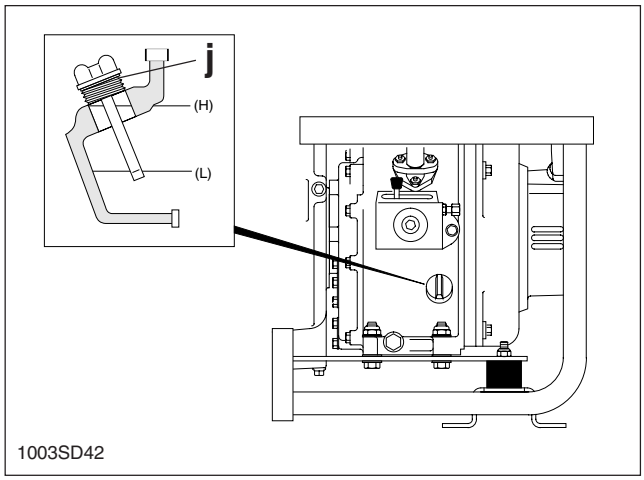


3.3 Engine Oil (cont.)

PT2Y / PT3Y

Always check oil level before starting engine, and add oil if level is low **(L)**. To check oil, remove dipstick **(j)** and insert it into oil pan. Do not screw in the dipstick . Fill engine with oil up to the mouth of the filler port **(H)**.

CAUTION: When checking oil level, make sure engine is level. If it is tilted, you may add too much or too little oil. If you overfill, the engine temperature will get too hot. If you do not add enough oil, the engine could seize up.

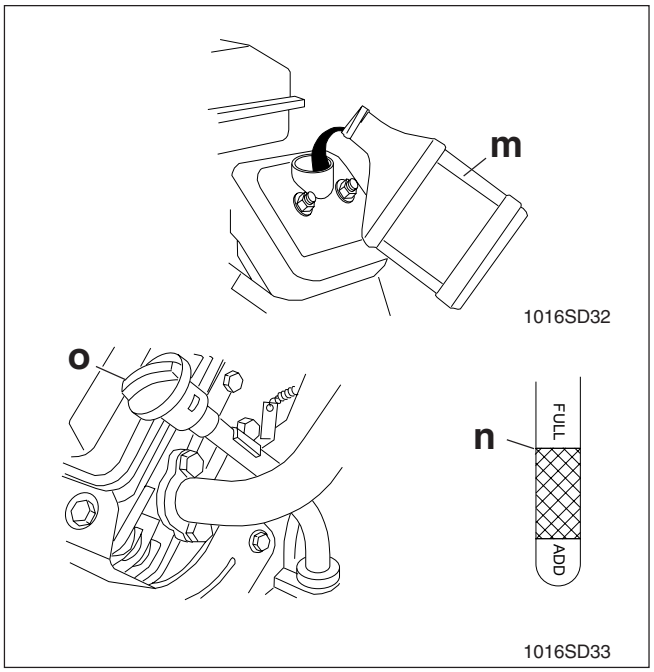


PTS4V

Check engine oil level daily before starting engine. Add oil as required.

To check oil level, place pump on a level surface. Clean area around oil fill and remove dipstick. Pour oil **(m)** slowly, checking oil level occasionally with dipstick. Fill to full mark on dipstick **(n)**. **DO NOT** overfill.

When measuring oil level, screw dipstick **(o)** firmly in place until cap bottoms on tube.



3.4 Air Cleaner

PT2A / PT3A / PT2B / PT2R

Service air cleaner frequently to prevent carburetor malfunction.

NEVER run engine without air cleaner. Severe engine damage will occur.

WARNING

NEVER use gasoline or other types of low flash point solvents for cleaning the air cleaner. A fire or explosion could result.

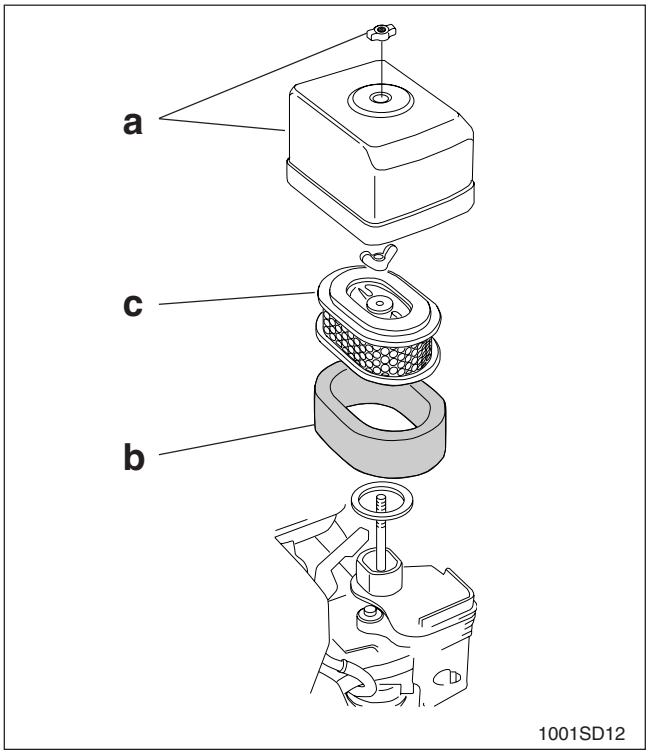
The engine is equipped with a dual element air cleaner.

1. Remove air cleaner cover **(a)**. Remove both elements and inspect them for holes or tears. Replace elements if damaged. Undamaged elements may be cleaned and reused.

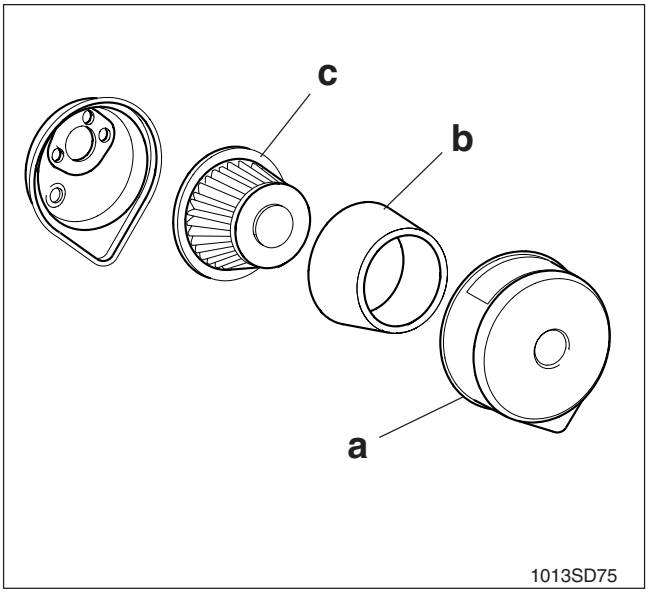
2. To clean foam element **(b)**:
   Wash in solution of mild detergent and warm water. Rinse thoroughly in clean water. Allow element to dry thoroughly. Once dry, soak element in clean engine oil and squeeze out excess.

3. Paper element **(c)**
   Tap element lightly to remove excess dirt or blow compressed air through filter from the inside out. Replace paper element if it appears heavily soiled.

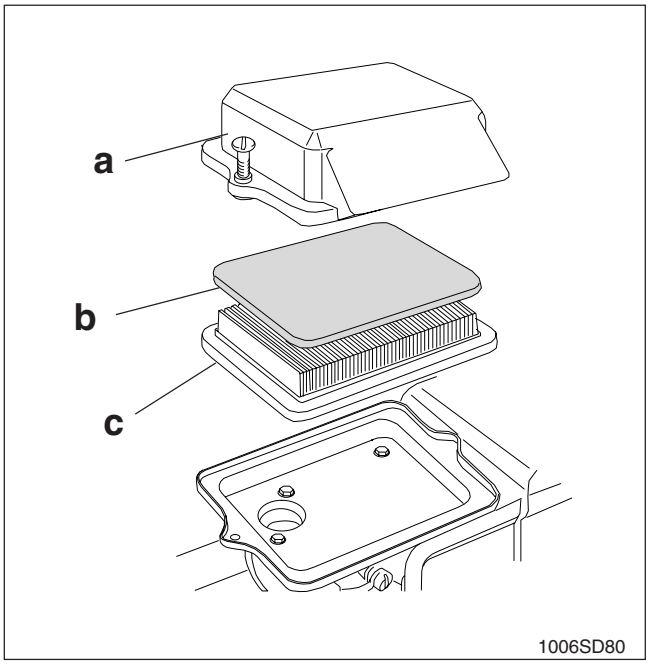
PT2A / PT3A



PT2R



PT2B



3.4 Air Cleaner (cont.)

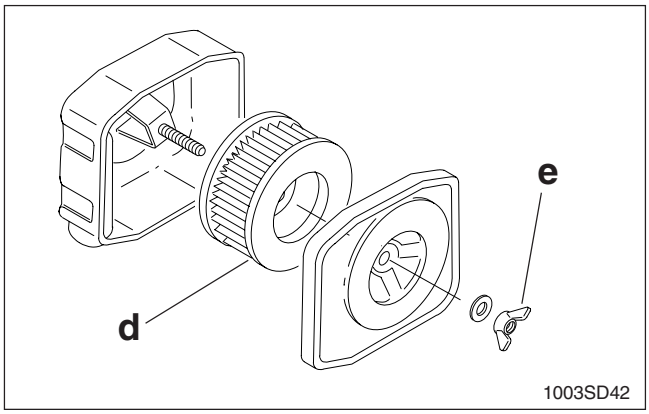
PT2Y / PT3Y

Replace air cleaner element **(d)** when engine power decreases or engine exhaust color becomes dark.

To check or replace element: loosen wing nut **(e)** and remove cover and element.

DO NOT wash the air cleaner element with detergent.

NEVER run engine without the air cleaner element. Rapid engine wear will result.



PT3V

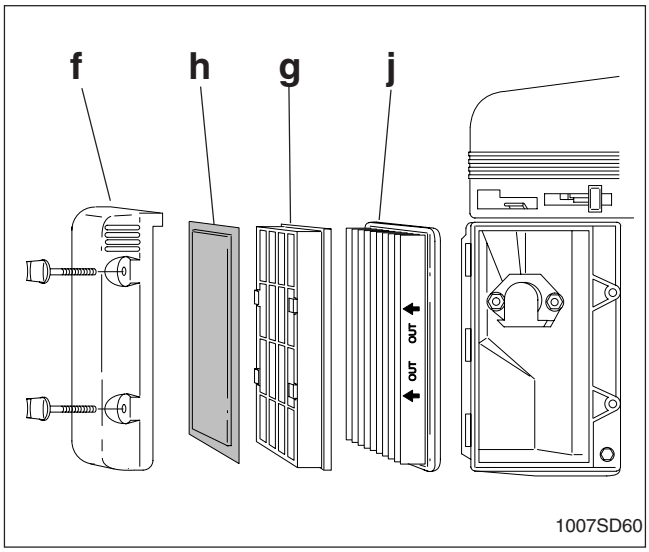
Service air cleaner frequently to prevent carburetor malfunction.

NEVER run engine without air cleaner. Severe engine damage will occur.

WARNING

NEVER use gasoline or other types of low flash point solvents for cleaning the air cleaner. A fire or explosion could result.

The engine is equipped with a dual element air cleaner.



1. Loosen cover knobs and remove air cleaner cover **(f)**. Remove both elements and retainer **(g)**. Inspect them for holes or tears. Replace elements if damaged. Undamaged elements may be cleaned and reused.

2. Foam element **(h)**
   Wash in solution of mild detergent and warm water. Rinse thoroughly in clean water. Allow element to dry thoroughly. Once dry, soak element in clean engine oil and squeeze out excess.

3. Paper element **(j)**
   Tap element lightly to remove excess dirt or blow compressed air through filter from the inside out. Replace paper element if it appears heavily soiled.

3.4 Air Cleaner (cont.)

PTS4V

Service air cleaner frequently to prevent carburetor malfunction.

NEVER run engine without air cleaner. Severe engine damage will occur.

NEVER use gasoline or other types of low flash point solvents for cleaning the air cleaner. A fire or explosion could result.

The engine is equipped with a dual element air cleaner. To service air cleaner:

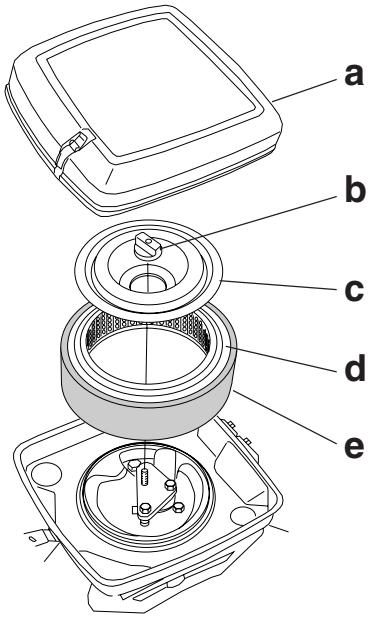
1. Remove cover **(a)**, knob **(b)**, and retaining plate **(c)**.

2. Remove foam precleaner **(e)** from filter cartridge **(d)**.

3. Wash precleaner in liquid detergent and water. Squeeze dry in a clean cloth. Saturate precleaner in engine oil, squeeze out excess oil. Replace precleaner if it is damaged or heavily soiled.

4. To clean cartridge, remove and tap lightly on a flat surface. Replace cartridge if it is damaged or heavily soiled.

Note: *Do not use petroleum solvents to clean precleaner or cartridge. Petroleum type solvents will damage them. Do not use pressurized air to clean cartridge. Pressurized air can also damage the cartridge.*



1016SD34

3.5 Spark Plug

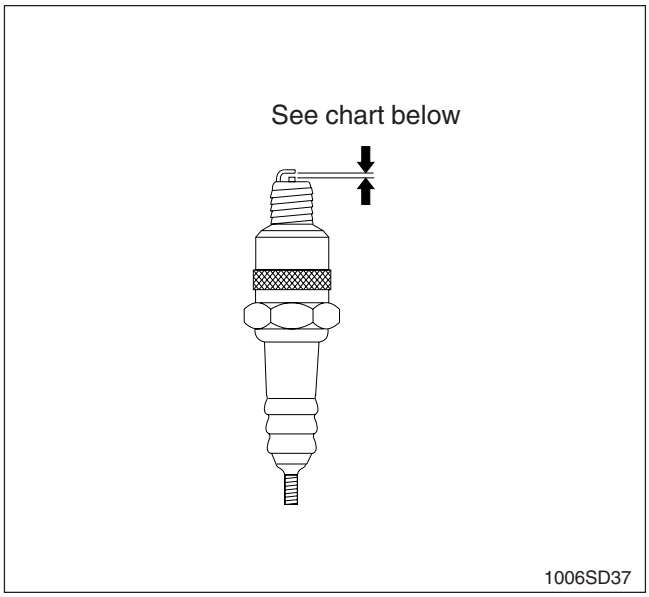
Clean or replace spark plug as needed to ensure proper operation. Refer to the engine Owner's Manual.

WARNING

The muffler becomes very hot during operation and remains hot for a while after stopping the engine. Do not touch the muffler while it is hot.

1. Remove spark plug and inspect it.
2. Replace plug if the insulator is cracked or chipped. Clean spark plug electrodes with a wire brush.
3. Set gap to meet specifications (see chart).
4. Tighten spark plug securely.

CAUTION: A loose spark plug can become very hot and may cause engine damage.



		PT2A / PT3A	PT2B	PT2R	PT3V / PTS4V
Spark Plug	type	(NGK) BPR 6ES BOSCH WR 7DC	Champion RCJ8	(NGK) B6HS Champion L86C	Champion RC12YC
Electrode Gap	in. (mm)	0.028–0.031 (0.7–0.8)	0.030 (0.76)	0.024–0.028 (0.6–0.7)	0.030 (0.76)

3.6 Carburetor Adjustment

PT2A / PT3A

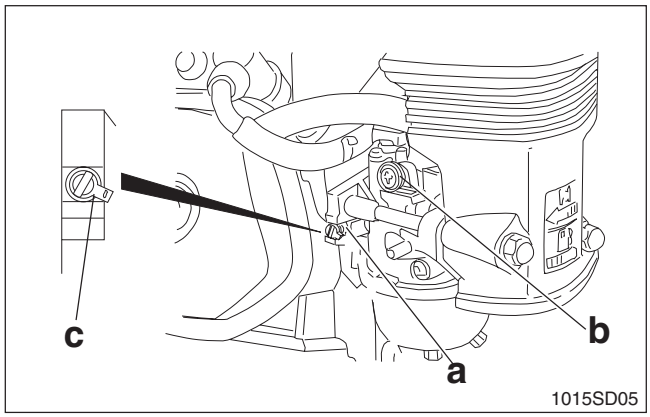
1. Start engine and allow it to warm up to operating temperature.

2. Set pilot screw **(a)** 2 turns out. See Note.

3. With the engine idling, turn pilot screw **(a)** in or out to the setting that produces the highest RPM.

4. After pilot screw is adjusted, turn throttle stop screw **(b)** to obtain the standard idle speed, 1400 ±150 rpm.

Note: *On some engines the pilot screw is fitted with a limiter cap **(c)** to prevent excessive enrichment of the air-fuel mixture in order to comply with emission regulations. The mixture is set at the factory and no adjustment should be necessary. Do not attempt to remove the limiter cap. The limiter cap cannot be removed without breaking the pilot screw.*



PT2B

Note: *All carburetor adjustments must be made with air cleaner attached to engine.*

Initial Adjustment:

1. Turn needle valve **(d)** clockwise (in) until it just closes. **Do not** over-tighten or damage may occur.

2. Open needle valve by turning counterclockwise (out) 1-1/2 turns.

   This initial adjustment will allow the engine to start and be warmed up before making final adjustment.

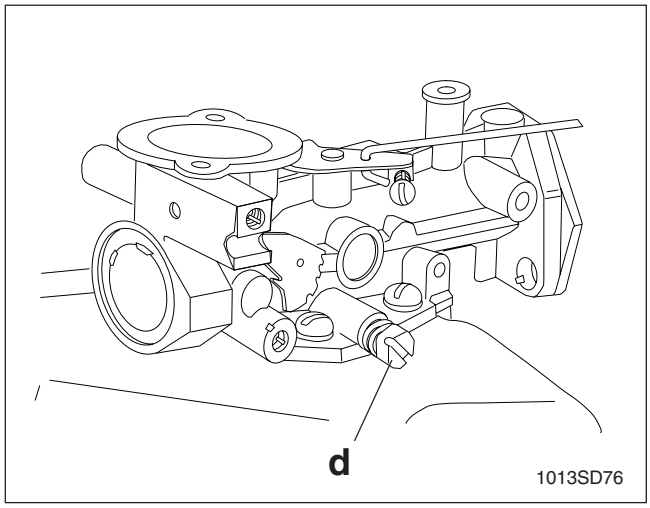
Final Adjustment:

1. Start the engine and allow it to warm up at least two minutes.

2. Turn needle valve **(d)** clockwise (in) until engine misses. This is the LEAN setting.

3. Turn the needle valve counterclockwise (out), past the point where the engine runs smoothly, until the engine starts missing again. This is the RICH setting.

4. Turn the needle valve clockwise (in) to the mid-point between the RICH and LEAN settings.



3.6 Carburetor Adjustment (cont.)

PT3V

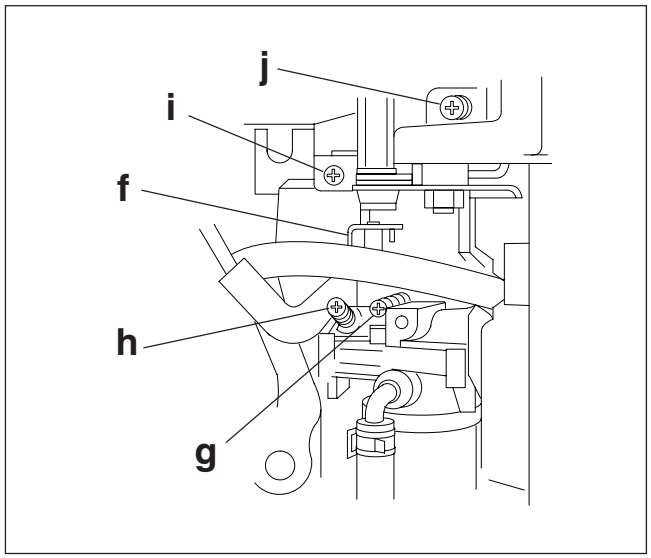
1. Start engine and allow it to warm up to operating temperature.

2. Place throttle control in idle position. Hold carburetor throttle lever **(f)** against idle speed screw. Turn idle speed screw **(g)** to obtain 1300 RPM.

3. While still holding carburetor throttle lever against idle speed screw, turn idle mixture screw **(h)** clockwise (lean) or counterclockwise (rich) until engine runs smoothly. Release carburetor throttle lever.

4. Adjust governed idle screw **(i)** to 1400 RPM. Move throttle control to the fast position. Engine should accelerate smoothly. If it does not, readjust carburetor, usually to a slighly richer mixture, by turning idle mixture screw **(h)** 1/8 turn counterclockwise.

5. Adjust top speed screw **(j)** to 3500 RPM.



PTS4V

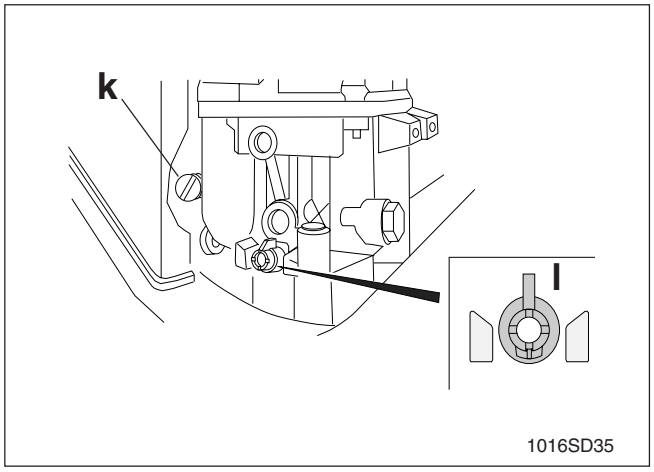
Note: *Air cleaner must be in place and engine warm when making adjustments to carburetor.*

1. With engine running, place throttle in SLOW position and rotate carburetor throttle lever against the idle speed screw **(k)** and hold it there.

2. Turn the idle speed screw to obtain 1300 to 1500 RPM.

3. While still holding the throttle lever against the idle speed screw, turn the idle mixture valve **(l)** midway between limits.

4. Readjust the idle speed to 1200 RPM and release carburetor throttle lever. Engine should accelerate smoothly when throttle is opened. If it does not, readjust idle mixture valve slightly counterclockwise.



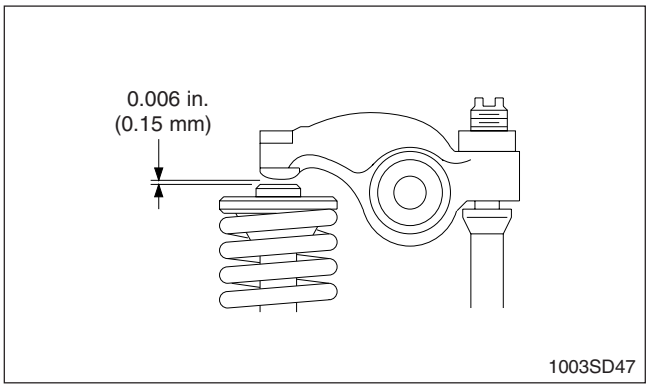
3.7 Adjusting Valve Clearance

PT2Y / PT3Y

Adjust valve clearance after first 20 hours of operation, and every 6 months or 500 hours thereafter.

Set valve clearance with engine cold and piston at the top of its compression stroke.

Valve Clearance Intake: 0.006" (0.15 mm)
Exhaust: 0.006" (0.15 mm)



3.8 Adjusting Engine Speed

PT2Y / PT3Y

Before making any engine adjustments, remove pump cover and check that impeller and pump housing are clean, and that impeller clearance is correct. Adjust engine to a no-load speed of:
3400 ± 100 RPM. **PT2Y**
3800 ± 100 RPM. **PT3Y**

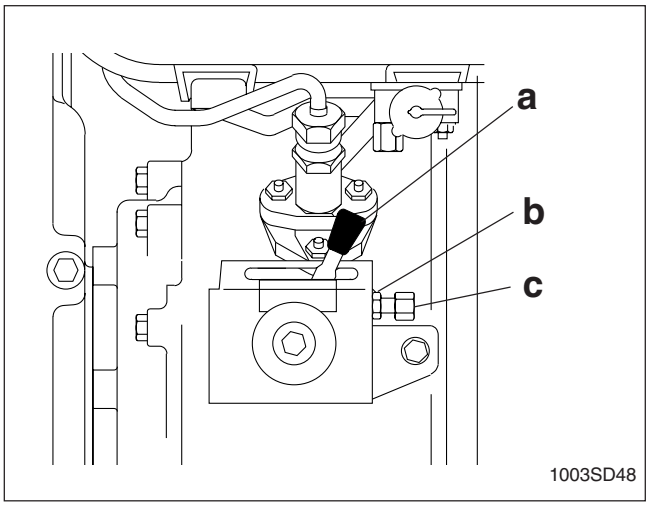
To adjust engine speed:

1. Fill pump housing with water. This will keep pump seals cool while running engine.

2. Start engine and allow it to warm up for a minute.

3. Loosen locknut **(b)** on throttle stop screw **(c)**. Turn screw in to decrease speed, out to increase speed. Make sure throttle lever **(a)** is touching stop screw before measuring RPM. Tighten locknut after correct engine speed is set.

CAUTION: Running pump at a speed higher than that listed in "Technical Data" can damage pump and engine. **DO NOT** adjust governor setting.



3.9 Cleaning Sediment Cup

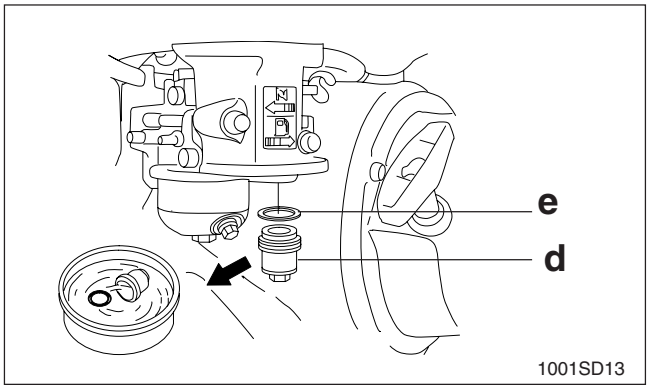
1. Turn fuel valve off.

2. Remove sediment cup **(d)** seal **(e)** and screen **(f)**.

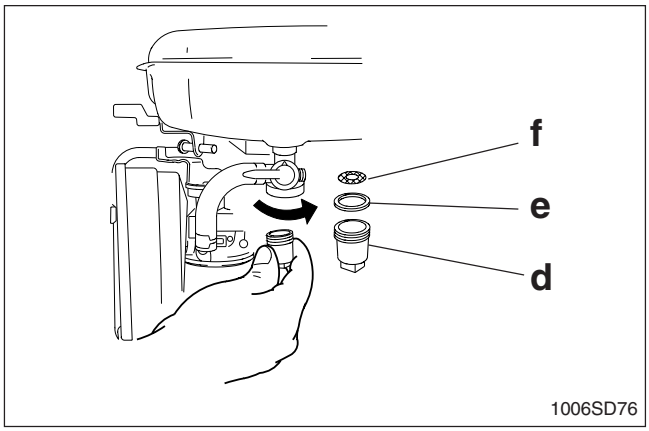
3. Wash them thoroughly in a nonflammable solvent. Dry them and reinstall.

4. Turn fuel valve on and check for leaks.

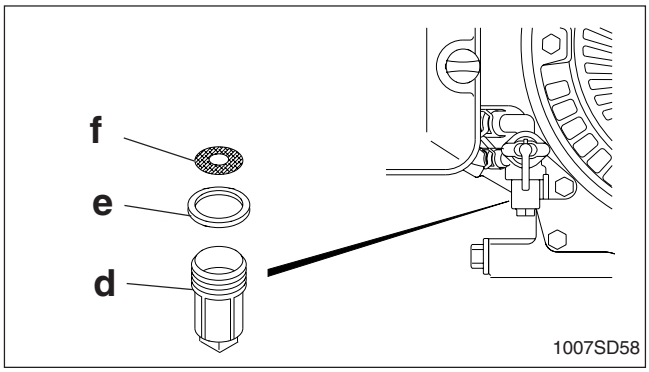
PT2A / PT3A



PT2R



PT3V / PTS4V



3.10 Mechanical Seal Lubrication

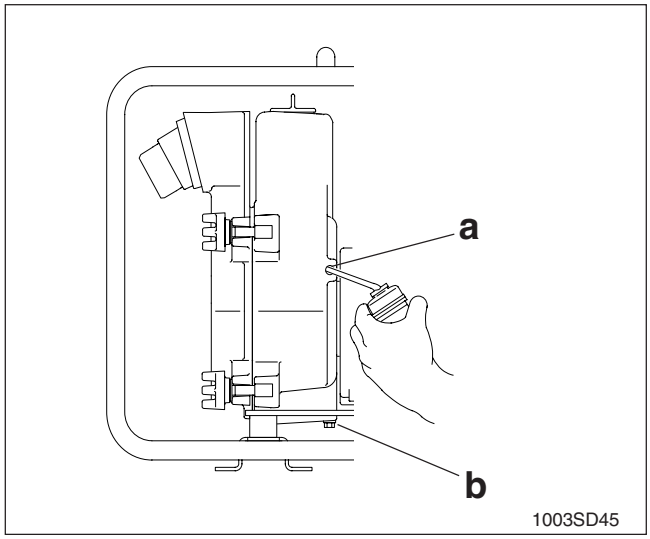
Change seal lubricant every 50 hours using SAE 30W oil.

1. Remove plugs **(a)** from both sides of pump housing for venting.

2. Remove bottom plug **(b)** and allow oil to drain from oil cavity.

3. Install bottom drain plug. Fill oil cavity through one of the side plug **(a)** holes until oil is level with top of hole or flows out hole on opposite side. Oil quantity: approximately 4 ounces (120 ml).

4. Install all plugs before operating pump.



3.11 Adjusting Impeller Clearance

If it is necessary to replace impeller or volute insert, be sure clearance between impeller and insert is adjusted correctly. The impeller **(c)** should be as close to the insert **(d)** as possible without rubbing against it. Clearance is adjusted by adding or removing shims **(e)** from behind insert. Inserts can be either plastic or steel. Plastic inserts float freely between the impeller and the volute. Steel inserts are attached to the pump cover and must be unbolted **(f)** before they can be removed.

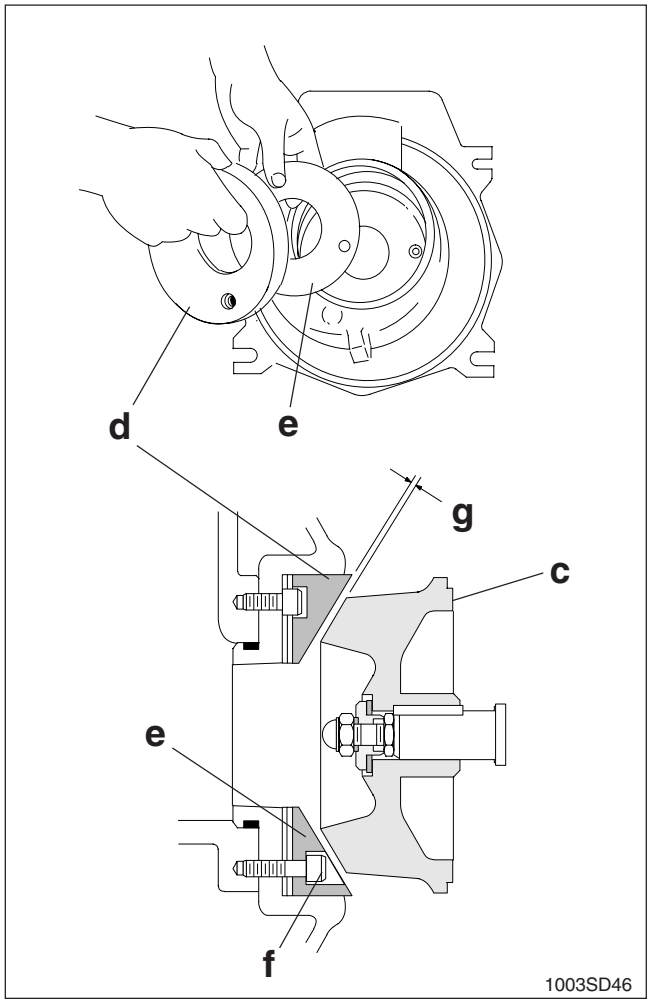
Check clearance **(g)** between impeller and insert by **slowly** pulling starter rope to turn impeller. On diesel engines without starter ropes, use hand crank.

Note: *Remove spark plug to make it easier to turn impeller. On diesel engines open decompression device before cranking engine.*

If starter or crank is difficult to turn, or rubbing is heard from inside pump, the impeller and insert are too close to each other. Remove a shim from behind insert and check again for rubbing. Continue removing shims until impeller turns easily.

Note: *It is important not to remove too many shims or the clearance between the impeller and insert will become too wide and pump performance will be reduced.*

As the impeller wears down, additional shims may be required to maintain the clearance between the impeller and insert.



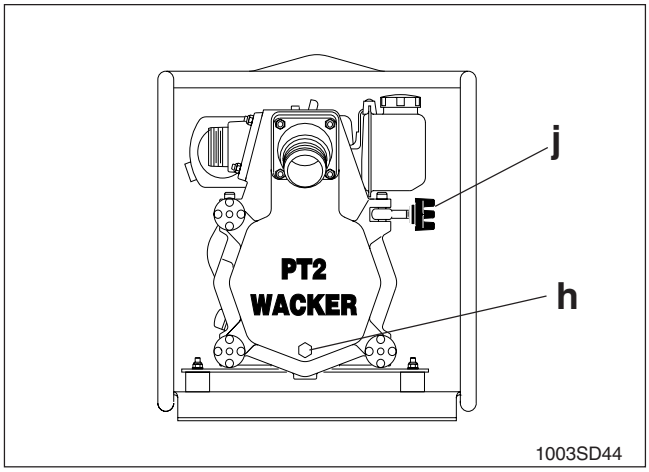
3.12 Cleaning Pump

After pumping water containing a large amount of dirt or debris, clean out inside of pump housing.

1. Remove drain plug **(h)** from pump housing and drain any water left in pump.
2. Loosen the four knobs holding the pump cover **(j)** and remove cover.
3. Clean out dirt and debris. Inspect impeller and volute insert for wear.

WARNING

The impeller may develop sharp edges. Use care when cleaning around impeller to prevent getting cut.

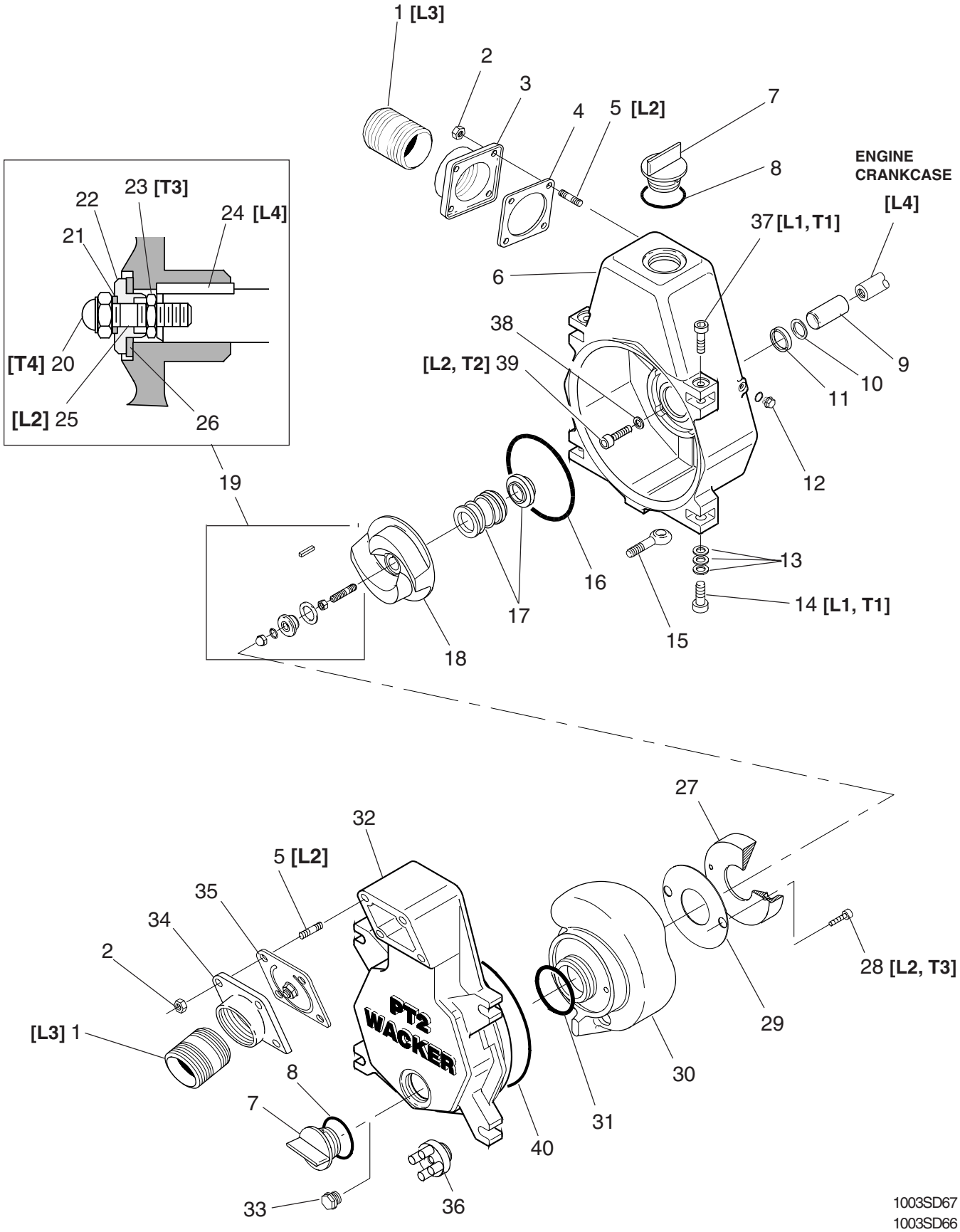


3.13 Storage

If pump is being stored for more than 30 days:

1. Remove drain plug from pump cover and drain out any water left in the housing.
2. Remove pump cover and clean inside of pump housing. Coat inside of pump with a light film of oil to reduce corrosion. A spray can of oil works well for this.
3. Tape up suction and discharge ports to prevent anything from falling into pump.
4. Change engine oil and follow procedures described in engine manual for engine storage.
5. Cover pump and engine and store in a clean, dry area.

3.14 PT2 Pump Assembly

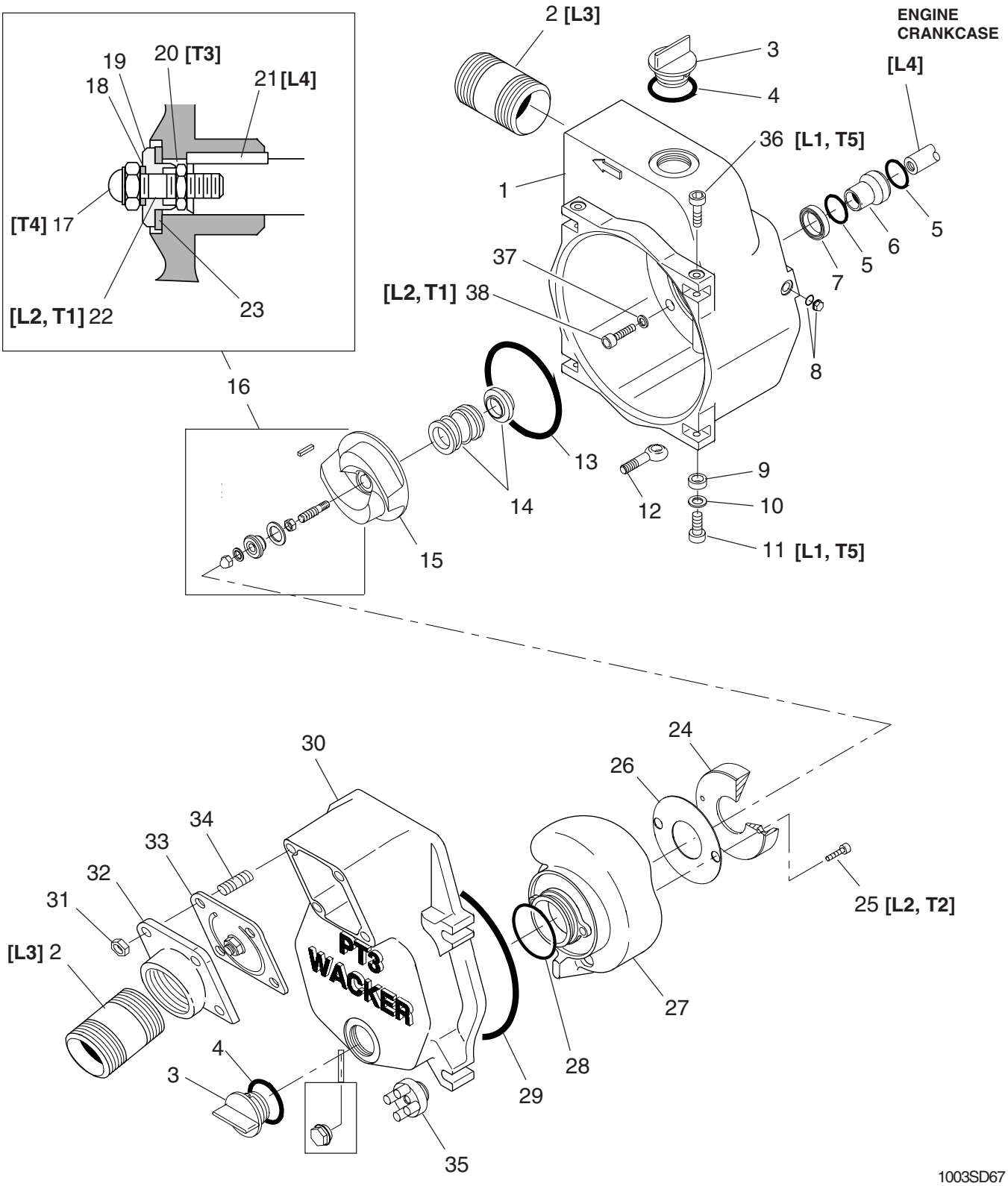


1003SD67
1003SD66

REF.	DESCRIPTION	QTY.
1	Fitting - nipple	2
2	Locknut M8	8
3	Flange - port	1
4	Gasket - priming plug	1
5	Stud M8x30	8
6	Kit - pump housing (incl. 7 & 8)	1
7	Plug - priming	2
8	Gasket - priming plug	2
9	Sleeve - engine shaft	1
10	Washer - flat	1
11	Seal-shaft	1
12	Plug M10 hex	3
	Ring - sealing	3
13	Washer 13	3
14	Screw M12x50	2
15	Bolt - eye	4
16	O-Ring	1
17	Seal - mechanical (std.)	1
18	Kit - impeller	1
19	Kit - mounting	1
20	Nut M8 hex.	1
21	Ring - sealing	1
22	Hub - impeller mount	1
23	Nut 5/16-24 hex jam	1
24	Key - square	1
25	Stud - impeller mount	1
26	Gasket - impeller mounting	1
27	Kit - seal insert (incl. 28)	1
28	Screw M8x25	2
29	Shim .005""	A/R
	Shim .010""	A/R
	Shim .020""	A/R
	Shim .040""	A/R
30	Volute	1
31	O-Ring	1
32	Kit - pump cover (incl. 7 & 8)	1
33	Plug M20, hex.	1
	Ring - sealing	1
34	Flange - port	1
35	Gasket - flapper	1
36	Knob	4
37	Screw M12x40	2
38	Ring - sealing	4
39	Screw M8x45	2
40	O-Ring	1

[L1] - 0029311 **[L2]** - 0029312 **[L3]** - 0079356 **[L4]** - 0073287
[T1] - 28 ft.lbs. (38 Nm) **[T2]** - 16 ft.lbs. (22 Nm) **[T3]** - 11 ft.lbs. (15 Nm) **[T4]** - 25 ft.lbs. (34 Nm)

3.15 PT3 Pump Assembly

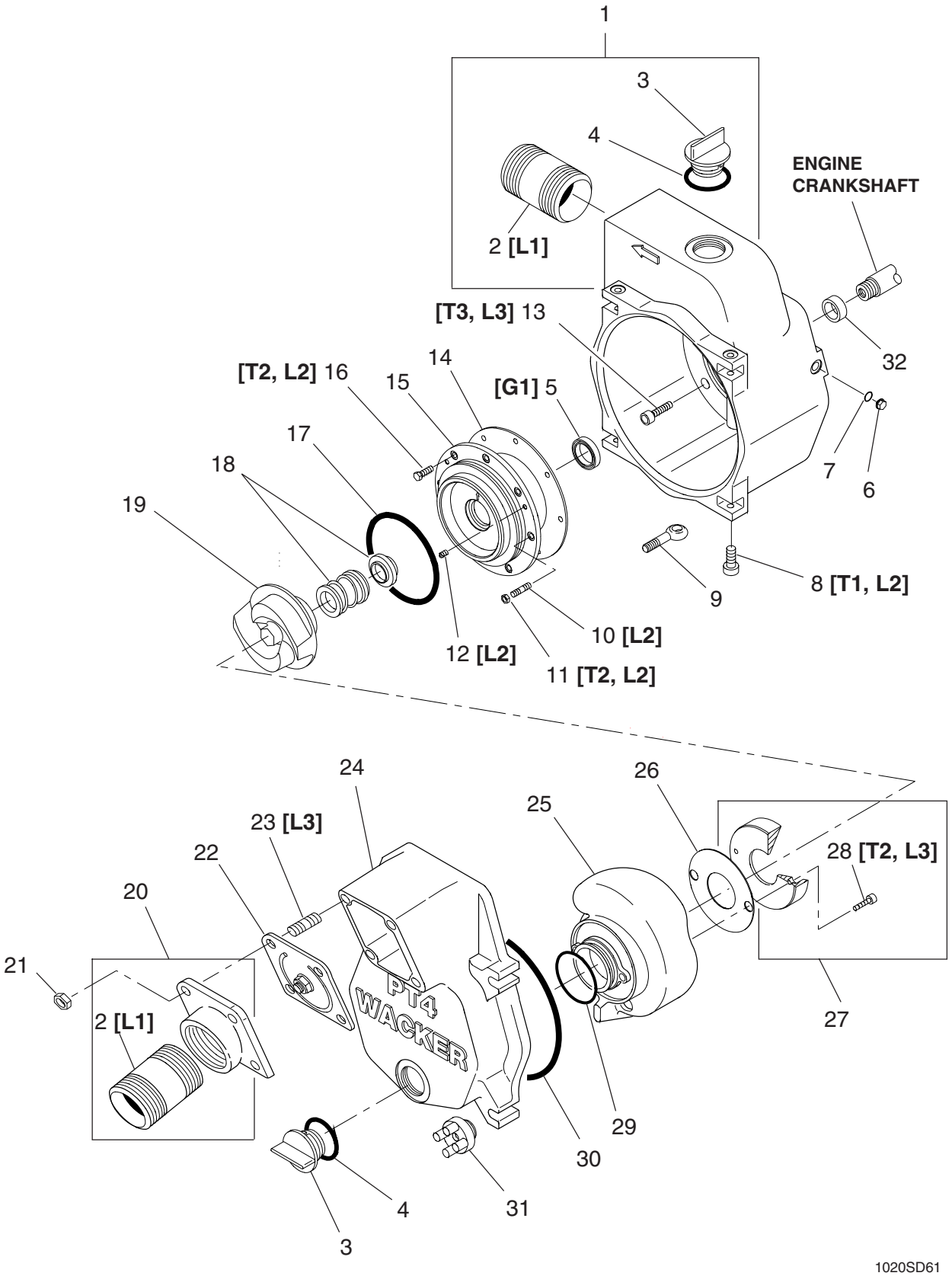


1003SD67
1004SD13

REF.	DESCRIPTION	QTY.
1	Kit - pump housing (incl. 1–4)	1
2	Fitting - nipple	2
3	Plug - priming	2
4	Gasket - priming plug	2
5	Seal - ring	2
6	Sleeve - engine	1
7	Seal - shaft	1
8	Plug M10, hex	3
	Seal - ring	3
9	Spacer - pump	2
10	Washer B13 flat	2
11	Screw M12x55	2
12	Bolt - eye	4
13	O-Ring	1
14	Seal - mechanical (std.)	1
15	Impeller	1
16	Kit - mounting (incl. 17–23)	1
17	Nut M10	1
18	Ring - sealing	1
19	Hub - impeller mount	1
20	Nut	1
21	Key - square	1
22	Stud - impeller mount	1
23	Gasket - impeller mount	1
24	Insert - steel (incl. 25)	1
25	Screw M8x35	2
26	Shim .005""	A/R
	Shim .010""	A/R
	Shim .020""	A/R
	Shim .040""	A/R
27	Volute	1
28	O-Ring	1
29	O-Ring	1
30	Kit - pump cover (incl. 3 & 4)	1
31	Locknut M8	4
32	Port (incl. 2)	1
33	Gasket - flapper	1
34	Stud M8x30	4
35	Knob	4
36	Screw M12x40	2
37	Seal - ring	4
38	Screw 3/8-16	4

[L1] - 0029311 **[L2]** - 0029312 **[L3]** - 0079356 **[L4]** - 0073287
[T1] - 15 ft.lbs. (21 Nm) **[T2]** - 16 ft.lbs. (22 Nm) **[T3]** - 11 ft.lbs. (15 Nm) **[T4]** - 25 ft.lbs. (34 Nm)

3.16 PTS4V Pump Assembly



REF.	DESCRIPTION	QTY.
1	Kit - pump housing (incl. 2–4)	1
2	Fitting - nipple	2
3	Plug - priming	2
4	Gasket - priming plug	2
5	Seal - shaft	1
6	Plug M10, hex	3
7	Seal - ring	3
8	Screw M12x40	4
9	Bolt - eye	4
10	Stud M8x20	2
11	Nut M8	2
12	Setscrew M8x10	3
13	Screw 7/16-14x1-1/4	4
14	Gasket - pump oil cover	1
15	Cover - oil chamber	1
16	Screw M8x20	5
17	O-Ring	1
18	Seal - mechanical (std.)	1
19	Impeller	1
20	Kit - suction port replacement (incl. 2)	1
21	Locknut M8	4
22	Gasket - flapper	1
23	Stud M8x30	4
24	Kit - pump cover (incl. 3 & 4)	1
25	Volute	1
26	Shim .005""	A/R
	Shim .010""	A/R
	Shim .020""	A/R
	Shim .040""	A/R
27	Kit - volute insert (incl. 28)	1
28	Screw M8x35	3
29	O-ring	1
30	O-ring	1
31	Knob	4
32	Sleeve - shaft	1

[G1] - Gease #2
[L1] - 0079356 **[L2]** - 0029311 **[L3]** - 0029312
[T1] - 28 ft.lbs. (38 Nm) **[T2]** - 16 ft.lbs. (22 Nm) **[T3]** - 40 ft.lbs. (54 Nm)

3.17 Inspecting Pump

Before disassembling pump, check for conditions both outside and inside the pump which could affect performance.

Inspecting Outside Pump:

- **CHECK THAT THE PUMP IS OPERATING WITHIN SPECIFICATIONS.**
  Remember that as suction lift and discharge head increases, pump output is reduced.

- **CHECK TYPE OF FLUID BEING PUMPED.**
  Pump will perform poorly if used to pump heavy sludges or mud.

- **CHECK SUCTION HOSE FOR LEAKS OR DAMAGE.**
  A puncture or tear above the water line will make the pump difficult or impossible to prime.

- **CHECK THAT SUCTION HOSE IS CORRECT TYPE.**
  Suction hose must have strong rigid walls. Thin-walled collapsible hoses like those used on the discharge side cannot be used.

- **CHECK THAT STRAINER HOSE LINES ARE NOT BLOCKED OR RESTRICTED.**
  Remove any dirt, debris or vegetation which might interfere with pump flow. If possible, flush hose lines with clear water at the end of each operation and suspend strainer in water, rather than rest on sandy or muddy bottom. Check that discharge hose is not kinked.

- **CHECK THAT ALL FITTINGS AND HOSE CLAMPS ON SUCTION LINE ARE TIGHT AND SEALING PROPERLY.**
  Fittings and clamps may loosen during operation. Add additional clamps where necessary to ensure good seal.

- **CHECK THAT PUMP CASE WAS FILLED WITH WATER AND PRIME PLUG SEALED TIGHTLY, BEFORE START-UP.**

Inspecting Inside Pump:

- **CHECK FOR DEBRIS AND DIRT INSIDE PUMP CASING.**
  If allowed to accumulate, it may restrict flow through the pump or impede the movement of the impeller.

- **CHECK ENGINE OPERATING SPEED.**
  Gasoline Engines: 3600 ±100 RPM
  Diesel Engines: 3400 ±100 RPM

  As engine operating RPM falls, pump capacity and discharge head are reduced.

- **CHECK FLAPPER VALVE AND INLET PORT FOR LEAKS OR DAMAGE.**
  If flapper valve is worn or distorted it may not seal tightly. Inspect threads on inlet port nipple for deep scratches which could allow air leaks.

- **CHECK CLEARANCE BETWEEN IMPELLER AND VOLUTE INSERT.**
  Additional shims are required to maintain clearance as impeller wears.

- **CHECK COVER O-RING.**
  Replace O-Ring if torn or crushed. Make sure cover is tightened evenly.

- **CHECK FOR WATER LEAK BETWEEN PUMP HOUSING AND ENGINE. INSPECT MECHANICAL SEAL LUBRICANT AND ENGINE OIL.**
  The presence of water indicates a loose impeller bolt or damage to mechanical seal.

- **CHECK FOR OIL LEAK BETWEEN PUMP HOUSING AND ENGINE.**
  An oil leak indicates a failed shaft seal.

- **CHECK PUMP SUCTION WITH VACUUM GAUGE.**
  If gauge reading is above 16 in. Hg (55 KPa), problem is probably outside the pump, in hose line or fitting.

3.18 Flapper Valve

The flapper valve **(1)** is located at the pump inlet **(2)**. During operation, this valve is open allowing a free path for water to flow into the pump case. When the pump is stopped, it closes and prevents water in the suction line from being lost.

A leak around the flapper gasket will cause the suction line to lose its prime and make the pump difficult or impossible to operate.

Recommended tools:
Socket wrench - 13mm

Removal:

1. Remove four locknuts **(3)** mounting suction (inlet) port **(2)** to pump.

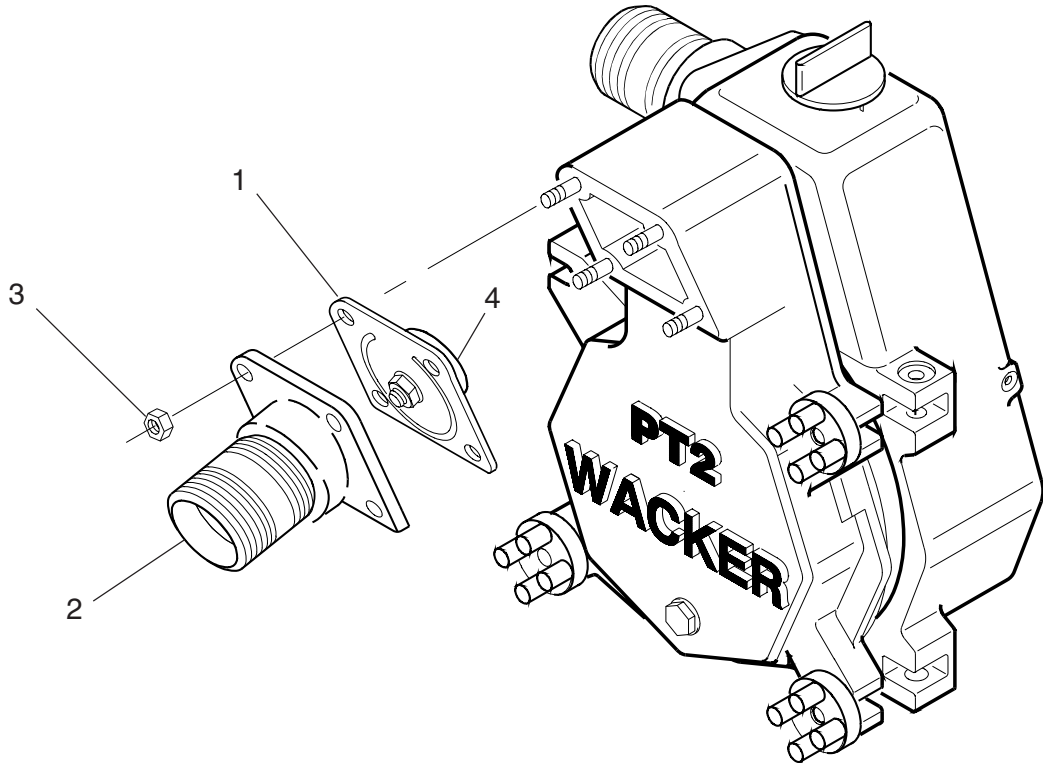
2. Remove inlet port and flapper valve assembly **(1)**.

Installation:

3. Install new flapper valve assembly, with large washer **(4)** facing inside of cover and flap opening facing down. This washer acts as a counterweight and helps seal the flapper gasket against the pump inlet when pump stops.

4. Mount inlet port **(2)** to pump. Tighten locknuts **(3)** evenly until flapper gasket begins to compress.

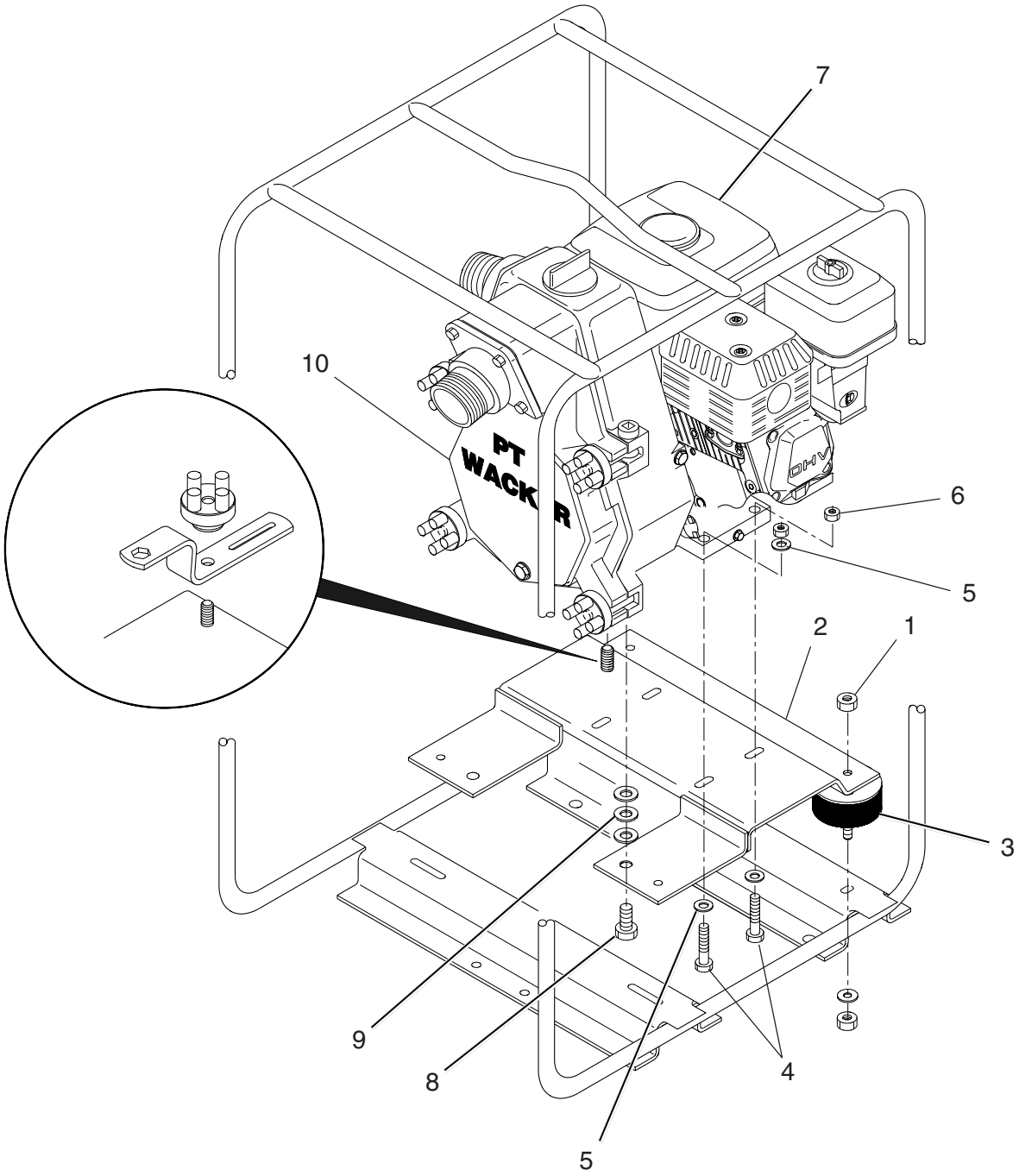
CAUTION: DO NOT overtighten. Overtightening may distort flapper gasket causing an air leak at inlet port.



1033SD49

3.19 Frame Assembly

(PT2 Shown)



1004SD40

3.19 Frame Assembly (cont.)

Recommended tools:
Socket wrench - 1/2" (13mm), 11/16" (17mm), 3/4" (19mm)
Allen wrench - 6mm

Removal:

1. Remove hardware **(1)** mounting console **(2)** to shockmounts **(3)**. Remove from frame.

Note: *Mounting hardware varies on all PT Series Pumps.*

2. Remove four screws **(4)**, washers **(5)**, and four locknuts **(6)** mounting engine side **(7)** to console.

3. Remove two screws **(8)** and washers **(9)** mounting pump side **(10)** to console.

Installation:

1. Mount pump side **(10)** to console **(2)** using screws **(8)** and washers **(9)**. Apply Loctite 243 or an equivalent medium strength threadlocker and torque to 28 ft.lbs (38 Nm).

2. Mount engine side **(7)** to console **(2)** using screws **(4)**, washers **(5)**, and locknuts **(6)**. Torque to 29 ft.lbs (40 Nm).

3. Mount console **(2)** to shockmounts **(3)** using hardware **(1)**.

Note: *See sealant and torque reference charts in back of book for appropriate threadlocking adhesives and torque values.*

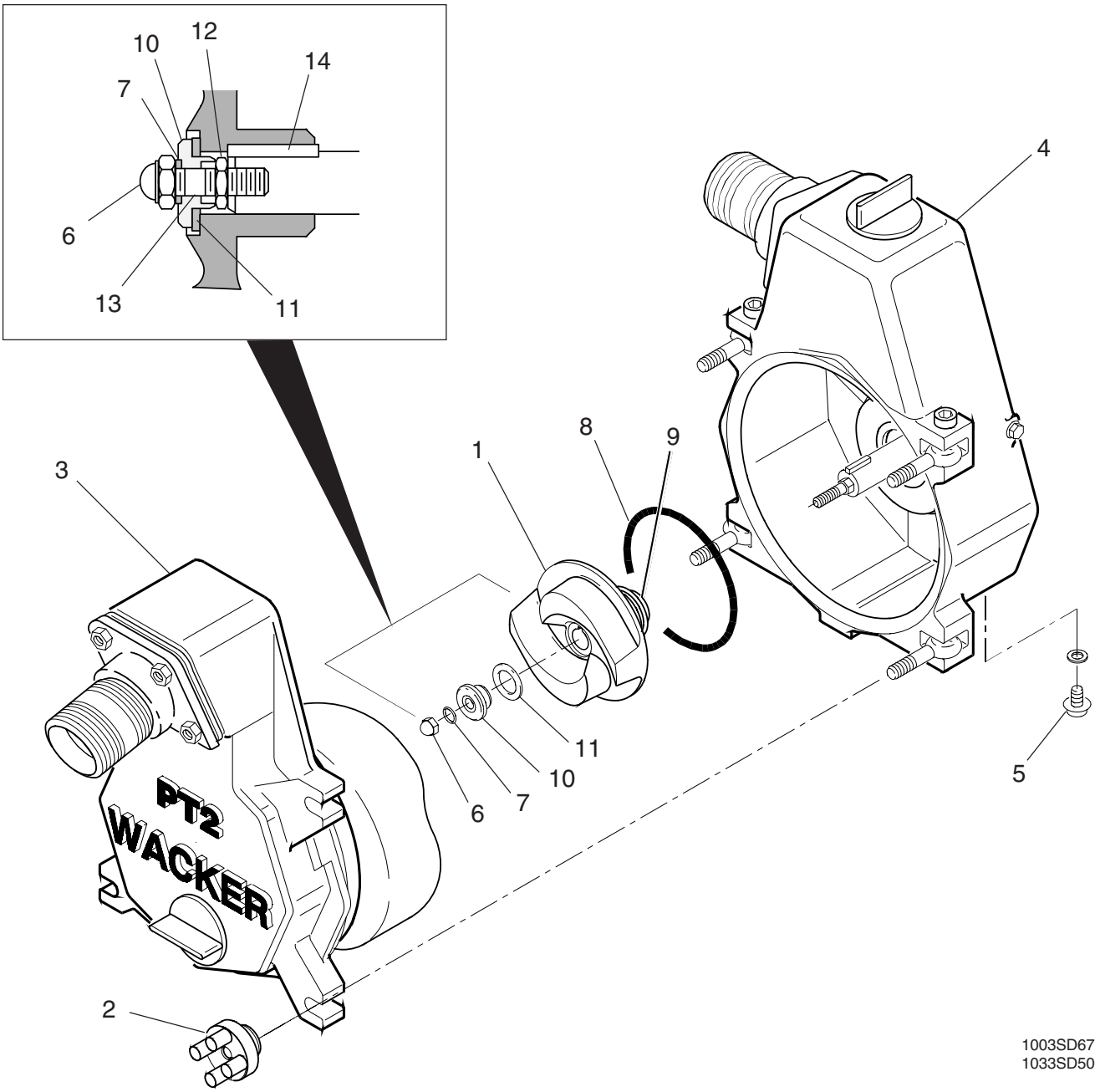
WARNING

Before you start the machine, ensure that all tools have been removed from the machine and that replacement parts and adjusters are firmly tightened.

3.20 Impeller

The impeller **(1)** will wear gradually during normal pump operations. The amount of wear depends on the quantity and composition of the solid particles being carried in the water.

The impeller should be replaced, if a new insert or additional shims are no longer sufficient to maintain clearance between insert and impeller.
Note: *Shim thickness should not exceed 0.125" (3mm).*



1003SD67
1033SD50

3.20 Impeller (cont.)

Recommended tools:
Socket wrench - 1/2" (13mm), 9/16"
Pry bar

Removal:

1. Remove pump / engine from frame. See Section 3.19 *Frame Assembly.*

2. Loosen four knobs **(2)** mounting front volute housing **(3)** to rear impeller housing **(4)**. Thoroughly wash out and clean around impeller **(1)** and inside of housing.

3. Remove bottom plug **(5)** from pump housing and drain oil from pump.

Note: *In the interests of invironmental protection, place plastic sheeting and a container under the pump to collect the liquid which drains off. Dispose of this liquid properly.*

4. Remove dome nut **(6)** and sealing ring **(7)**. Using a pry bar or 3-jaw puller, insert behind impeller and pull impeller off of engine shaft being carefull not to damage O-ring **(8)** behind impeller.

CAUTION: Use care when handling impeller to avoid damage to seal surfaces.

Note: *The mechanical seal **(9)** will remain on the impeller when it is removed.*

5. Push hub **(10)** out from impeller and remove gasket **(11)**.

6. Loosen jam nut **(12)** securing stud **(13)** in engine shaft.

7. Remove stud and key **(14)**.

	LOCATING DIM. Stud (13) in. (mm)	TORQUE VALUE Jam Nut (12) ft.lbs. (Nm)	TORQUE VALUE Dome Nut (6) ft.lbs. (Nm)
PT2A PT2B PT2R PT2Y	1.00 (25)	11 (15)	25 (34)
PT3A PT3V PT3Y	1-3/16 (30)	31 (42)	27 (37)
PTS4V	1-1/8 (28)	20 (27)	27 (37)

Installation:

1. Install mechanical seal **(9)** on impeller **(1)** if not already done. See Section 3.21 *Pump Seals.*

2. Press hub **(10)**, with gasket **(11)**, into front end of impeller.

3. Install long threaded end of stud **(13)** in engine shaft making sure enough of the stud is exposed to mount the impeller. Apply Loctite 271 or an equivalent high strength threadlocker and secure with jam nut **(12)**.

Note: *See chart for stud locating dimensions and torque values for jam nuts & dome nuts.*

4. Place key **(14)** in slot on engine shaft.

5. Install impeller **(1)** on engine shaft. Place sealing ring **(7)** over stud and secure with dome nut **(6)**. Apply Loctite 222 or an equivalent low strength threadlocker.

⚠ WARNING

Remove spark plug from engine before testing impeller.

6. Turn impeller by hand and check that it turns freely.

Note: *If back of impeller rubs on pump housing, remove impeller and install one additional copper washer between impeller and shaft sleeve.*

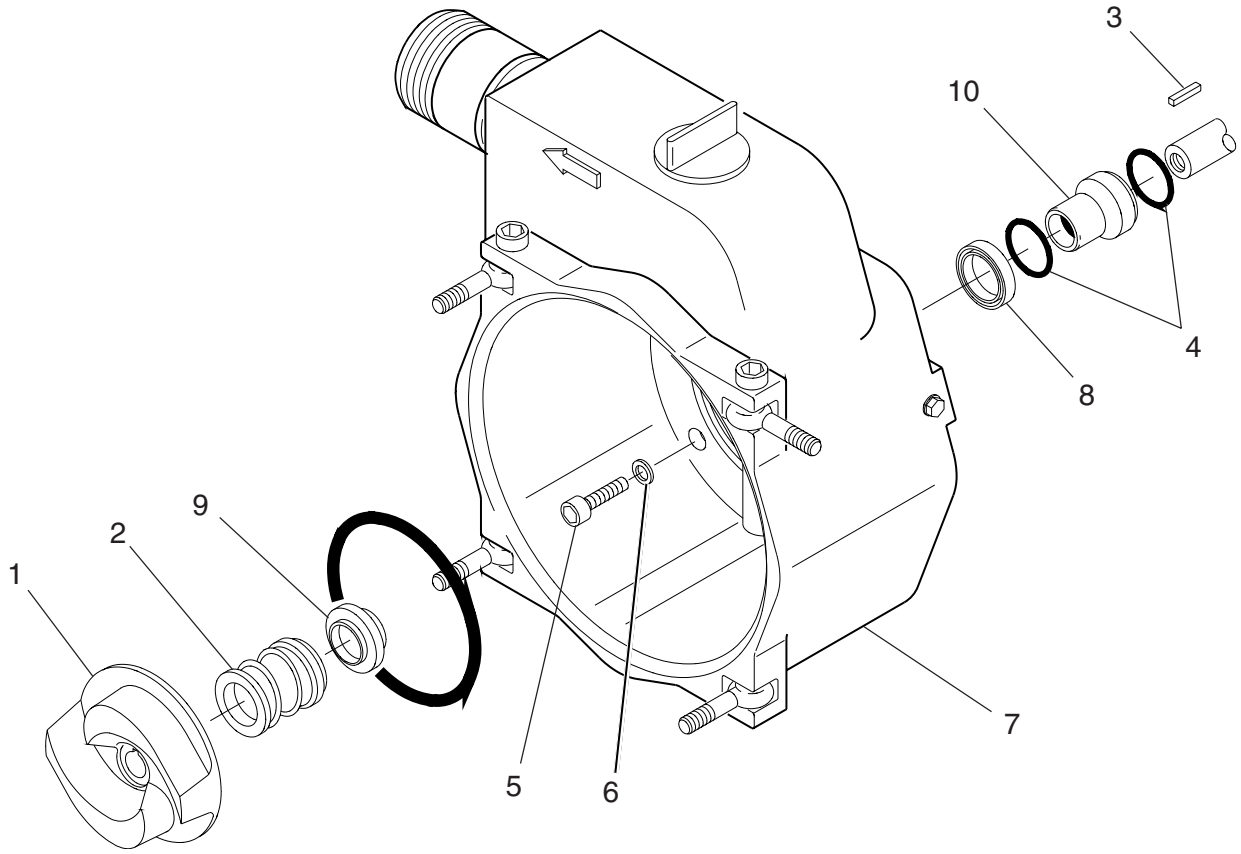
7. Install drain plug **(5)**. Fill pump oil cavity to specified level and check for leaks between pump housing and engine.

Note: *See Sections 1.10, 1.11, & 1.12* Technical Data *for oil level specifications.*

8. Mount front volute housing **(3)** to rear impeller housing **(4)** using four knobs **(2)**.

9. Install spark plug and pull starter rope. If impeller is binding, remove shims from behind volute insert. See Section 3.11 *Adjusting Impeller Clearance*.

3.21 Pump Seals



1033SD55

3.21 Pump Seals (cont.)

Recommended tools:
Socket wrench - 1/2" (13mm)
Allen wrench - 1/4", 5/16", 3/8"

Removal:

1. Remove impeller **(1)**. See Section 3.20 *Impeller.*

2. Pull mechanical seal **(2)** off impeller.

3. Remove key **(3)** and washer(s) **(4)** from engine shaft.

Note: *The quantity of washers may vary between pumps. When removing washers, note their position and quantity on engine shaft to ensure that they will be reinstalled correctly.*

4. Remove four screws **(5)** and washers **(6)** mounting the pump housing **(7)** to the engine. Remove pump housing.

5. Remove shaft seal **(8)** from rear of pump housing.

6. Press stationary half of mechanical seal **(9)** out from pump housing.

7. Remove sleeve **(10)** and any remaining washers from engine shaft for inspection or replacement.

Installation:

CAUTION: When handling and installing the mechanical seal, it is important to keep hands and tools clean and to avoid touching or pressing on seal faces.

1. Grease shaft seal **(8)** using Shell Alvania #2 or equivalent. Press seal with open end facing into pump housing **(7)**.

2. Slide sleeve **(10)** over engine shaft. Be sure to replace any washers that were removed.

Note: *If the quantity or position of the washers are in doubt, install sleeve with one washer on either side.*

3. Press stationary half of mechanical seal **(9)** into pump housing.

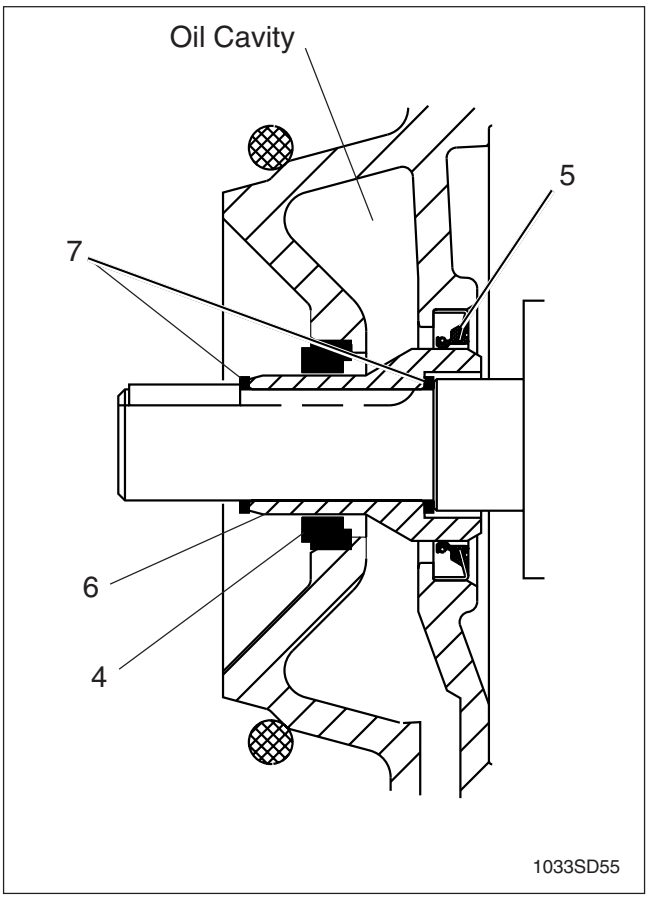
4. Slide pump housing over engine shaft being careful not to cut lip of shaft seal **(8)** on keyway in shaft.

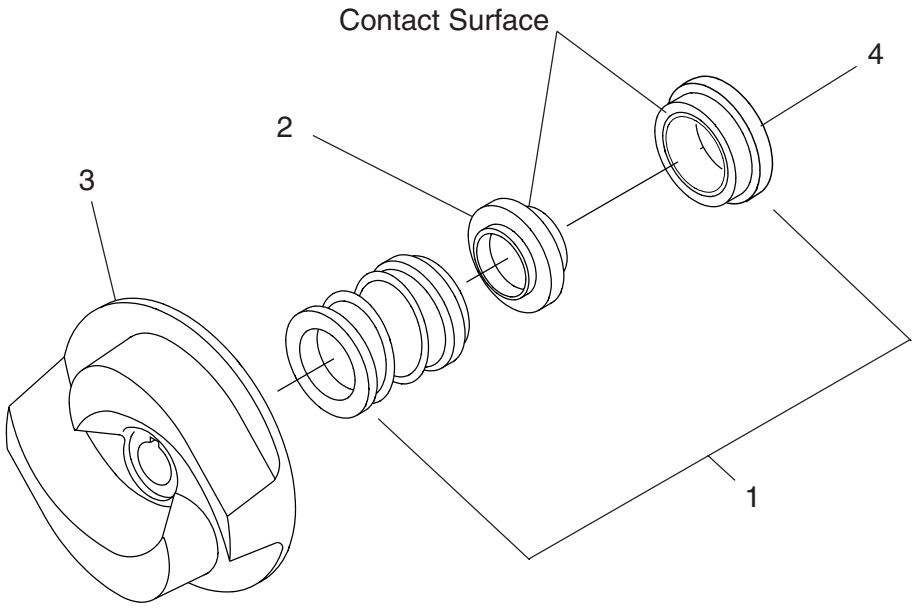
5. Mount pump housing **(7)** to engine using four screws **(5)** and washers **(6)**. Apply Loctite 271 or an equivalent high strength threadlocker and torque to 16 ft.lbs (22 Nm).

6. Push mechanical seal **(2)** completely on impeller **(1)**.

7. Install impeller **(1)**. See Section 3.20 *Impeller.*

3.22 Inspecting Pump Components





3.22 Inspecting Pump Components (cont.)

Mechanical Seal

The PT Series Pumps use a carbon-ceramic mechanical seal **(1)**. Its design provides excellent wear and sealing characteristics. Inspect the seal for damage and wear as described below.

1. The two contact surfaces between seal halves should have flat, smooth surface and be absolutely free of any scratches, cracks, nicks, or pitting.

CAUTION: Replace seal if surfaces appear damaged in any way.

2. Inspect the rubber ring, inside the rotating seal half **(2)**, for damage.

Note: *The rotating seal half must seal tightly around the impeller **(3)**. For this reason it is important to examine the impeller surface, in the area where the seal mounts, for pitting, rust or other damage which could prevent a good fit.*

3. Inspect the O-ring on the stationary half **(4)**. Make sure it seals tight enough to prevent water from leaking past it and the seal from spinning in housing.

Shaft Seal and Sleeve

The shaft seal **(5)** is used to prevent the seal lubricant from leaking out of the oil cavity in the pump housing. It is located at the back of the pump housing and rides on a metal sleeve **(6)** which is placed over the engine shaft.

If oil is observed leaking from the rear of the pump housing, both the seal and sleeve must be inspected. The surface of the sleeve, where the seal rides, should be smooth.

CAUTION: Replace sleeve if rusted, pitted or looks worn. Always replace it along with the shaft seal.

Sleeve Washers

Inspect the condition of the copper sleeve washers **(7)**. These washers vary between pumps and in some cases are used to shim the impeller **(3)** to prevent it from rubbing against the oil cover or pump housing.

CAUTION: Replace washers if they are badly crushed or distorted.

Washers may be located both in front of and behind the shaft seal **(5)**.

Note: *Install washers in the same position and quantities as they were removed.*

If impeller **(3)** rubs against housing after it has been installed, insert one additional copper washer between impeller and sleeve **(6)**.

Note: *On PT2 Series Pumps an aluminum sleeve washer is used. Install this washer directly behind impeller.*

3.23 Testing

Suction Test

Required Tools:
Vacuum Gauge - P/N 28755
Tachometer

1. Fill pump housing with cold water until it flows out from discharge port.

2. Tighten pump cover and prime plug .

3. Bring engine up to operating speed. Check engine RPM. See Section 1.10, 1.11, & 1.12 *Technical Data* for different PT engine speeds.

Note: *Keep pump housing filled with water at all times while pump is running. If too much water is lost during test procedure, stop engine and reprime pump. It may be necessary to tilt pump or partially cover discharge port, to prevent water in the pump housing from being lost while still allowing air to be vented.*

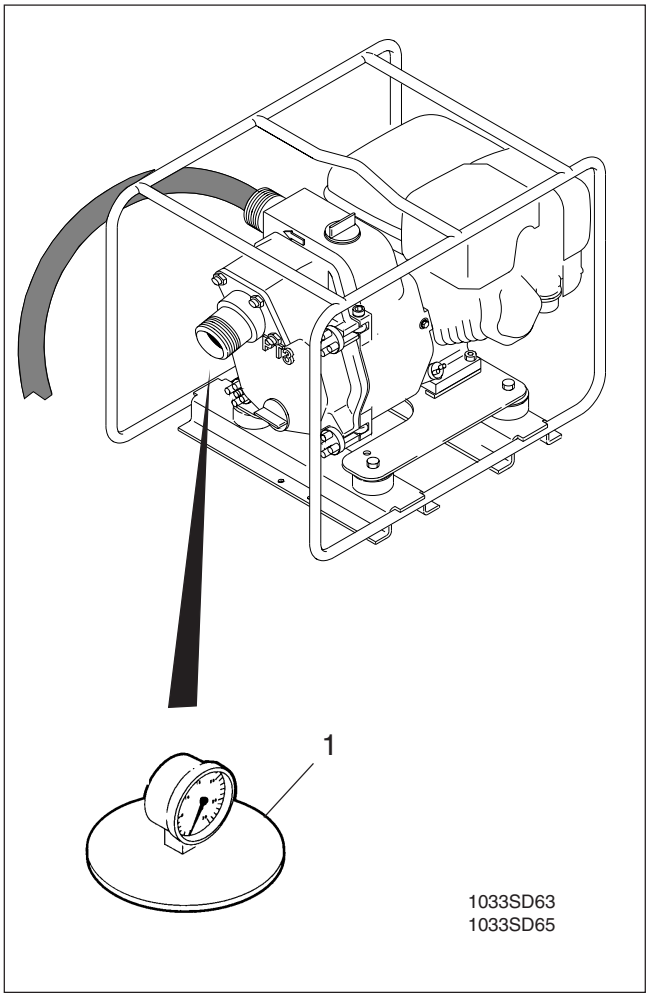
4. Grease mounting face of vacuum gauge **(1)**, to ensure a good seal. Press gauge over inlet port.

5. Gauge reading should slowly climb and then hold steady.

6. With gauge still against inlet port, turn off engine. Gauge reading should not change.

Note: *See vacuum chart for appropriate gauge readings.*

This test **MUST** be completed within a few minutes to prevent the water in the pump housing from getting hot, which will result in lower readings. If possible, allow cold water to run into discharge port while testing pump.



	Excellent	Satisfactory
in.Hg (KPa)	20–24 (68–82)	16–20 (55–68)

3.24 Troubleshooting

Problem / Symptom	Reason / Remedy
Pump does not take in water.	1. Not enough priming water in housing. 2. Engine speed too low. Adjust speed. 3. Strainer plugged. Clean strainer. 4. Suction hose damaged. Replace or repair hose. 5. Air leak at suction port. Check that fittings are tight and sealing properly. 6. Pump too high above water. 7. Debris collecting in pump housing. Clean pump housing. 8. Too much clearance between impeller and insert.
Pump takes in water; little or no discharge.	1. Engine speed too low. Adjust speed. 2. Suction strainer partially plugged. Clean strainer. 3. Impeller worn. Adjust clearance by adding shims or replace impeller. 4. Volute insert worn or damaged. Adjust clearance or replace insert.
Suction hose leaks at inlet.	1. Clamps are not sealing properly. Tighten, replace, or add clamp. 2. Hose diameter is too large. 3. Hose is damaged.
Discharge hose does not stay on coupling.	1. Pressure may be too high for clamps being used. Add another clamp. 2. Hose kinked or end blocked. Check hose.
Impeller does not turn; pump is hard to start.	1. Impeller jammed or blocked.Open pump cover and clean dirt and debris from inside of pump housing. 2. Impeller and insert binding. Adjust clearance by removing shim from behind insert.
Engine does not start or stops during operation.	1. Debris in pump housing, blocking impeller. 2. Low oil level in engine.

Notes:

Table of Contents

4.1 Description and Operation

PG Series Pumps use an impeller **(1)** and volute **(2)** to create the suction and discharge pressures required for pump operation.

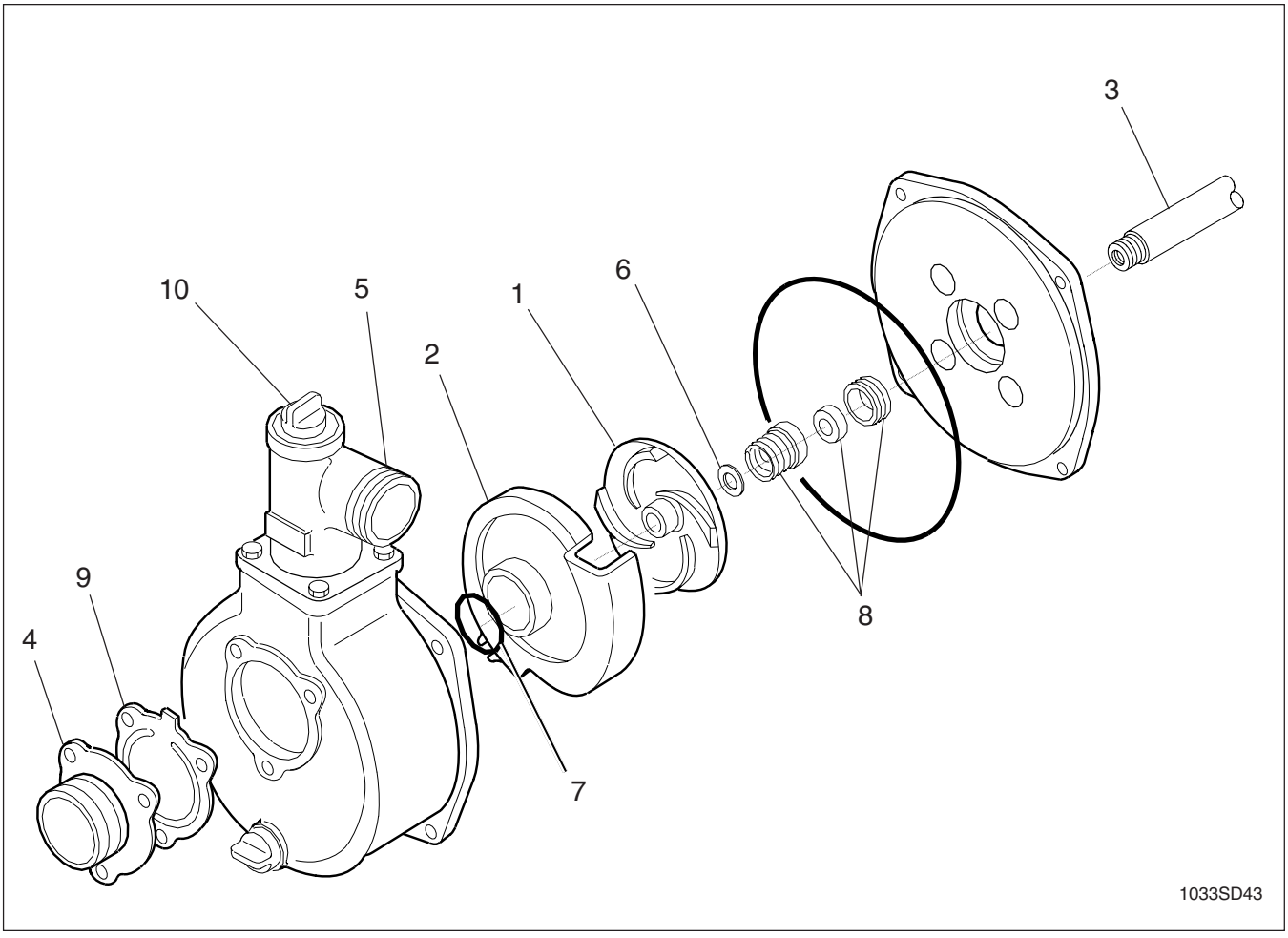
The impeller is threaded directly to the engine drive shaft **(3)** and rotates inside the volute casing. Water is drawn into the pump inlet **(4)** by the low pressure area created at the eye of the impeller. Vanes on the impeller move the liquid into the volute where it is gathered and directed to the discharge port **(5)**.

Clearance between the impeller and volute is maintained by the addition of shim washers **(6)** behind the impeller. A movable tapered ring **(7)** set inside the volute, can be shimmed to maintain close tolerances between the volute and impeller to maintain pump efficiency.

A mechanical seal **(8)** mounted behind the impeller, prevents water from following the engine drive shaft and seals the rear of the pump housing to prevent leakage.

The flapper valve **(9)** at the pump inlet closes when the pump stops. This valve seals the inlet port and prevents the prime water in the suction hose from being lost.

Pump case is easily filled with water by removing the priming plug **(10)**.



4.2 Periodic Maintenance Schedule

The chart below lists basic pump and engine maintenance. Refer to engine manufacturer's Operation Manual for additional information on engine maintenance. A copy of the engine Operation Manual was supplied with the machine when it was shipped.

	PG2A	PG3A
DAILY (Before Starting)		
Check fluid level.	•	•
Check engine oil level.	•	•
Inspect for leaks between pump and engine.	•	•
Inspect air cleaner. Clean as needed.	•	•
Check and tighten external hardware.	•	•
NEW ENGINE BREAK-IN (First 20 hrs.)		
Change engine oil and replace filter.	•	•
EVERY 2 WEEKS (50 hrs.)		
Clean air cleaner.	•	•
EVERY MONTH (100 hrs.)		
Check and clean spark plug.	•	•
Clean sediment cup.	•	•
Change engine oil and replace filter.	•	•
Clean cooling system.	•	•
EVERY 3 MONTHS (300 hrs.)		
Check and adjust valve clearances.	•	•
Check and adjust impeller clearance.	•	•

4.3 Air Cleaner

Service air cleaner frequently to prevent carburetor malfunction.

CAUTION: NEVER run engine without air cleaner. Severe engine damage will occur.

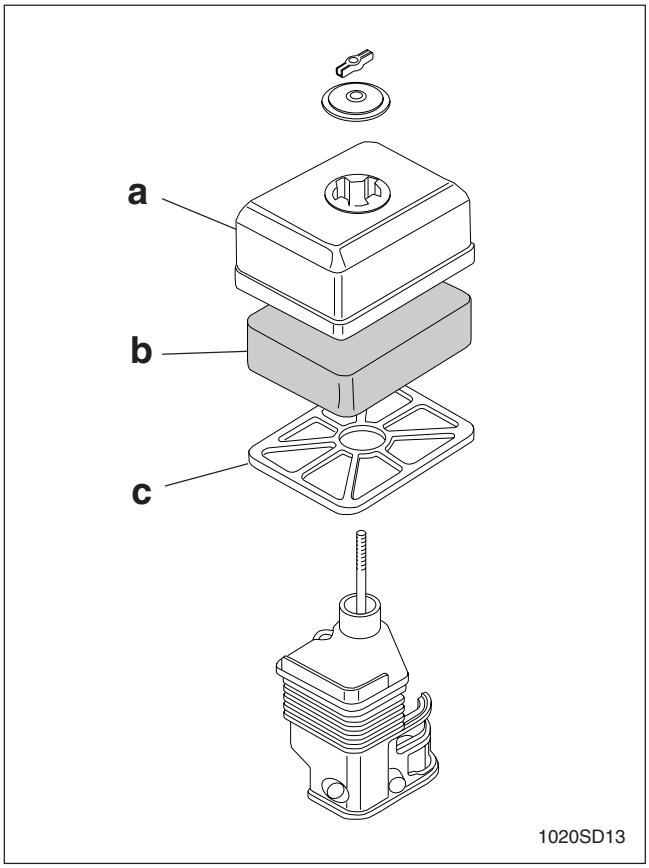
WARNING

NEVER use gasoline or other types of low flash point solvents for cleaning the air cleaner. A fire or explosion could result.

To service:

1. Remove air cleaner cover **(a)**. Inspect element **(b)** for holes or tears. Replace element if damaged.
2. Wash element in solution of mild detergent and warm water. Rinse thoroughly in clean water. Allow element to dry thoroughly.

   Soak element in clean engine oil and squeeze out excess oil.
3. Install element, grid plate **(c)**, and air cleaner cover.



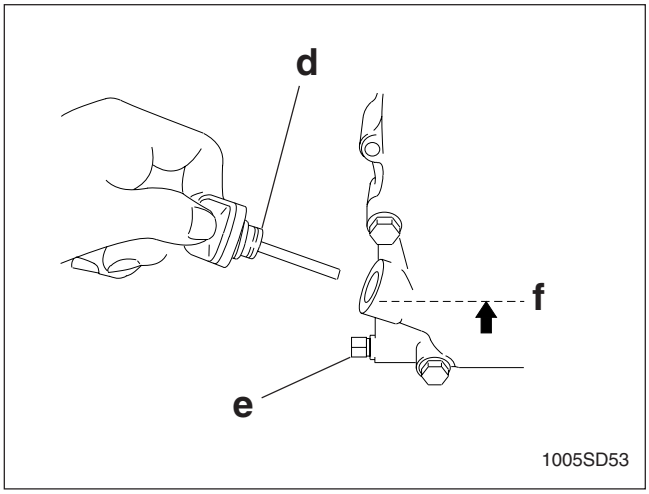
4.4 Engine Oil

Drain oil while engine is still warm.

1. Remove oil fill plug **(d)** and drain plug **(e)** to drain oil.
2. Install drain plug.
3. Fill engine crankcase with recommended oil up to level of plug opening **(f)**.

   Oil capacity: 20 oz. (0.6 liters)

4. Install oil filler plug.



4.5 Spark Plug

Clean or replace spark plug as needed to ensure proper operation. Refer to the engine Operation Manual.

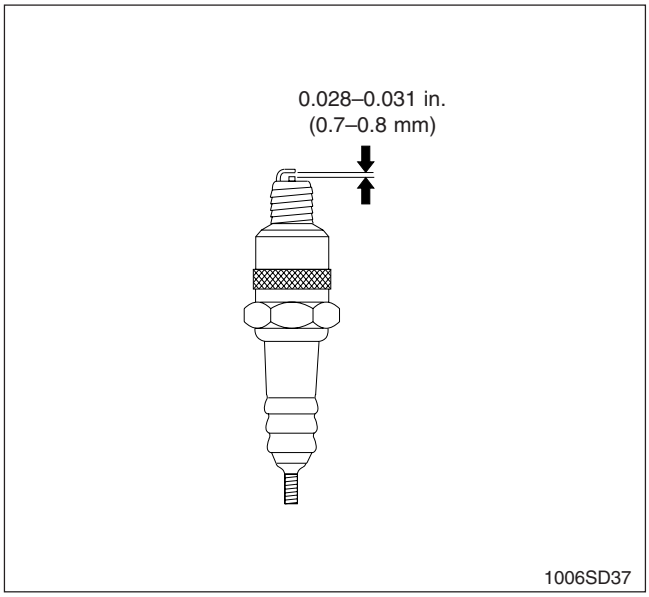
Recommended Plug: (NGK) BPR 6ES

WARNING

The muffler becomes very hot during operation and remains hot for a while after stopping the engine. Do not touch the muffler while it is hot.

1. Remove spark plug and inspect it.
2. Replace plug if the insulator is cracked or chipped. Clean spark plug electrodes with a wire brush.
3. Set gap to 0.028–0.031" (0.7–0.8 mm).
4. Tighten spark plug securely.

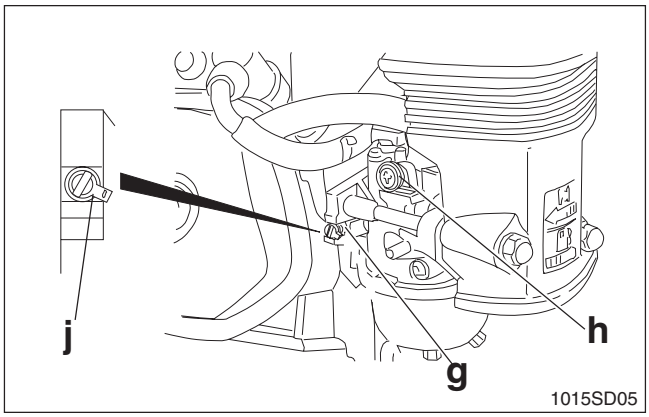
CAUTION: A loose spark plug can become very hot and may cause engine damage.



4.6 Carburetor Adjustment

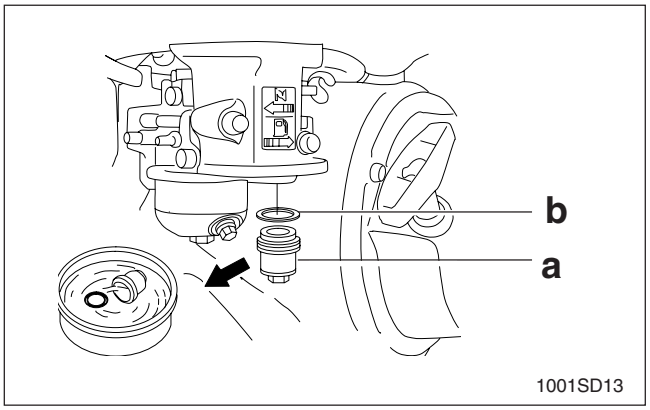
1. Start engine and allow it to warm up to operating temperature.
2. Set pilot screw **(g)** 2 turns out. See Note.
3. With the engine idling, turn pilot screw **(g)** in or out to the setting that produces the highest rpm.
4. After pilot screw is adjusted, turn throttle stop screw **(h)** to obtain the standard idle speed, 1400 ±150 rpm.

Note: *On some engines the pilot screw is fitted with a limiter cap **(j)** to prevent excessive enrichment of the air-fuel mixture in order to comply with emission regulations. The mixture is set at the factory and no adjustment should be necessary. **Do not** attempt to remove the limiter cap. The limiter cap cannot be removed without breaking the pilot screw.*



4.7 Cleaning Sediment Cup

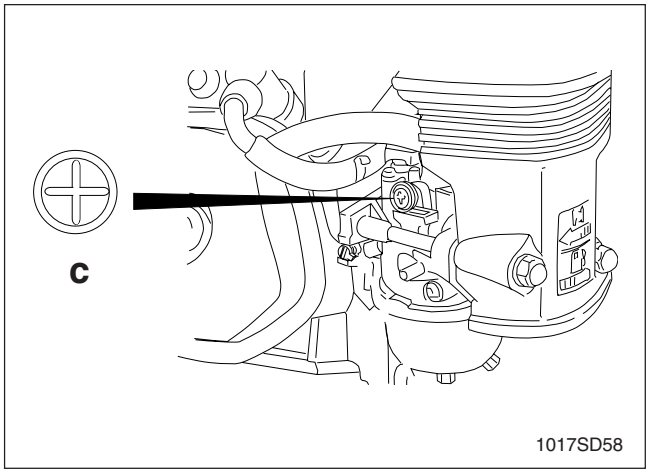
Turn fuel valve off. Remove sediment cup **(a)** and O-ring **(b)**. Wash them thoroughly in a nonflammable solvent. Dry them and re-install. Turn fuel valve on and check for leaks.



4.8 Adjusting Idle Speed

To adjust idle speed:

1. Start engine and allow it to warm up to normal operating temperature.
2. Turn throttle stop screw **(c)** in to decrease speed, out to increase speed.



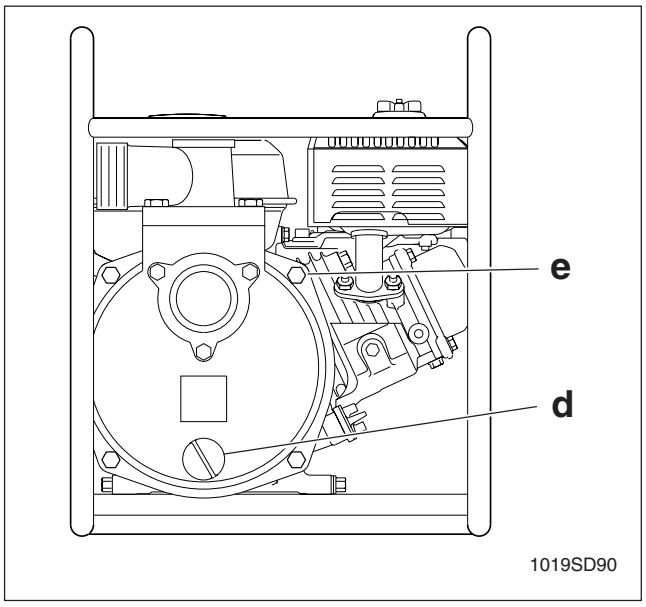
4.9 Cleaning Pump

After pumping water containing a large amount of dirt or debris, clean out inside of pump housing.

1. Remove drain plug **(d)** from pump housing and drain any water left in pump.
2. Remove the four screws **(e)** holding the pump cover and remove cover.
3. Clean out dirt and debris. Inspect impeller and volute for wear.

WARNING

The impeller may develop sharp edges. Use care when cleaning around impeller to prevent getting cut.



4.10 Adjusting Impeller Clearance

If it is necessary to replace impeller or volute, be sure clearance between impeller and volute is adjusted correctly. The impeller **(f)** should be as close to the volute **(g)** as possible without rubbing against it. Clearance is adjusted by adding or removing shims **(h)** from behind impeller. To adjust the clearance do the following:

1. Remove pump housing but do not remove impeller.

2. Measure the distance **(j)** of volute.

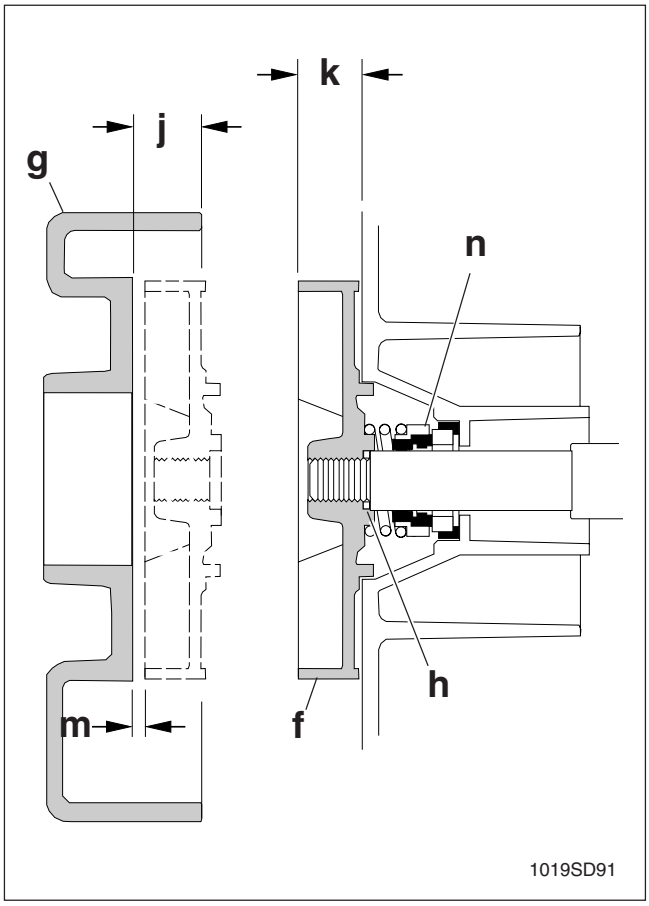
3. Measure the distance **(k)** of impeller.

4. Subtract the distance **(k)** from **(j)**.
   (j) - **(k)** = **(m)** clearance.

5. The clearance between the volute and the impeller should be 0.012" (0.3 mm) to 0.028" (0.7 mm). Adjust the distance by removing the impeller and adding shims as needed.

   Each shim measures 0.012" (0.3 mm).

As the impeller wears down, additional shims may be required to maintain the clearance between the impeller and the volute. Check the clearance whenever the mechanical seal **(n)**, impeller, volute, or rear flange plate are replaced.



4.11 Storage

If pump is being stored for more than 30 days:

1. Remove drain plug from pump cover and drain out any water left in the housing.

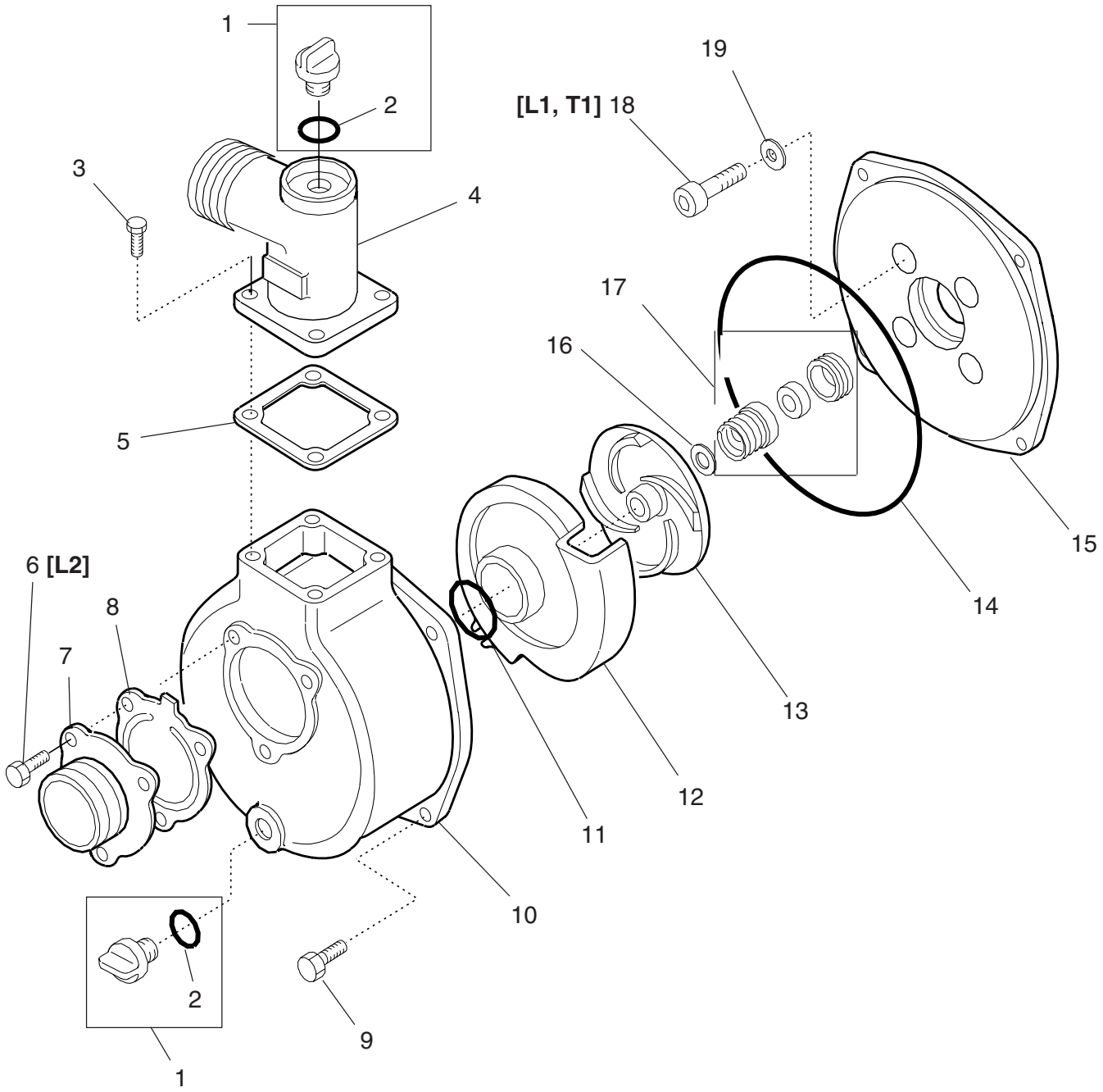
2. Remove pump cover and clean inside of pump housing. Coat inside of pump with a light film of oil to reduce corrosion. A spray can of oil works well for this.

3. Tape up suction and discharge ports to prevent anything from falling into pump.

4. Change engine oil and follow procedures described in engine manual for engine storage.

5. Cover pump and engine and store in a clean, dry area.

4.12 PG Pump Assembly



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REF.	DESCRIPTION	QTY.
1	Set - plug (incl. 2)	2
2	O-ring	1
3	Screw (PG2 - M8x25) (PG3 - M10x30)	4
4	Port - discharge	1
5	Gasket - discharge	1
6	Screw (PG2 - M8x20) (PG3 - M10x25)	3
7	Port - suction	1
8	Gasket - flapper valve	1
9	Screw (PG2 - M8x22) (PG3 - M10x25)	4
10	Housing - pump case	1
11	Ring - tapered	1
12	Volute	1
13	Impeller	1
14	O-ring	1
15	Flange - mounting	1
16	Washer - shim	3
17	Seal - mechanical	1
18	Screw M8x60	4
19	Washer - seal	4

[L1] - 0029312
[T1] - 16 ft.lbs. (22 Nm)

[L2] - 0029311
[T2] - 26 ft.lbs. (37 Nm)

4.13 Inspecting Pump

Before disassembling pump, check for conditions both outside and inside the pump which could affect performance.

Inspecting Outside Pump:

- **CHECK THAT THE PUMP IS OPERATING WITHIN SPECIFICATIONS.**
  Remember that as suction lift and discharge head increases, pump output is reduced.

- **CHECK TYPE OF FLUID BEING PUMPED.**
  Pump will perform poorly if used to pump heavy sludges or mud.

- **CHECK SUCTION HOSE FOR LEAKS OR DAMAGE.**
  A puncture or tear above the water line will make the pump difficult or impossible to prime.

- **CHECK THAT SUCTION HOSE IS CORRECT TYPE.**
  Suction hose must have strong rigid walls. Thin-walled collapsible hoses like those used on the discharge side cannot be used.

- **CHECK THAT STRAINER HOSE LINES ARE NOT BLOCKED OR RESTRICTED.**
  Remove any dirt, debris or vegetation which might interfere with pump flow. If possible, flush hose lines with clear water at the end of each operation and suspend strainer in water, rather than rest on sandy or muddy bottom. Check that discharge hose is not kinked.

- **CHECK THAT ALL FITTINGS AND HOSE CLAMPS ON SUCTION LINE ARE TIGHT AND SEALING PROPERLY.**
  Fittings and clamps may loosen during operation. Add additional clamps where necessary to ensure good seal.

- **CHECK THAT PUMP CASE WAS FILLED WITH WATER AND PRIME PLUG SEALED TIGHTLY, BEFORE START-UP.**

Inspecting Inside Pump:

- **CHECK FOR DEBRIS AND DIRT INSIDE PUMP CASING.**
  If allowed to accumulate, it may restrict flow through the pump or impede the movement of the impeller.

- **CHECK ENGINE OPERATING SPEED.**
  3600 ±100 RPM

  As engine operating RPM falls, pump capacity and discharge head are reduced.

- **CHECK FLAPPER VALVE AND INLET PORT FOR LEAKS OR DAMAGE.**
  If flapper valve is worn or distorted it may not seal tightly. Inspect threads on inlet port nipple for deep scratches which could allow air leaks.

- **CHECK CLEARANCE BETWEEN IMPELLER AND VOLUTE INSERT.**
  Additional shims are required to maintain clearance as impeller wears.

- **CHECK PUMP HOUSING O-RING AND REAR PUMP FLANGE.**
  Replace O-Ring if torn or crushed. Make sure cover is tightened evenly. Check that rear plate is not warped.

- **CHECK FOR WATER LEAK BETWEEN PUMP HOUSING AND ENGINE. INSPECT MECHANICAL SEAL LUBRICANT AND ENGINE OIL.**
  The presence of water indicates a loose impeller bolt or damage to mechanical seal.

- **CHECK FOR OIL LEAK BETWEEN PUMP HOUSING AND ENGINE.**
  An oil leak indicates a failed shaft seal.

- **CHECK PUMP SUCTION WITH VACUUM GAUGE.**
  If gauge reading is above 16 in. Hg (55 KPa), problem is probably outside the pump, in hose line or fitting.

4.14 Flapper Valve

The flapper valve **(1)** is located at the pump inlet **(2)**. During operation, this valve is open allowing a free path for water to flow into the pump case. When the pump is stopped, it closes and prevents water in the suction line from being lost.

A leak around the flapper gasket will cause the suction line to lose its prime and make the pump difficult or impossible to operate.

Recommended tools:
Socket wrench - 1/2" (13mm)
Phillips head screwdriver

Removal:

1. Remove three screws **(3)** mounting suction (inlet) port **(2)** to pump.

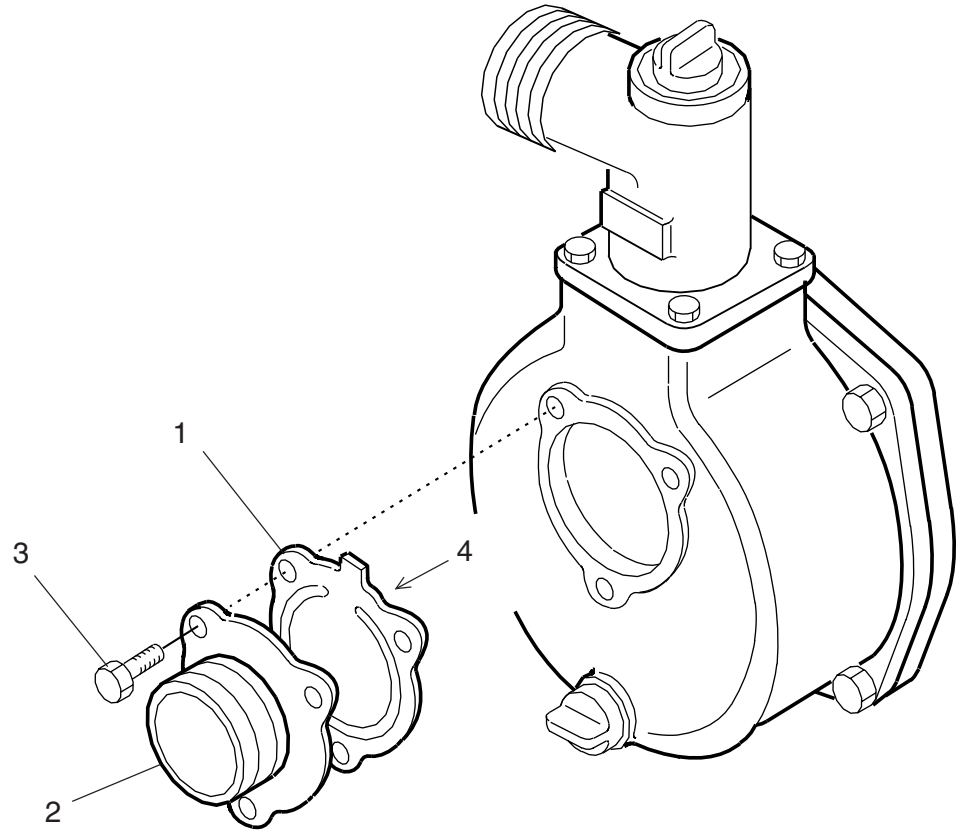
2. Remove inlet port and flapper valve assembly **(1)**.

Installation:

3. Install new flapper valve assembly, with large washer **(4)** facing suction port. This washer acts as a counterweight and helps seal the flapper gasket against the pump inlet when pump stops.

4. Mount inlet port **(2)** to pump. Secure with screws **(3)** evenly until flapper gasket begins to compress. Use Loctite 243 or an equivalent medium strength threadlocker on screws.

CAUTION: DO NOT overtighten. Overtightening may distort flapper gasket causing an air leak at inlet port.



1033SD69

4.15 Frame Assembly

Recommended tools:
Socket wrench - 1/2" (13mm)

Removal:

1. Remove four screws **(1)** and nuts **(2)** mounting pump/engine **(3)** to frame **(4)**.

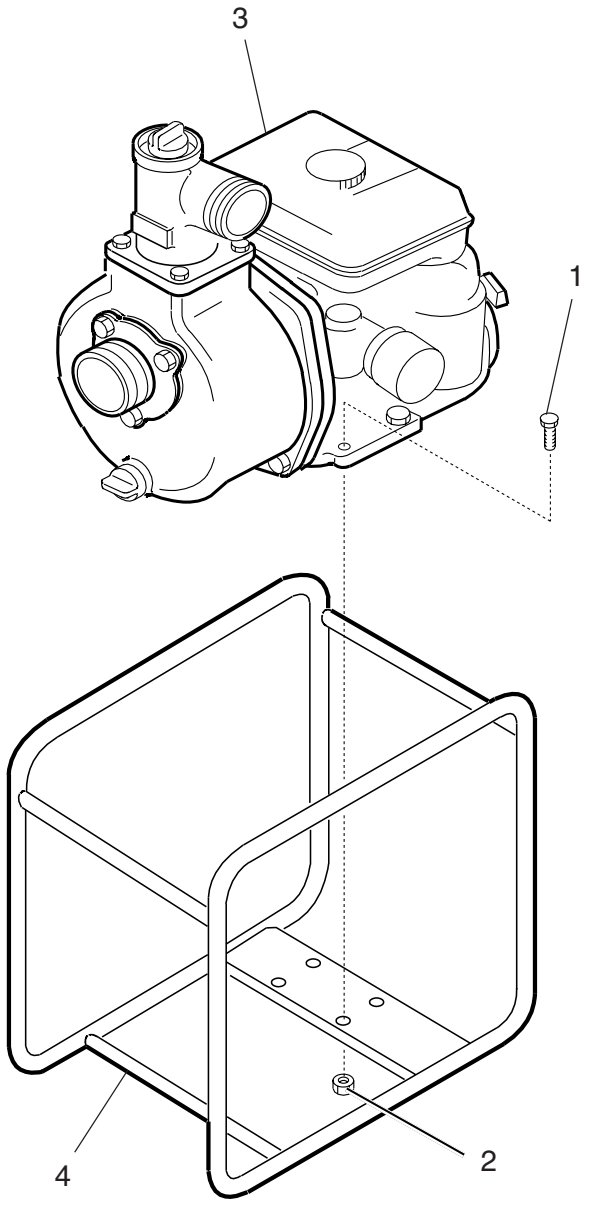
Installation:

1. Mount pump / engine **(3)** to frame **(4)** using screws **(1)** and nuts **(2)**. Apply Loctite 243 or an equivalent medium strength threadlocker and torque to 26 ft.lbs. (35 Nm).

Note: *See sealant and torque reference charts in back of book for appropriate threadlocking adhesives and torque values.*

WARNING

Before you start the machine, ensure that all tools have been removed from the machine and that replacement parts and adjusters are firmly tightened.



1033SD70

4.16 Pump Housing

Recommended tools:
Socket wrench - 1/2" (13mm)
Rubber / Plastic mallet

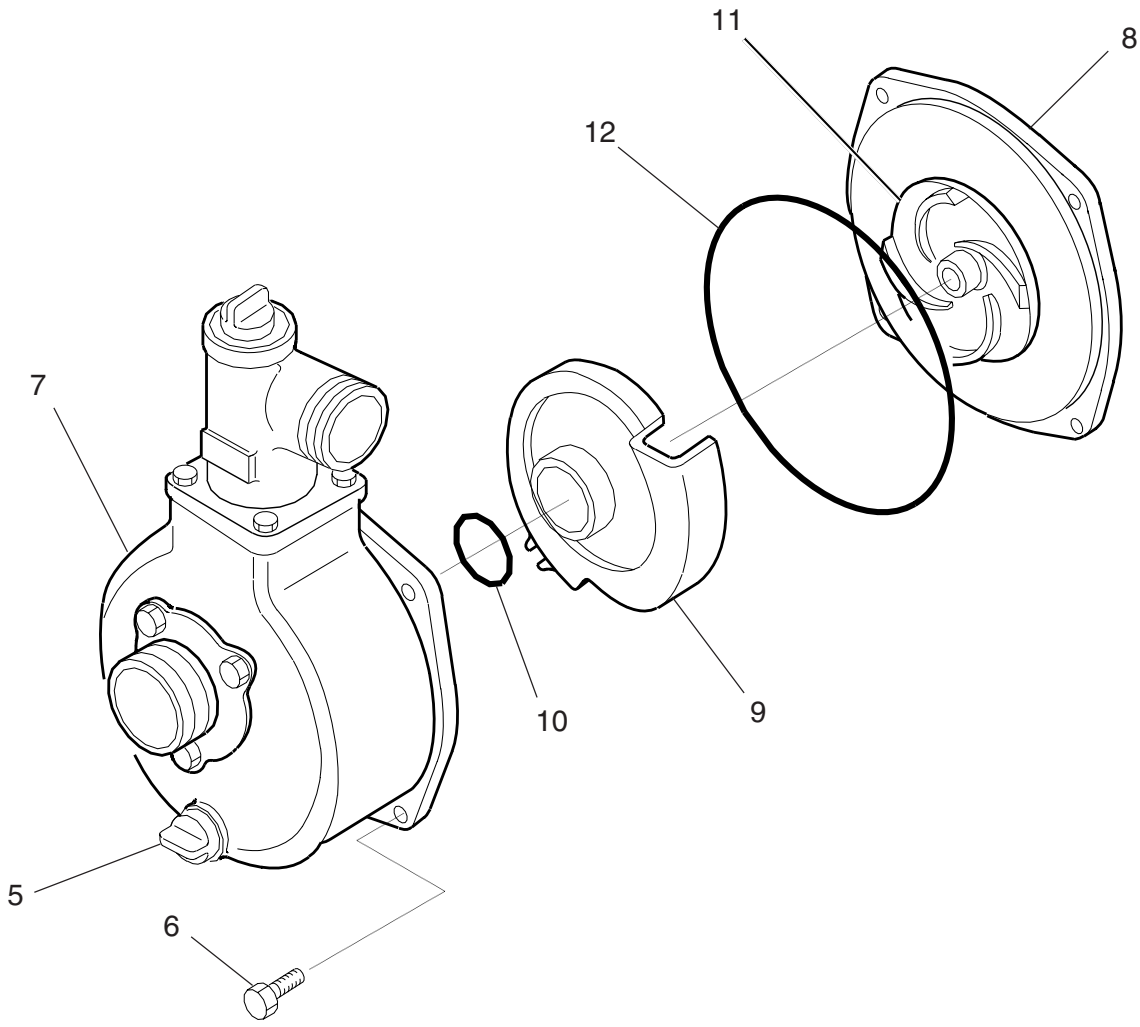
Removal:

1. Remove drain plug **(5)** from bottom of housing and drain water from pump case.
2. Remove four screws **(6)** mounting pump housing **(7)** to the back pump flange **(8)**.
3. Lightly tap housing with mallet to break seal and remove housing.
4. Thoroughly clean debris from pump housing **(7)**, volute **(9)**, and flange **(8)**.
5. Remove volute **(9)** and clean O-Ring **(10)** and intake port.

Installation:

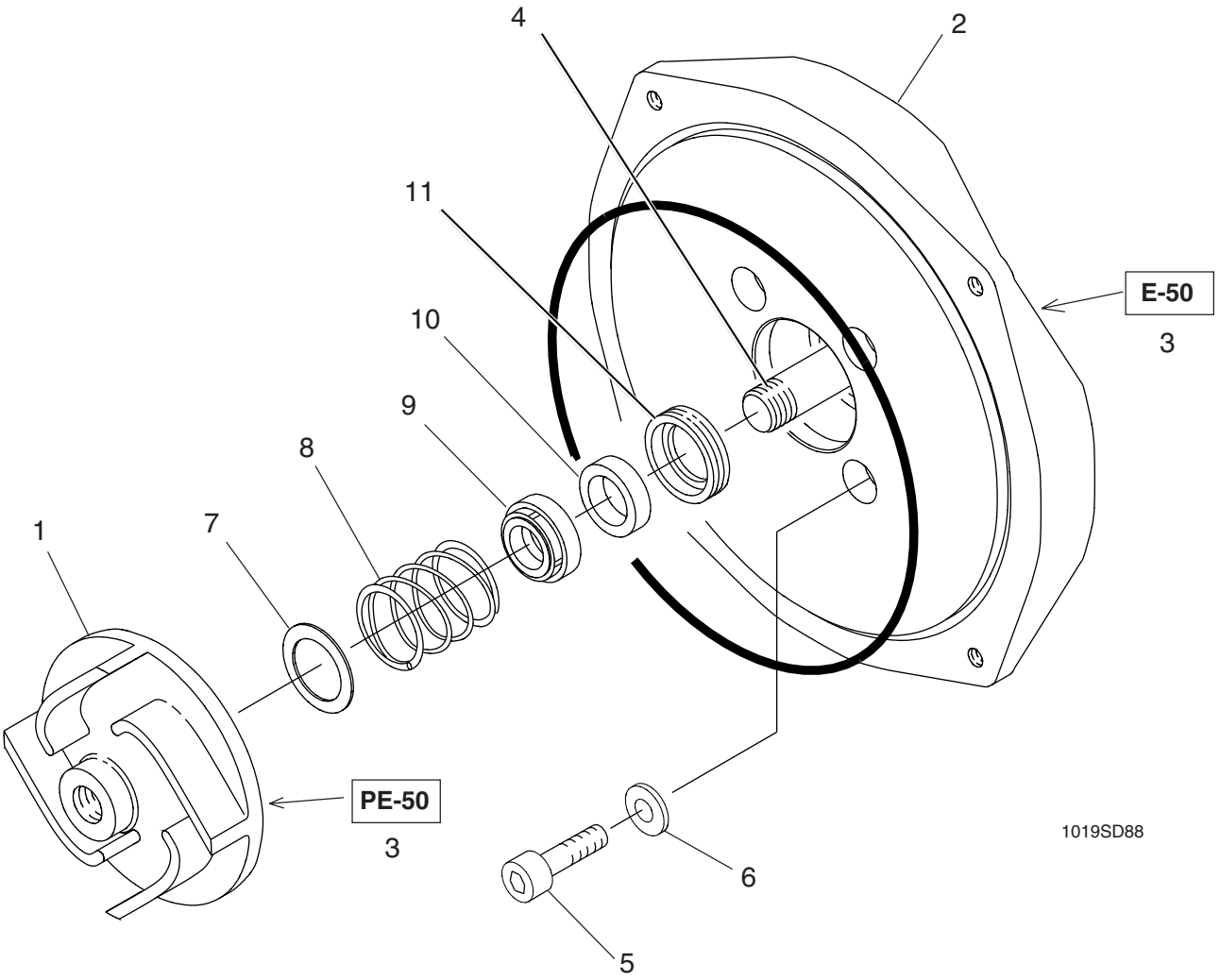
1. Check clearance between impeller **(11)** and volute **(9)**. Add shims as required. See Section 4.10 *Adjusting Impeller Clearance.*
2. Inspect O-Rings **(12)** and **(10)**. Grease O-Rings lightly before assembly. Make sure areas where O-Rings seat are clean.
3. Mount pump housing **(7)** to flange **(8)**. Secure evenly with screws **(6)**. Torque to 26 ft.lbs. (37 Nm).

Note: *Pump housing **MUST** seal flush around rear flange. Replace pump flange if it appears warped or bent.*



1033SD72

Impeller / Mechanical Seal Assembly



4.17 Impeller

CAUTION: When replacing either the impeller **(1)** or rear pump flange **(2)**, make note of the I.D. numbers found on back of each component casting **(3)**. **MAKE SURE REPLACEMENT PARTS HAVE THE SAME NUMBER MARKINGS–THEY ARE NOT INTERCHANGEABLE.**

Recommended tools:
- Socket wrench - 1/2" (13mm)
- Allen wrench - 6mm
- Plastic / rubber mallet

Removal:

1. Remove pump housing. See Section 4.16 *Pump Housing.*

2. Unscrew impeller **(1)** counterclockwise from engine shaft **(4)**.

Note: *If the impeller is hard to remove, tap it with a plastic mallet. Do not lose any adjusting shims.*

3. Remove four screws **(5)** and washers **(6)** mounting rear pump flange **(2)** to engine.

Installation:

1. Mount rear pump flange **(2)** to engine. Secure with screws **(5)** and washers **(6)**. Apply Loctite 271 or an equivalent high strength threadlocker and torque to 16 ft.lbs. (22 Nm)

Note: *Install rear pump flange with drain channel facing down.*

2. Install mechanical seal. See Section 4.18 *Mechanical Seal Replacement.*

3. Screw impeller **(1)** clockwise onto engine shaft. **DO NOT** apply any threadlocker to threads of impeller or engine shaft.

4.18 Mechanical Seal Replacement

Removal:

1. Remove the impeller **(1)**. See Section 4.17 *Impeller.*

Note: *Do not lose any adjusting shims* **(7)**.

2. Remove mechanical seal spring **(8)** and carbon face **(9)** from engine shaft.

3. Remove mechanical seal ceramic face **(10)** and L-ring **(11)** from rear pump flange.

Installation:

1. Clean engine shaft, remove any rust. Also clean contact surface of ceramic and carbon faces with a clean cloth. **DO NOT** lubricate seal faces.

2. Place ceramic face **(10)** in L-ring **(11)** and install in pump flange.

3. Carefully place carbon face **(9)** and seal spring **(8)** on engine shaft.

4. Mount impeller to engine shaft. Turn impeller shaft clockwise to tighten.

4.19 Testing

Suction Test

Required Tools:
Vacuum Gauge - P/N 28755
Tachometer

1. Fill pump housing with cold water until it flows out from discharge port.

2. Tighten pump cover and prime plug.

3. Bring engine up to operating speed. Check engine RPM. See Section 1.13 *Technical Data* for PG engine speeds.

Note: *Keep pump housing filled with water at all times while pump is running. If too much water is lost during test procedure, stop engine and reprime pump. It may be necessary to tilt pump or partially cover discharge port, to prevent water in the pump housing from being lost while still allowing air to be vented.*

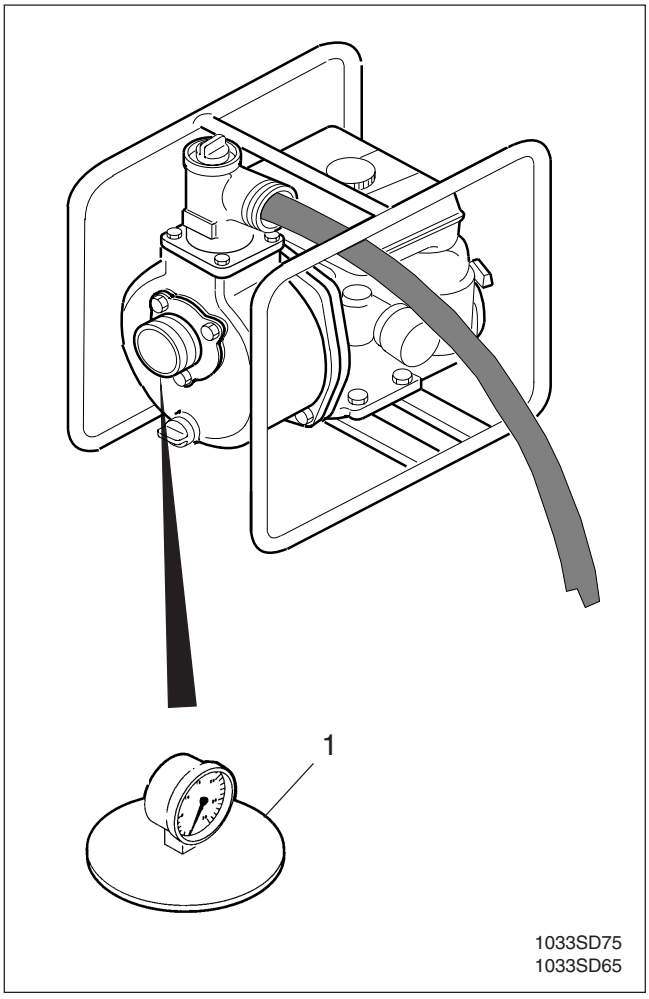
4. Grease mounting face of vacuum gauge **(1)**, to ensure a good seal. Press gauge over inlet port.

5. Gauge reading should slowly climb and then hold steady.

6. With gauge still against inlet port, turn off engine. Gauge reading should not change.

Note: *See vacuum chart for appropriate gauge readings.*

This test **MUST** be completed within a few minutes to prevent the water in the pump housing from getting hot, which will result in lower readings. If possible, allow cold water to run into discharge port while testing pump.



1033SD75
1033SD65

	Excellent	Satisfactory
in.Hg (KPa)	20–24 (68–82)	16–20 (55–68)

4.20 Troubleshooting

Problem / Symptom	Reason / Remedy
Pump does not take in water.	1. Not enough priming water in housing. 2. Engine speed too low. Adjust speed. 3. Strainer plugged. Clean strainer. 4. Suction hose damaged. Replace or repair hose. 5. Air leak at suction port. Check that fittings are tight and sealing properly. 6. Pump too high above water. 7. Debris collecting in pump housing. Clean pump housing. 8. Too much clearance between impeller and volute.
Pump takes in water, little or no discharge.	1. Engine speed too low. Adjust speed. 2. Suction strainer partially plugged. Clean strainer. 3. Impeller worn. Adjust clearance by adding shims or replace impeller. 4. Volute worn or damaged. Adjust clearance or replace volute.
Suction hose leaks at inlet.	1. Clamps are not sealing properly. Tighten, replace, or add clamp. 2. Hose diameter is too large. 3. Hose is damaged.
Discharge hose does not stay on coupling.	1. Pressure may be too high for clamps being used. Add another clamp. 2. Hose kinked or end blocked. Check hose.
Impeller does not turn; pump is hard to start.	1. Impeller jammed or blocked. Open pump cover and clean dirt and debris from inside of pump housing. 2. Impeller and volute binding. Adjust clearance by removing shim(s) from behind impeller.

Notes:

Table of Contents

5.1 Description and Operation

PD Series Pumps use a diaphragm **(1)** and two flapper valves **(2) & (3)** to create the suction and discharge pressures required for pump operation.

The pump engine operates a large rubber diaphragm through a 6:1 reduction gear box, engine shaft and connecting rod **(4)**.

When the diaphragm **(1)** is pulled up, a vacuum is created in the pump chamber. This closes the discharge valve **(2)** and opens the inlet valve **(3)** drawing liquid into the pump chamber.

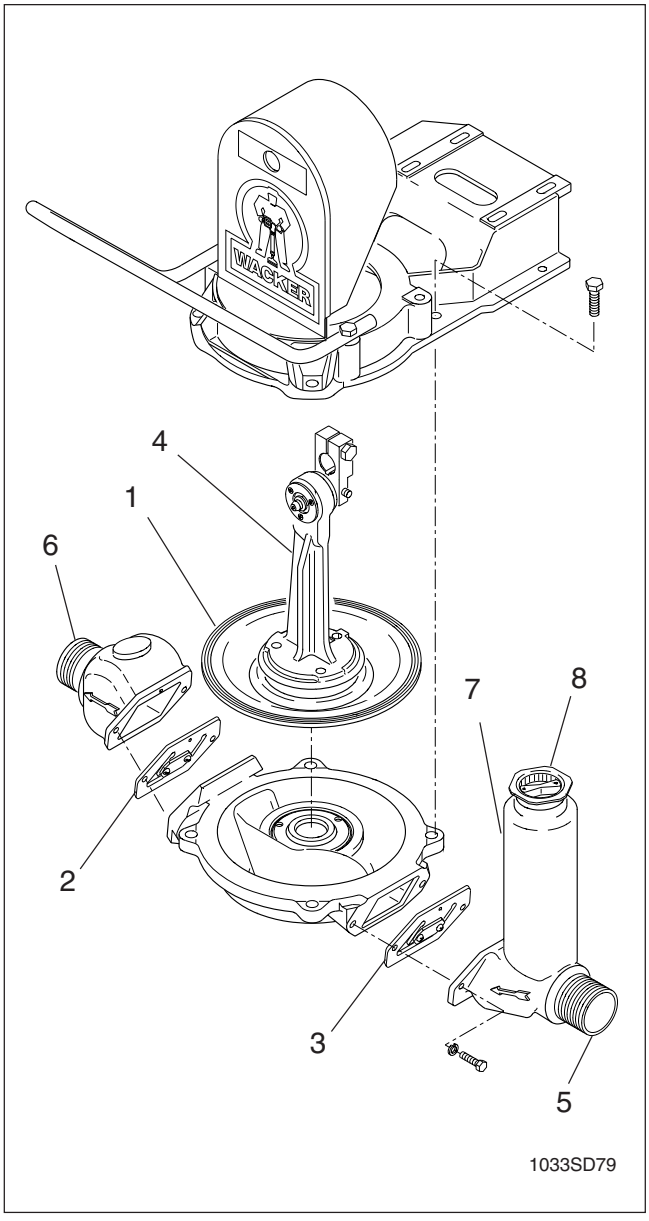
When the diaphragm is depressed, the resulting pressure closes the inlet port **(5)**, opens the discharge valve and the liquid is forced out through the pump outlet **(6)**.

This pumping action has several advantages. Since the pumping action is due only to the suction and pressure created by the movement of the diaphragm, there are no close tolerances to be held. This fact along with large valve openings, allow very thick and heavy liquids to be passed through the pump with no jamming or clogging.

A suction inlet port **(7)** on the intake side of the pump, absorbs sharp back pressure spikes which occur when the inlet valve **(3)** closes on the downward stroke of the diaphragm.

PD Series Pumps do not need priming under normal conditions. However, for high lifts or if pump valves are dry, fill pump box with water before initial start-up. Add water through fill plug **(8)** on top of surge chamber.

Since this is a positive displacement pump, it can handle large volumes of air along with the fluid being pumped. This allows the pump to keep operating even if the strainer is not completely submerged, or is temporarily interrupted.



5.2 Periodic Maintenance Schedule

The chart below lists basic pump and engine maintenance. Refer to engine manufacturer's Operation Manual for additional information on engine maintenance. A copy of the engine Operation Manual was supplied with the machine when it was shipped.

	PDT2A PDI2A	PDT3A PDI3A
DAILY (Before Starting)		
Check fluid level.	•	•
Check engine oil level.	•	•
Inspect air cleaner. Clean as needed.	•	•
Check and tighten external hardware.	•	•
NEW ENGINE BREAK-IN (First 20 hrs.)		
Change engine oil and replace filter.	•	•
EVERY 2 WEEKS (50 hrs.)		
Clean air cleaner.	•	•
Grease pump connecting rod bearing.	•	•
EVERY MONTH (100 hrs.)		
Check and clean spark plug.	•	•
Clean sediment cup.	•	•
Change engine oil and replace filter.	•	•
EVERY 3 MONTHS (300 hrs.)		
Check and adjust valve clearances.	•	•
Change oil in pump gearcase.	•	•

5.3 Air Cleaner

Service air cleaner frequently to prevent carburetor malfunction.

NEVER run engine without air cleaner. Severe engine damage will occur.

NEVER use gasoline or other types of low flash point solvents for cleaning the air cleaner. A fire or explosion could result.

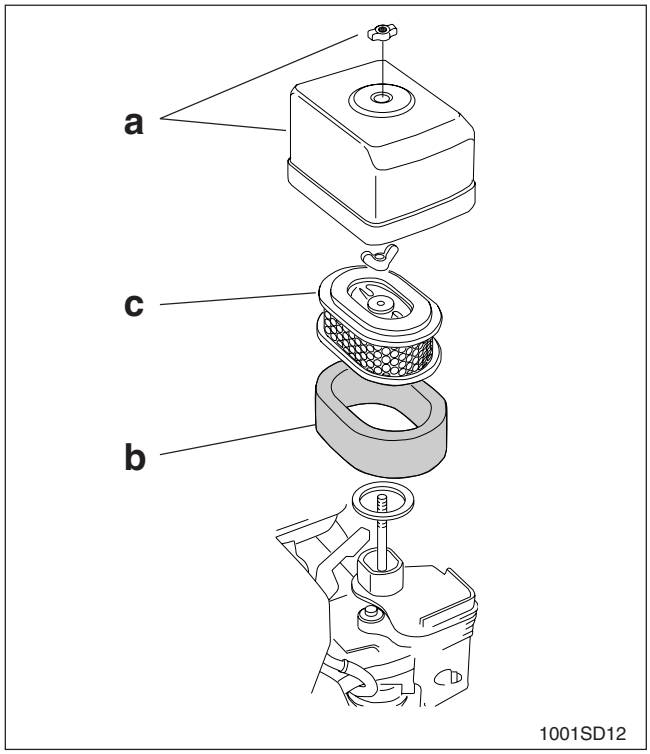
The engine is equipped with a dual element air cleaner.

1. Remove air cleaner cover **(a)**. Remove both elements and inspect them for holes or tears. Replace damaged elements.

2. Foam Element **(b)**
   Wash in solution of mild detergent and warm water. Rinse thoroughly in clean water. Allow element to dry thoroughly.

   Soak element in clean engine oil and squeeze out excess oil.

3. Paper element **(c)**
   Tap element lightly to remove excess dirt or blow compressed air through filter from the inside out. Replace paper element if it appears heavily soiled.



5.4 Engine Oil

Drain oil while engine is still warm.

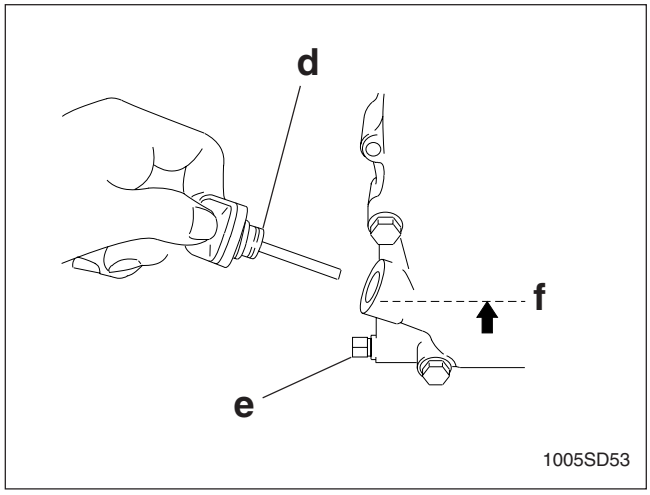
1. Remove oil fill plug **(d)** and drain plug **(e)** to drain oil.

2. Install drain plug.

3. Fill engine crankcase with recommended oil up to level of plug opening **(f)**.

   Oil capacity: 21 oz. (0.6 liters)

4. Install oil filler plug.



5.5 Spark Plug

Clean or replace spark plug as needed to ensure proper operation. Refer to the engine Owner's Manual.

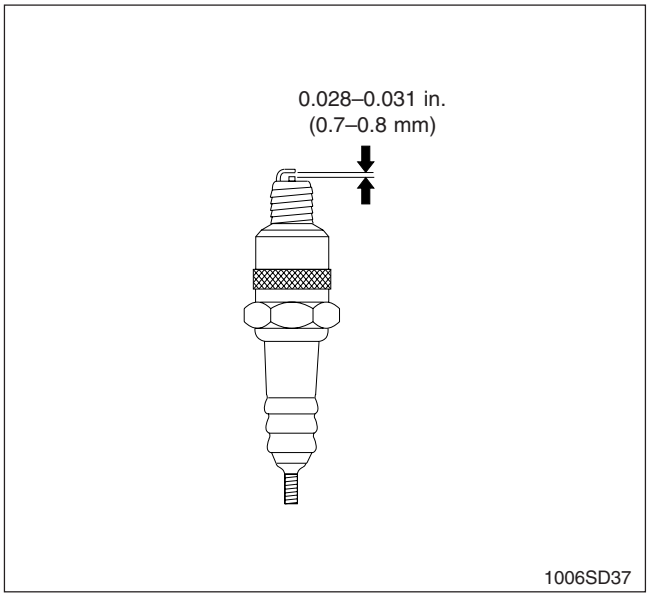
Recommended Plug: (NGK) BPR 6ES
BOSCH WR 7DC

WARNING

The muffler becomes very hot during operation and remains hot for a while after stopping the engine. Do not touch the muffler while it is hot.

1. Remove spark plug and inspect it.
2. Replace plug if the insulator is cracked or chipped. Clean spark plug electrodes with a wire brush.
3. Set gap to 0.028–0.031" (0.7–0.8 mm).
4. Tighten spark plug securely.

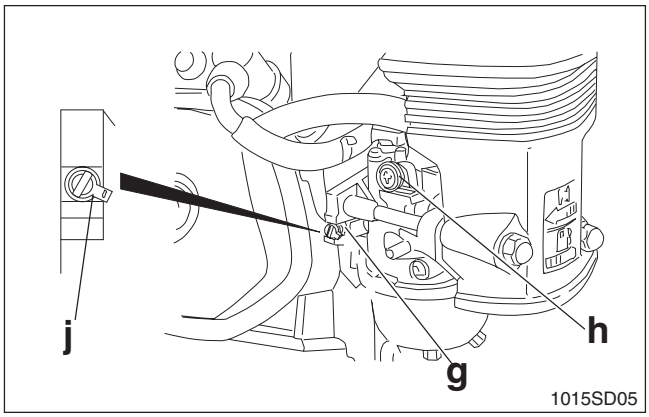
CAUTION: A loose spark plug can become very hot and may cause engine damage.



5.6 Carburetor Adjustment

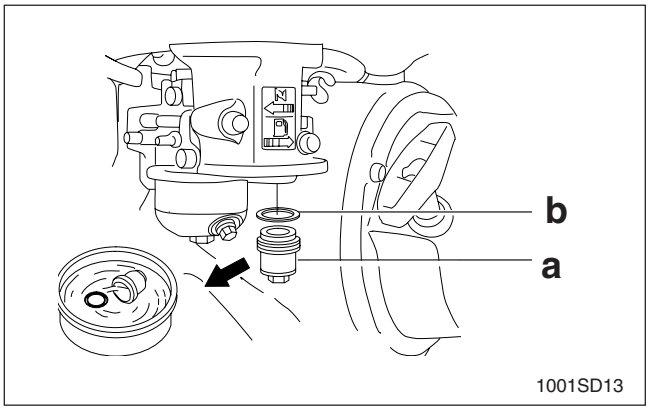
1. Start engine and allow it to warm up to operating temperature.
2. Set pilot screw **(g)** 2 turns out. See Note.
3. With the engine idling, turn pilot screw **(g)** in or out to the setting that produces the highest rpm.
4. After pilot screw is adjusted, turn throttle stop screw **(h)** to obtain the standard idle speed, 1400 ±150 rpm.

Note: *On some engines the pilot screw is fitted with a limiter cap **(j)** to prevent excessive enrichment of the air-fuel mixture in order to comply with emission regulations. The mixture is set at the factory and no adjustment should be necessary. **Do not** attempt to remove the limiter cap. The limiter cap cannot be removed without breaking the pilot screw.*



5.7 Cleaning Sediment Cup

Turn fuel valve off. Remove sediment cup **(a)** and O-ring **(b)**. Wash them thoroughly in a nonflammable solvent. Dry them and re-install. Turn fuel valve on and check for leaks.

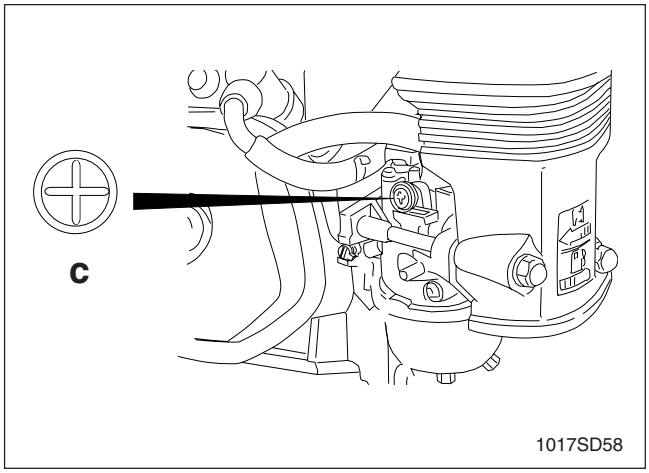


5.8 Adjusting Idle Speed

To adjust idle speed:

1. Start engine and allow it to warm up to normal operating temperature.

2. Turn throttle stop screw **(c)** in to decrease speed, out to increase speed.



5.9 Gear Case

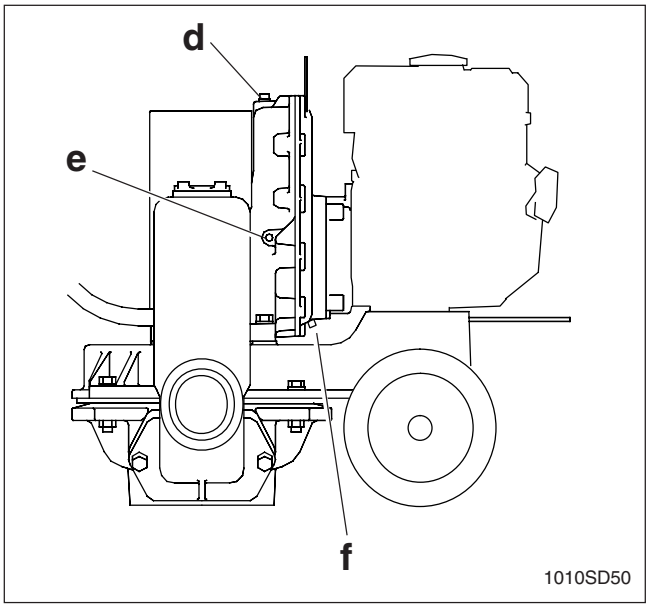
Check the oil level in the gear case once a week or every 25 hours of operation.

Remove oil level plug **(e)**. Check that oil level is even with plug opening. If oil level is low, add oil through the top fill plug opening **(d)**. Do not overfill.

Change oil in gear case once a year or every 300 hours of operation.

Drain oil through drain plug opening **(f)** at bottom of gear case. Add oil through fill plug on top of gear case.

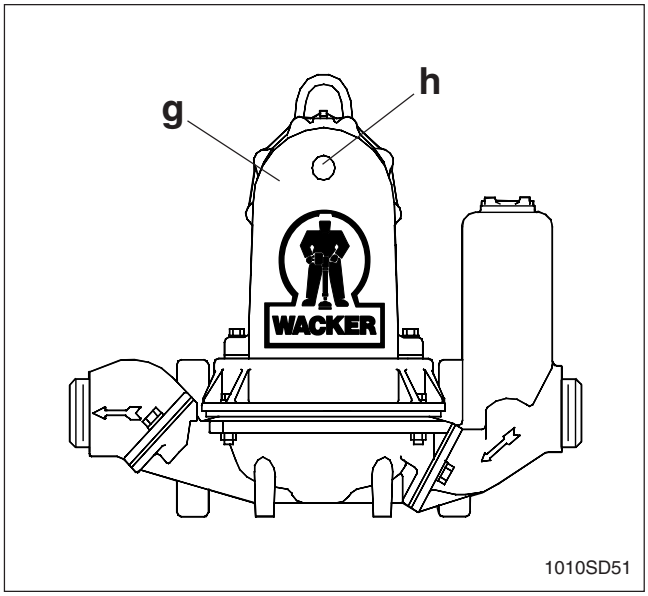
Oil capacity: 32 oz. (1000 ml) SAE 30



5.10 Connecting Rod Bearing

Grease connecting rod bearing once a week or every 25 hours of operation.

Use a hand-operated grease gun. Add grease through grease fitting located behind access hole **(h)** provided on front cover.



5.11 Cleaning Pump

When pumping heavy sludges or water containing large amounts of dirt and solids, clean the pump often. If allowed to sit in the pump and dry, these materials will harden and could damage the valves or diaphragm inside the pump the next time it is used.

When cleaning pump:

1. Pump clean water through pump for a few minutes after each use to flush dirt from inside pump and hoses.

2. Remove dirt from between engine cooling fins to prevent them from clogging up. This will prevent engine from overheating.

3. Remove front cover **(g)** and clean dirt and grease build-up from connecting rod and inside of front pump cover.

5.12 Storage

If pump is being stored for more than 30 days:

1. Clean pump as described in Section 5.11 *Cleaning Pump.*

2. Drain out any water left in the pump housing.

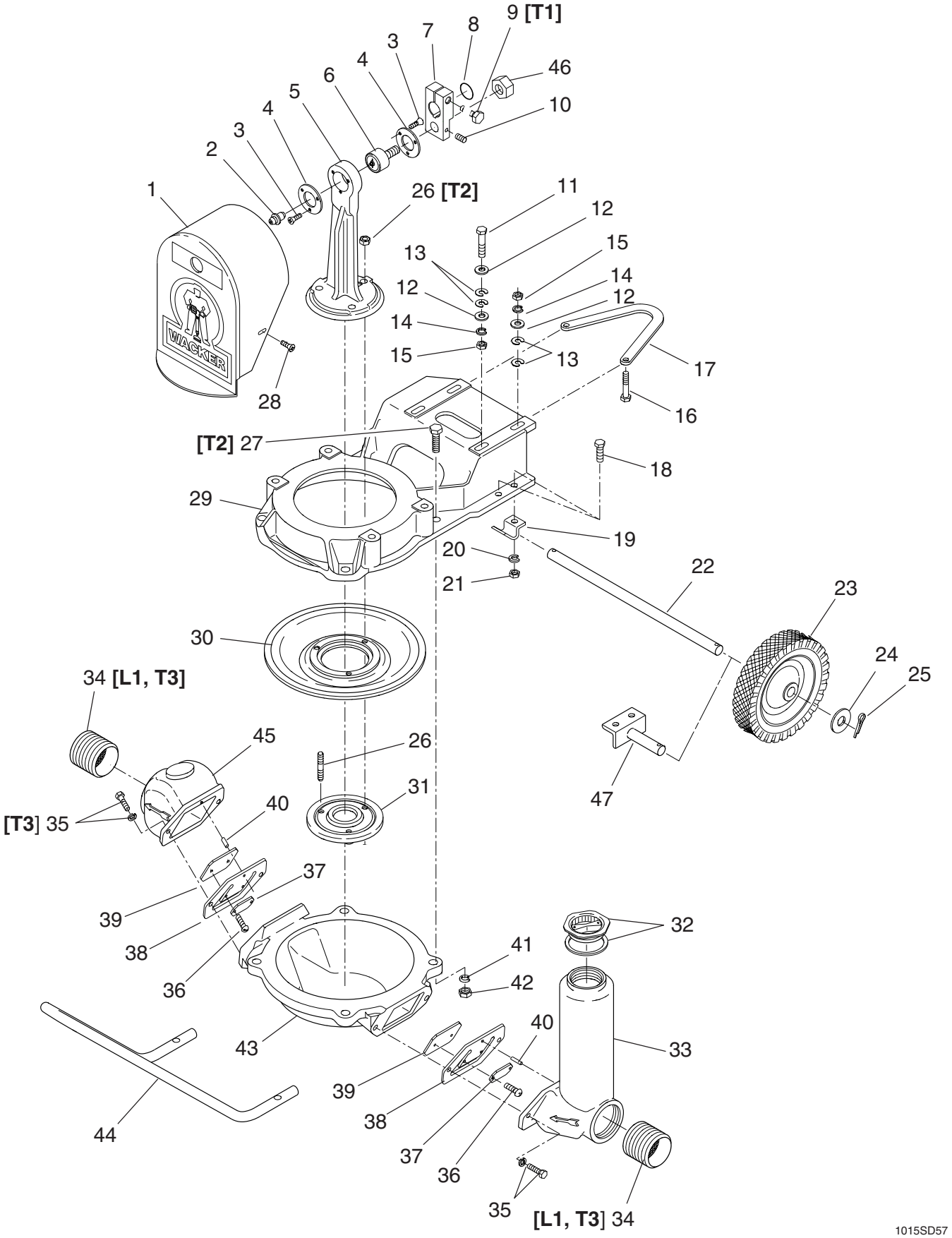
3. Remove pump cover and clean inside of pump housing. Spray connecting rod and inside of pump cover with a light film of oil.

4. Tape up suction and discharge ports to prevent anything from falling into pump.

5. Change engine oil and follow procedures described in engine manual for engine storage.

6. Cover pump and engine and store in a clean, dry area.

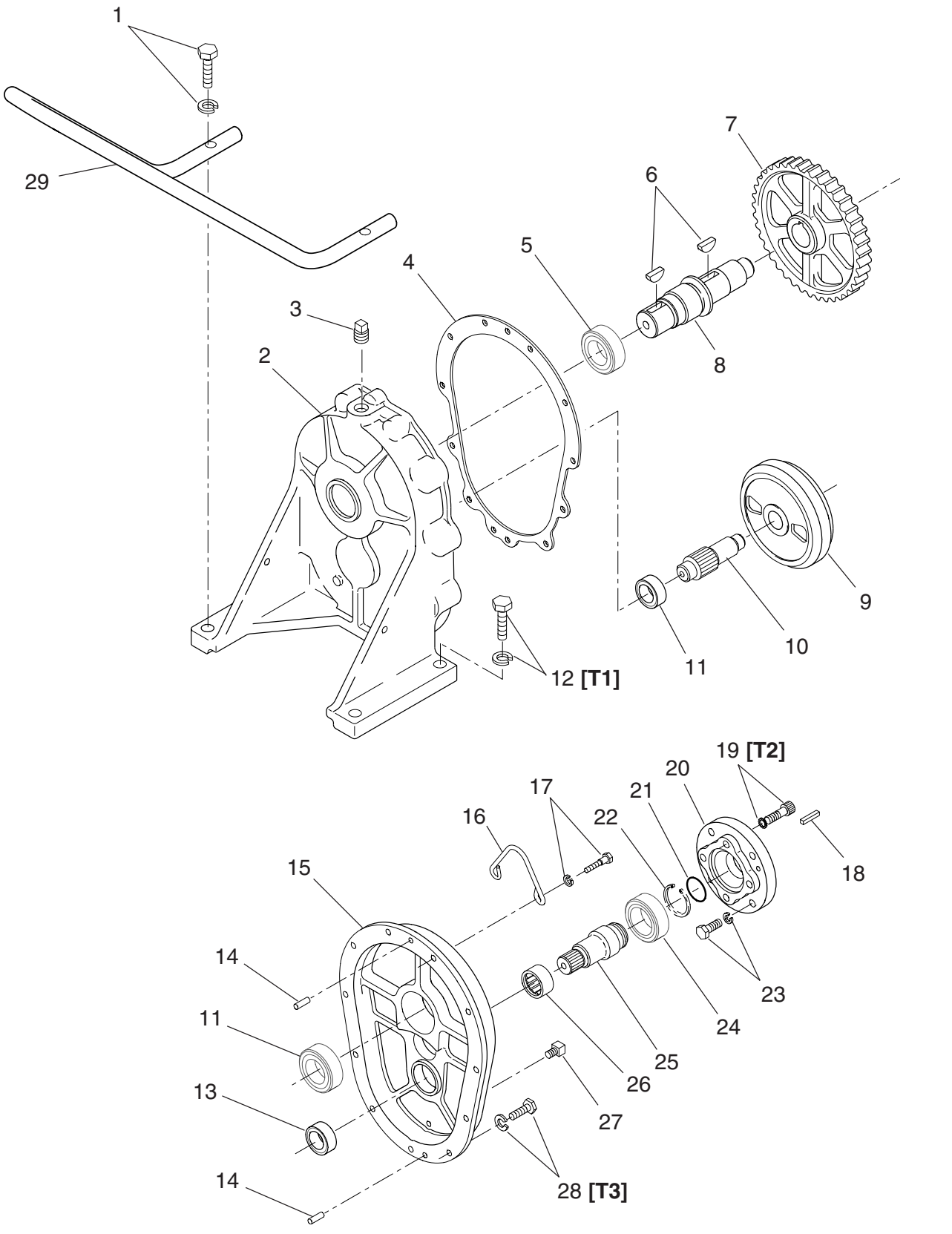
5.13 PD Pump Assembly



REF.	DESCRIPTION	QTY.
1	Cover - gearbox	1
2	Fitting - grease	1
3	Screw #10-32x1/2	6
4	Washer - retaining	2
5	Connecting rod	1
6	Bearing - cam follower	1
7	Crank - arm	1
8	Seal - oil	1
9	Screw 1/2x1-1/2	1
10	Setscrew	1
11	Screw 5/16-18x2	2
12	Washer 5/16	6
13	Shim - engine	8
14	Washer - lock 5/16	4
15	Nut 5/16	4
16	Screw 5/16-18x2-1/4	2
17	Bracket - bumper	1
18	Screw	2
19	Bracket	1
20	Washer - lock	2
21	Nut	2
22	Axle	1
23	Wheel	2
24	Washer	2
25	Pin - cotter	2
26	(PD2) Stud	3
	(PD3) Bolt - carriage	3
27	Screw 1/2x2-1/4	4
28	Screw #10-24x1/2	2
29	Housing - pump case	1
30	Diaphragm - TPE, (standard)	1
31	Diaphragm - rubber, (optional)	1
32	Plug 2", priming	1
33	Port - suction (inlet)	1
34	Fitting - NPT	1
35	Washer - lock (incl. 36)	4
36	Screw #10-32x1/2	4
37	Weight - retainer valve	2
38	Gasket - flapper valve	2
39	Weight - flapper valve	2
40	Pin 1/8x3/8, spring	2
41	Washer - lock	4
42	Nut 1/2	4
43	Housing - water box	1
44	Handle - towing pole	1
45	Flange - discharge	1
46	Nut - lock	1
47	Axle - stub	2

[L1] - (0026695)
[T1] - 55–60 ft.lbs. (75–81 Nm) **[T2]** - 35–40 ft.lbs. (48–54 Nm) **[T3]** - 16–20 ft.lbs. (22–27 Nm)

5.14 Gearbox Assembly



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REF.	DESCRIPTION	QTY.
1	Screw 1/2-13x2-1/2 (incl. washer)	2
2	Gearbox	1
3	Plug - oil 3/8-18	1
4	Gasket - gearbox	1
5	Bearing	1
6	Key - woodruff	2
7	Gear	1
8	Shaft - gear	1
9	Gear - internal	1
10	Gear - pinion	1
11	Bearing	2
12	Screw 1/2-13x1-3/4 (incl. washer)	2
13	Bearing	1
14	Pin 1/4x3/4, dowel	2
15	Cover	1
16	Hook - lifting	1
17	Screw 1/4x1-1/4 (incl. lock washer)	2
18	Key	1
19	Screw 5/16-18x1 (incl. lock washer)	4
20	Adapter - engine	1
21	O-Ring	1
22	Retaining Ring	1
23	Screw 5/16-24x1 (incl. lock washer)	4
24	Bearing	1
25	Gear - pinion	1
26	Bearing - needle	1
27	Plug - oil 1/8 NPT	2
28	Screw 1/4x1 (incl. lock washer)	9
29	Handle - towing pole	1

[T1] - 55–60 ft.lbs. (75–81 Nm) **[T2]** - 10–11 ft.lbs. (14–15 Nm)
[T3] - 7–8 ft.lbs. (9.5–11 Nm)

5.15 Inspecting Pump

Before disassembling pump, check for conditions both outside and inside the pump which could affect performance.

Inspecting Outside Pump:

- **CHECK THAT THE PUMP IS OPERATING WITHIN SPECIFICATIONS.**
  Remember that as suction lift and discharge head increases, pump output is reduced. On the PD Series Pumps, discharge head **CANNOT** exceed 25' (7.6m).

- **CHECK TYPE OF FLUID BEING PUMPED.**
  Although the PD Series Pumps are designed to handle heavy sludges and muddy water, the mixture must be fluid enough to flow freely.

- **CHECK SUCTION HOSE FOR LEAKS OR DAMAGE.**
  A puncture or tear above the water line will make the pump difficult or impossible to prime.

- **CHECK THAT SUCTION HOSE IS CORRECT TYPE.**
  Suction hose must have strong rigid walls. Thin-walled collapsible hoses like those used on the discharge side cannot be used.

- **CHECK THAT STRAINER HOSE LINES ARE NOT BLOCKED OR RESTRICTED.**
  Remove any dirt, debris or vegetation which might interfere with pump flow. If possible, flush hose lines with clear water at the end of each operation and suspend strainer in water, rather than rest on sandy or muddy bottom. Check that discharge hose is not kinked.

- **CHECK THAT ALL FITTINGS AND HOSE CLAMPS ON SUCTION LINE ARE TIGHT AND SEALING PROPERLY.**
  Fittings and clamps may loosen during operation. Add additional clamps where necessary to ensure good seal.

- **CHECK THAT SUCTION HOSE RUNS EVEN WITH OR DOWN HILL FROM PUMP.**
  If the suction line is elevated above pump inlet, back pressure in the hose may prevent pump inlet valve from sealing. Discharge rate is reduced.

- **CHECK THAT PRIME PLUG IS TIGHT. PRIME FOR HIGH LIFTS OR WHEN VALVE RUBBERS ARE DRY, TO IMPROVE SUCTION UPON INITIAL START-UP.**

Inspecting Inside Pump:

- **CHECK THAT BOLTS AROUND DIAPHRAGM ARE SECURE AND TIGHTENED EVENLY.**
  A loose bolt will prevent a good seal around gasket.

- **CHECK ENGINE OPERATING SPEED.**
  3000 ±100 RPM

  As engine operating RPM falls, pump capacity and discharge head are reduced.

- **CHECK FLAPPER VALVE AND INLET PORT FOR LEAKS OR DAMAGE.**
  If flapper valve is worn or distorted it may not seal tightly. Inspect threads on inlet port nipple for deep scratches which could allow air leaks.

- **CHECK FOR DEBRIS AND DIRT INSIDE PUMP CASING.**
  Dirt and debris trapped under the diaphragm may interfere with its operation. This may occur if a strainer was not attached to the suction line, allowing large particles to enter the pump box. **Always** attach a strainer to suction hose.

  Large solids can also form under the diaphragm, if sludge or mud from last application is allowed to harden in pump box without being flushed.

- **CHECK DIAPHRAGM FOR CRACKS, PUNCTURES OR TEARS.**
  A damaged diaphragm will not produce sufficient suction or discharge pressure.

- **CHECK PUMP SUCTION WITH VACUUM GAUGE.**
  If gauge reading is above 16 in. Hg (55 KPa), problem is probably outside the pump, in hose line or fitting.

5.16 Flapper Valve

Recommended tools:
Socket wrench - 3/8"
Screwdriver

Removal:

1. Remove two screws **(1)** and washers **(2)** mounting either the suction (inlet) port **(3)** or discharge port **(4)** to pump water box **(5)**.

2. Remove flapper valves **(6)**.

3. Remove large weights **(7)** and small weights **(8)** from each side of flapper valve.

Installation:

1. Install new flapper valve assembly, with small weight **(8)** toward intake side of each valve.

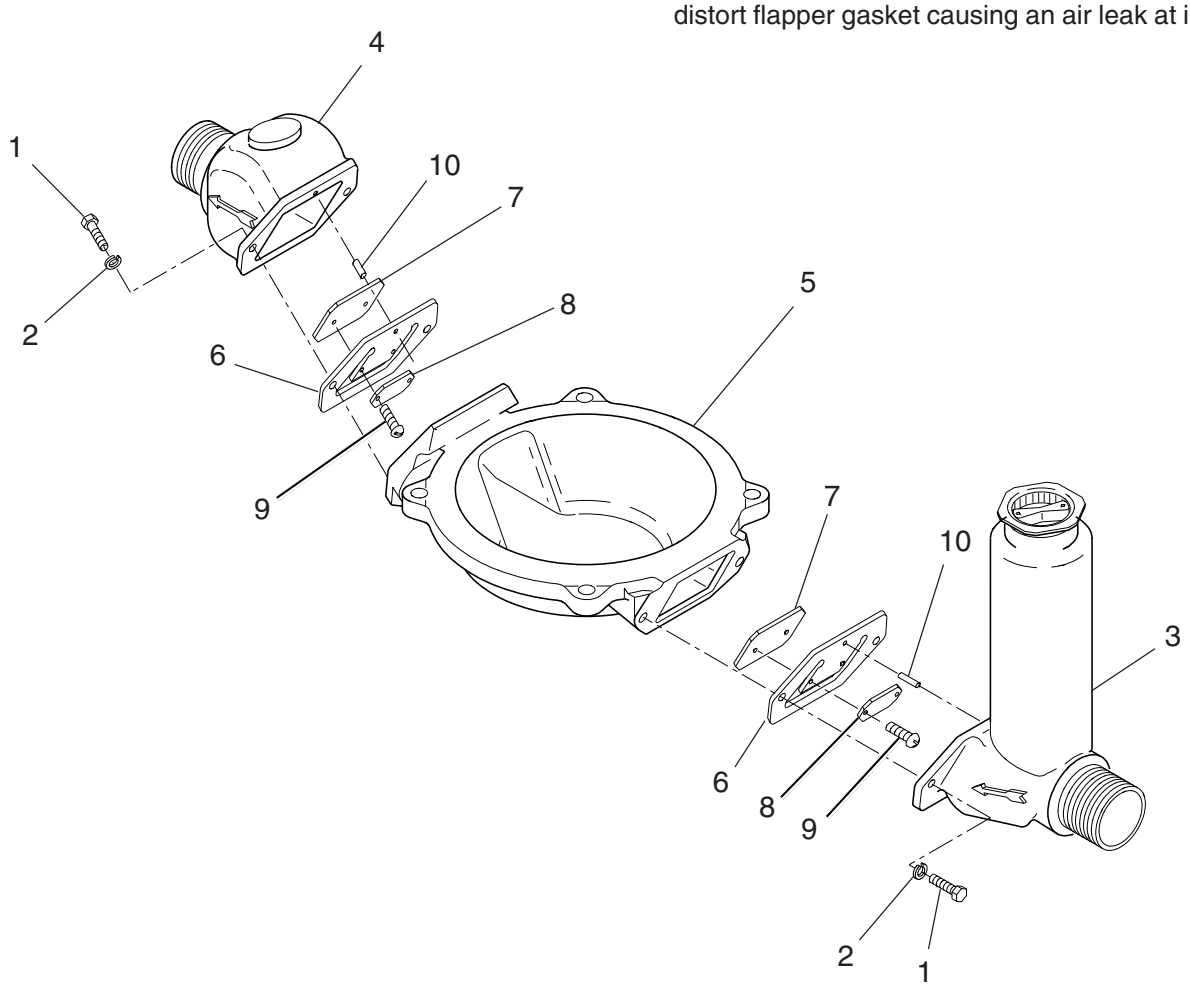
2. Tighten screws **(9)** on valve weights until rubber begins to compress.

CAUTION: DO NOT overtighten. Overtightening may distort rubber gasket, preventing it from sealing properly.

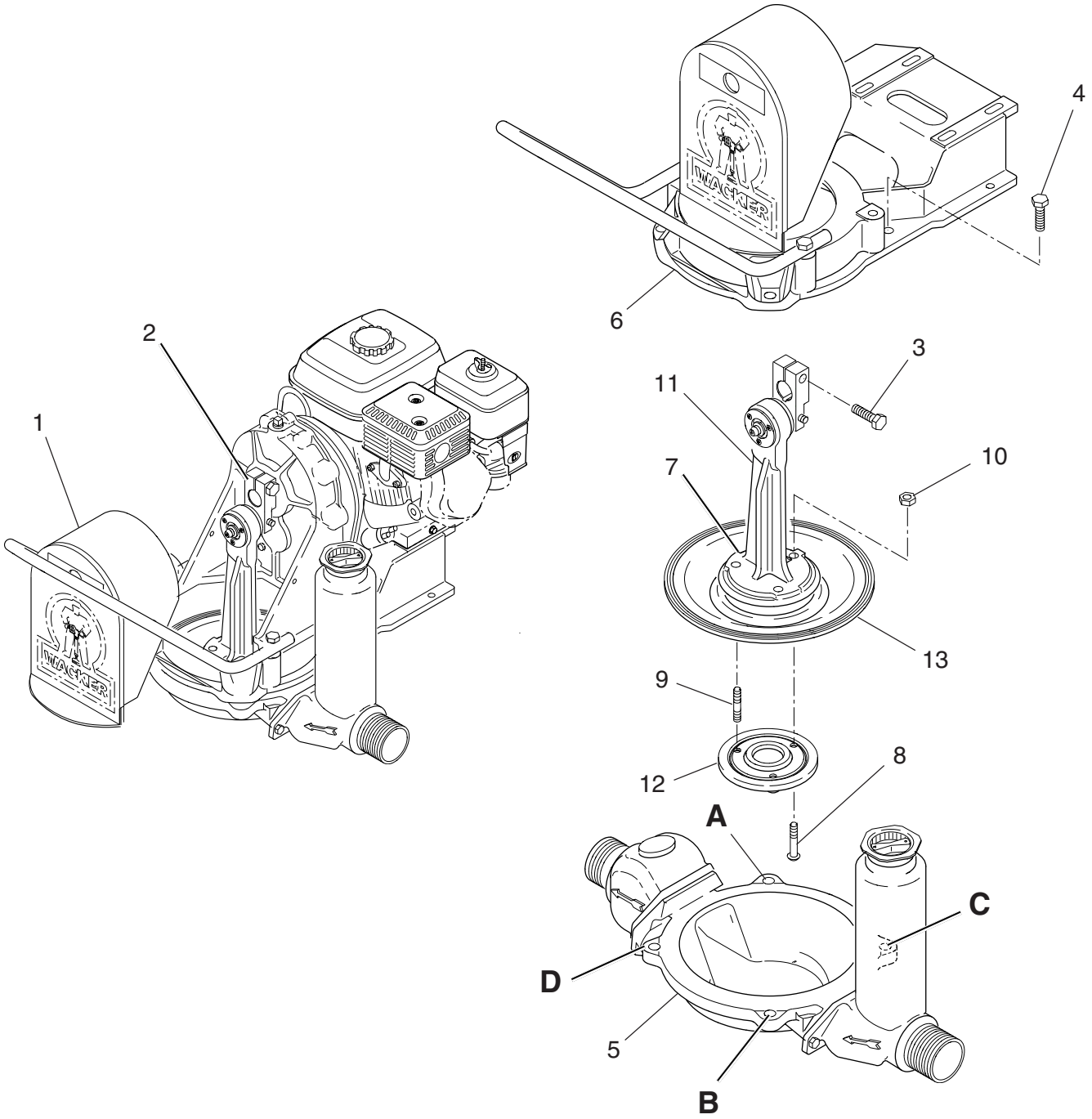
3. Use dowel pins **(10)** on pump water box **(5)** and position flapper valves.

4. Mount suction (inlet) port **(3)** or discharge port **(4)** to pump using screws **(1)** and washers **(2)**. Torque to 16–20 ft.lbs (22–27 Nm).

CAUTION: DO NOT overtighten. Overtightening may distort flapper gasket causing an air leak at inlet port.



5.17 Diaphragm



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1033SD85

5.17 Diaphragm (cont.)

Recommended tools:
Socket wrench - 3/4"
Screwdriver
Pry bar

Removal:

1. Remove connecting rod cover **(1)**.
2. With stop switch against spark plug, pull starter until crank arm **(2)** is in its uppermost position.
3. Loosen screw **(3)** mounting crank arm to gear shaft. See Section 5.20 *Gearcase.*
4. Remove four screws **(4)** mounting water box **(5)** to pump frame **(6)**.
5. Lower water box assembly **(5)** from pump frame **(6)** and remove connecting rod / diaphragm assembly **(7)**.
6. Remove three screws **(8)** or studs **(9)** and nuts **(10)** mounting connecting rod **(11)** and mounting plate **(12)** to diaphragm **(13)**.

Installation:

1. Position new diaphragm **(13)** in between mounting plate **(12)** and connecting rod **(11)**. Secure with either screws **(8)** or studs **(9)** and nuts **(10)**. Torque nuts to 35–40 ft. lbs. (48–54 Nm).
2. Mount crank arm **(2)** to gear shaft. Secure with screw **(3)** and torque to 55–60 ft. lbs. (75–81 Nm).
3. Carefully position connecting rod / diaphragm assembly **(7)** between pump frame **(6)** and water box assembly **(5)**. Secure with four screws **(4)**. Torque screws to 23 ft. lbs. (32 Nm.)

CAUTION: Tighten bolts evenly, in progressive steps **A-B-C** &**D**, to ensure a tight seal around diaphragm. When assembled correctly, diaphragm should be compressed to approx. 3/8" (9.5 mm) around entire circumference.

4. Replace crank arm cover **(1)**.

5.18 Connecting Rod & Bearing

Recommended tools:
- Socket wrench 1-1/8"
- Allenwrench 5/32"
- Screwdriver

Removal:

1. Remove connecting rod / diaphragm assembly. See Section 5.17 *Diaphragm*.
2. Remove crank arm retaining nut **(1)**.
3. Loosen crank arm setscrew **(2)** .
4. Remove three screws **(3)** mounting retaining washers **(4)** to both sides of connecting rod **(5)**.
5. Support connecting rod **(5)** in an arbor press. Press on threaded end of bearing cam **(6)** to remove it.

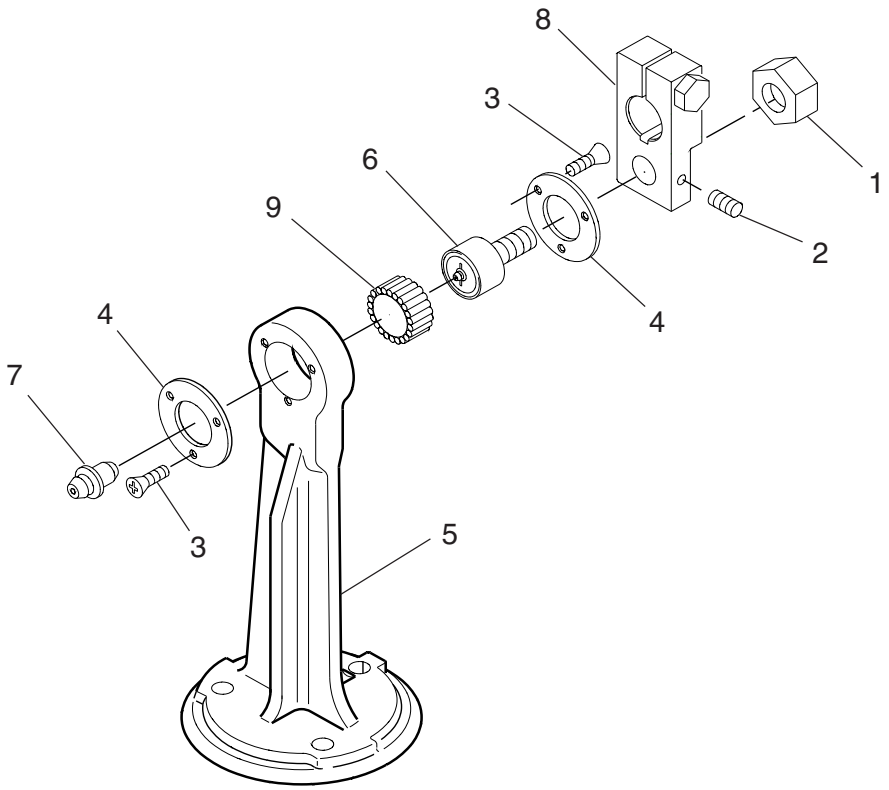
CAUTION: When bearing shaft is pressed out of crank arm, 25 bearing needles **(9)** will be free, and may fall out of the bearing race. If the bearing is to be reused, use care to avoid losing any bearing needles. **DO NOT** press on grease fitting **(7)** in bearing shaft!

Installation:

1. Insert bearing needles **(9)** into connecting rod **(5)**.

Note: *Use grease to hold needles in place during installation.*

2. Insert bearing cam **(6)** into connecting rod.
3. Mount retaining washers **(4)** to both sides of connecting rod using three screws **(3)**.
4. Support bearing shaft in arbor press and press crank arm **(8)** onto bearing shaft. Secure crank arm using setscrew **(2)** and nut **(1)**.
5. Before mounting connecting rod / diaphragm assembly, scrape edges around diaphragm clean. See Section 5.17 *Diaphragm* for installation procedure.
4. After asssembly, grease bearing with Shell Alvania #2 through fitting **(7)**.



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5.19 Engine

Recommended tools:
Socket wrench - 1/2" (13mm)

Removal:

1. Remove drain plug **(1)** from bottom of gearbox and drain oil. Install plug back into gearbox.

2. Remove four screws **(2)** and lock washers **(3)** mounting engine adapter **(4)** to engine **(5)**.

3. Remove two screws **(6)**, washers **(7)**, lock washers **(8)**, and nuts **(9)** mounting bumper bracket **(10)** and rear part of engine to pump housing.

4. Remove two screws **(11)**, four washers **(7)**, two lock washers **(8)**, and nuts **(9)** mounting front part of engine to pump housing.

5. Pull engine away from gearbox until engine shaft is clear of engine adapter **(4)**.

Note: *When removing engine, keep in mind there are shims **(12)** between pump housing and engine. **DO NOT** throw away shims. They are to be reused when mounting engine to pump housing.*

Installation:

1. Position engine **(5)** on pump housing.

Note: *Turn engine shaft to align key **(13)** with keyway in engine adapter **(4)**.*

2. Slide engine into gearbox.

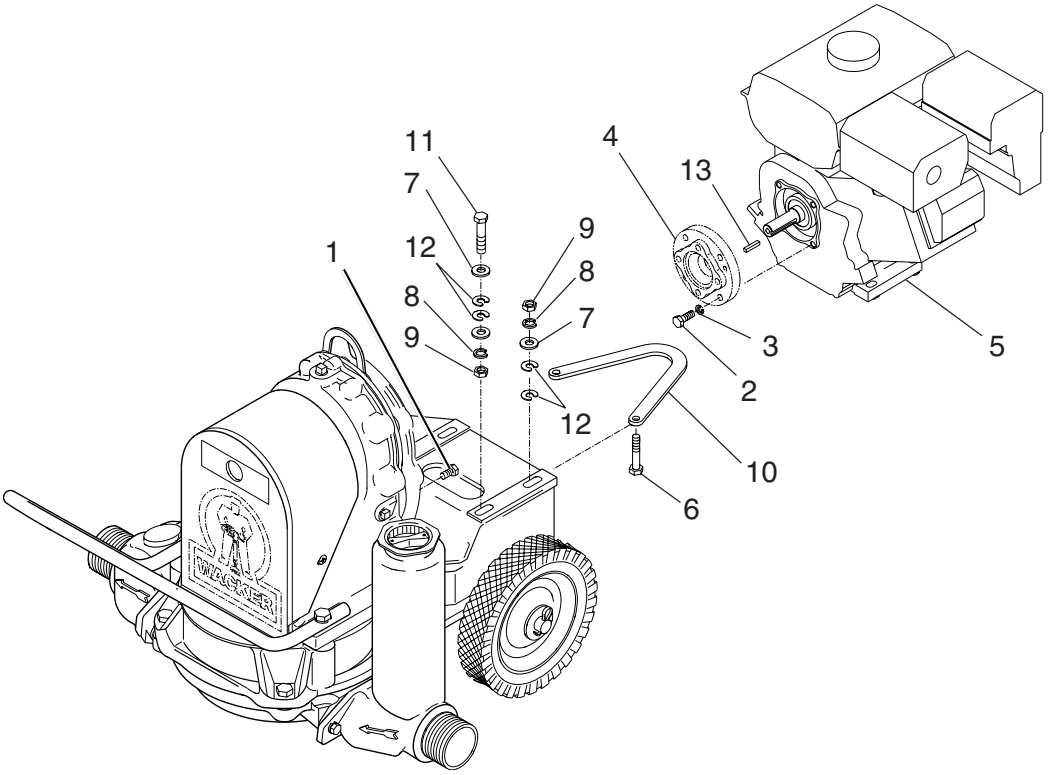
3. Mount engine **(5)** to engine adapter **(4)** using four screws **(2)** and lock washers **(3)**.

4. Mount front part of engine to pump housing using two screws **(11)**, four washers **(7)**, two lock washers **(8)**, and nuts **(9)**.

Note: *Place two shims **(12)** as shown between engine and pump housing prior to tightening mounting hardware. Also note configuration of hardware.*

5. Mount rear part of engine and bumper bracket **(10)** to pump housing using two screws **(6)**, washers **(7)**, lock washers **(8)**, and nuts **(9)**.

6. After installation, make sure drain plug **(1)** is installed and fill gearbox with oil. See Section 1.14 *Technical Data (PD2/PD3)* for lubrication specifications.



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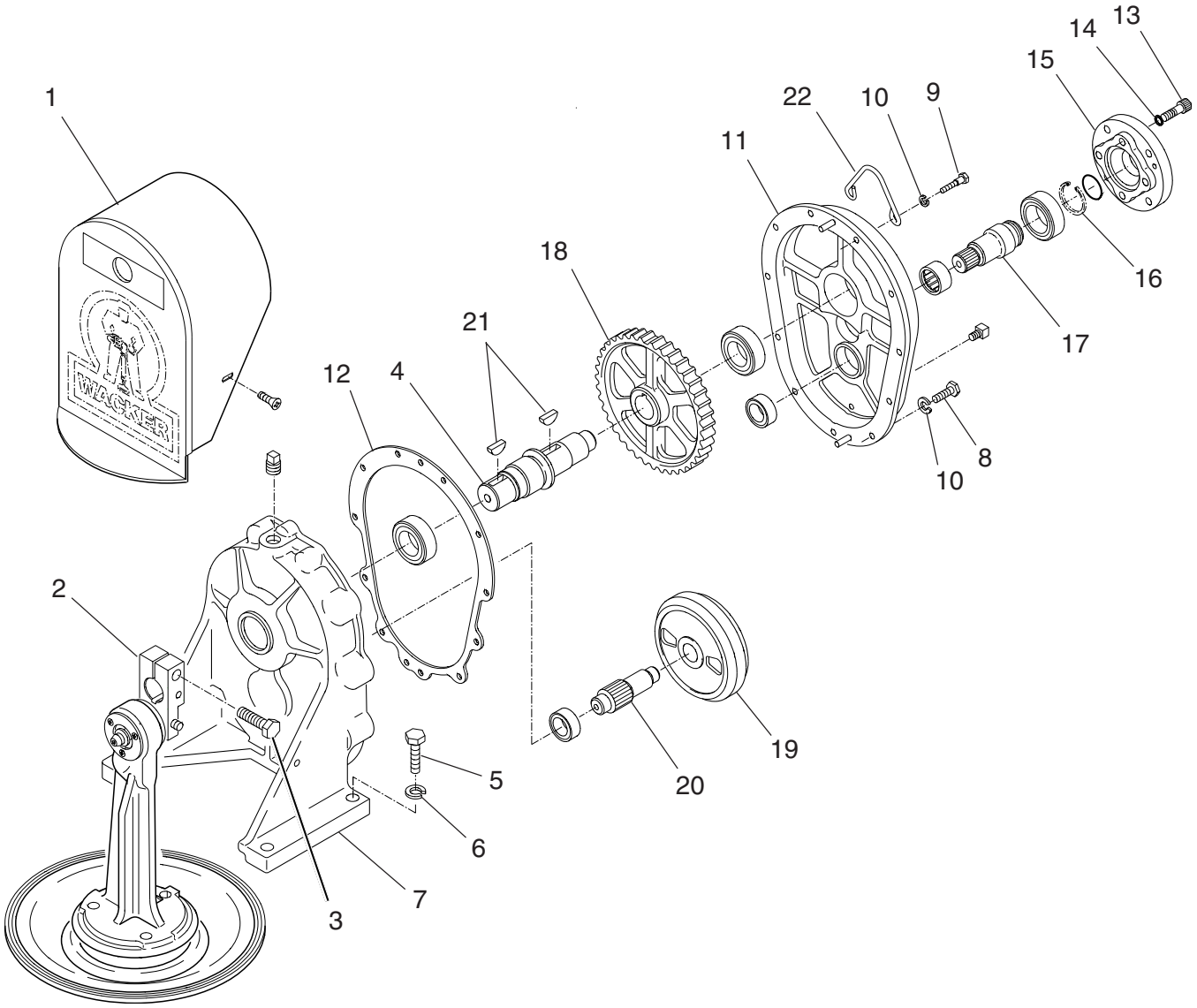
5.20 Gearcase



1033SD91

5.20 Gearcase (cont.)

Recommended tools:
Socket wrench - 7/16"
Pry bar
Allen wrench - 1/4"

Removal:

1. Remove engine from pump housing. See Section 5.19 *Engine.*

2. Remove connecting rod cover **(1)**.

3. With stop switch against spark plug, pull starter until crank arm **(2)** is in its uppermost position.

4. Loosen screw **(3)** mounting crank arm **(2)** to gear shaft **(4)**. Pry crank arm off gear shaft.

5. Remove four screws **(5)** and lock washers **(6)** mounting gearbox **(7)** to pump housing.

6. Lift gearbox from pump housing.

7. Remove nine screws **(8)**, two screws **(9)**, and lock washers **(10)** mounting gearbox cover **(11)** to gearbox **(7)**.

CAUTION: When separating the cover from gearbox, be careful not to damage gasket **(12)**.

8. Remove four screws **(13)** and lock washer **(14)** mounting engine adapter **(15)** to gearbox cover **(11)**.

9. Remove retaining ring **(16)** and pull pinion gear **(17)** from gearbox cover.

10. Pull gear **(18)** and shaft **(4)** from gearbox **(7)**.

11. Pull internal gear **(19)** and pinion gear **(20)** from gearbox **(7)**.

Installation:

1. Inspect all gaskets, seals, and bearings between pump components and replace if necessary.

2. Press pinion gear **(20)** and internal gear **(19)** into gearbox **(7)**.

3. Align keys on shaft **(21)** with slots in gearbox and gear **(18)** and press into gearbox.

4. Align pinion gear **(17)** and press into gearbox cover **(11)**. Install retaining ring **(16)**.

5. Mount engine adapter **(15)** to gearbox cover using four screws **(13)** and lock washers **(14)**. Torque screws to 10–11 ft.lbs. (14–15 Nm).

6. Mount gearbox cover **(11)** to gearbox **(7)** using nine screws **(8)** and lock washers **(10)**. Torque screws to 7–8 ft.lbs. (9.5–11 Nm).

7. Mount lifting bracket **(22)** to gearbox cover **(11)** using two screws **(9)** and lock washers **(10)**.

8. Mount gearbox assembly to pump housing using four screws **(5)** and lock washers **(6)**. Torque screws to 55–60 ft.lbs. (75–81 Nm).

9. Mount crank arm **(2)** to gear shaft **(4)**. Secure with screw **(3)** and torque to 55–60 ft. lbs. (75–81 Nm).

10. Install engine to gearbox and pump housing. See Section 5.19 *Engine.*

11. Mount connecting rod cover **(1)**.

5.21 Testing

Suction Test

Required Tools:
Vacuum Gauge - P/N 28755
Tachometer

1. Check that mounting hardware for diaphragm and valves are tight.

2. If valves are dry, run pump for a few minutes while adding water through prime plug in suction chamber. This will wet rubber gaskets in valves and provide a better seal while testing.

3. Replace prime plug and tighten.

4. Bring engine up to operating speed. Check engine RPM.

   3000 ±100 RPM

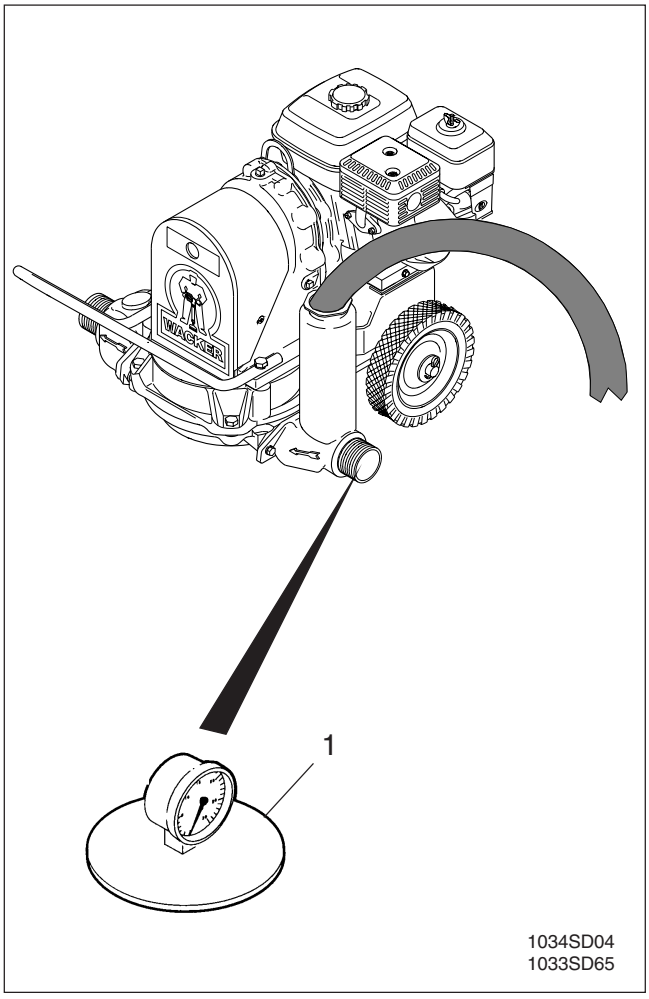
5. Grease mounting face of vacuum gauge **(1)**, to ensure a good seal. Press gauge over inlet port.

Note: *It is not necessary to keep water in the pump case while testing diaphragm pumps. This pump design does not use a mechanical seal, which requires water in the pump case to keep seal surfaces cool.*

6. Gauge reading will fluctuate slightly as connecting rod operates diaphragm.

   A HIGH reading of 16 in.Hg (55 KPa) is good.

The pump may operate satisfactorily even at readings less than this. The valve's rubber gaskets seal better while pump is actually working.



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1033SD65

5.22 Troubleshooting

Problem / Symptom	Reason / Remedy
Engine does not start.	1. Engine problem. See engine manufacturer's service manual for troubleshooting and repair. 2. Engine oil level too low. Add oil to engine. 3. Pump housing filled with dirt and debris. Disassemble and clean inside of pump. 4. Pump gear case damaged. Inspect and repair.
Engine starts but pump does not take in water.	1. Pump is located too high above or too far away from water. Locate pump closer to water. 2. Air leak on suction side of pump. Check that hose fittings and cap on surge chamber are tight and sealing properly. 3. Suction hose damaged or collapsed. Repair or replace hose. 4. Strainer plugged. Clean or replace strainer. 5. Dirt collecting inside pump and hoses, blocking flow. Clean inside of pump and flush hoses. 6. Engine running slow. Check engine speed and adjust. See "Technical Data" for engine speed. 7. Pump valves damaged or not seating properly. Check for stones and gravel embedded in valves. Replace valves. 8. Diaphragm loose or damaged. Inspect diaphragm for damage. Replace and tighten.
Pump output low.	1. Pump located too high above or too far away from water. Locate pump closer to water. 2. Suction strainer or intake line partially plugged. Clean hose line and strainer. 3. Discharge hose is kinked or end is blocked. Check that hose lies straight and flows freely. 4. Discharge hose too narrow. Use hose of equal diameter or larger than suction hose.

Notes:

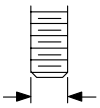
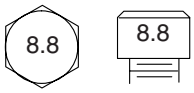
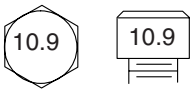
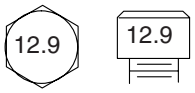
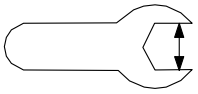
Use Of Threadlockers and Sealants

Threadlocking adhesives and sealants are specified throughout this manual and should be used where indicated. Threadlocking compounds normally break down at temperatures above 350° F (175° C). If a screw or bolt is hard to remove, heat it using a small propane torch to break down sealant. When applying sealants, follow instructions on container. The sealants listed below are recommended for use on WACKER equipment.

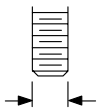
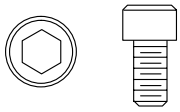
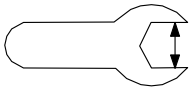
TYPE ( ) = Europe	COLOR	USAGE	PART NO. - SIZE
Loctite 222 Hernon 420 Omnifit 1150 (50M)	Purple	Low strength, for locking threads smaller than 1/4" (6 mm). Hand tool removable. Temp. range, -65 to 300 degrees F (-54 to 149 degrees C)	73287 - 10 ml
Loctite 243 Hernon 423 Omnifit 1350 (100M)	Blue	Medium strength, for locking threads larger than 1/4" (6 mm). Hand tool removable. Temp. range, -65 to 300 degrees F (-54 to 149 degrees C)	29311 - .5 ml 17380 - 50 ml
Loctite 271 / 277 Hernon 427 Omnifit 1550 (220M)	Red	High strength, for all threads up to 1" (25 mm). Heat parts before disassembly. Temp. range, -65 to 300 degrees F (-54 to 149 degrees C)	29312 - .5 ml 26685 - 10 ml 73285 - 50 ml
Loctite 290 Hernon 431 Omnifit 1710 (230LL)	Green	Medium to high strength, for locking preassembled threads and for sealing weld porosity (wicking). Gaps up to 0.005" (0.13 mm) Temp. range, -65 to 300 degrees F (-54 to 149 degrees C)	28824 - .5 ml 25316 - 10 ml
Loctite 609 Hernon 822 Omnifit 1730 (230L)	Green	Medium strength retaining compound for slip or press fit of shafts, bearings, gears, pulleys, etc. Gaps up to 0.005" (0.13 mm) Temp. range, -65 to 300 degrees F (-54 to 149 degrees C)	29314 - .5 ml
Loctite 545 Hernon 947 Omnifit 1150 (50M)	Brown	Hydraulic sealant Temp. range, -65 to 300 degrees F (-54 to 149 degrees C)	79356 - 50 ml
Loctite 592 Hernon 920 Omnifit 790	White	Pipe sealant with Teflon for moderate pressures. Temp. range, -65 to 300 degrees F (-54 to 149 degrees C)	26695 - 6 ml 73289 - 50 ml
Loctite 515 Hernon 910 Omnifit 10	Purple	Form-in-place gasket for flexible joints. Fills gaps up to 0.05" (1.3 mm) Temp. range, -65 to 300 degrees F (-54 to 149 degrees C)	70735 - 50 ml
Loctite 496 Hernon 110 Omnifit Sicomet 7000	Clear	Instant adhesive for bonding rubber, metal and plastics; general purpose. For gaps up to 0.006" (0.15 mm) Read caution instructions before using. Temp. range, -65 to 180 degrees F (-54 to 82 degrees C)	52676 - 1 oz.
Loctite Primer T Hernon Primer 10 Omnifit VC Activator	Aerosol Spray	Fast curing primer for threadlocking, retaining and sealing compounds. Must be used with stainless steel hardware. Recommended for use with gasket sealants.	2006124 - 6 oz.

TORQUE VALUES

Metric Fasteners (DIN)

	TORQUE VALUES (Based on Bolt Size and Hardness)						**WRENCH SIZE**			
										
Size	Ft.Lb.	Nm	Ft.Lb.	Nm	Ft.Lbs.	Nm	Inch	Metric	Inch	Metric
M3	*11	1.2	*14	1.6	*19	2.1	7/32	5.5	-	2.5
M4	*26	2.9	*36	4.1	*43	4.9	9/32	7	-	3
M5	*53	6.0	6	8.5	7	10	5/16	8	-	4
M6	7	10	10	14	13	17	-	10	-	5
M8	18	25	26	35	30	41	1/2	13	-	6
M10	36	49	51	69	61	83	11/16	17	-	8
M12	63	86	88	120	107	145	3/4	19	-	10
M14	99	135	140	190	169	230	7/8	22	-	12
M16	155	210	217	295	262	355	15/16	24	-	14
M18	214	290	298	405	357	485	1-1/16	27	-	14
M20	302	410	427	580	508	690	1-1/4	30	-	17

Inch Fasteners (SAE)

	 SAE 5		 SAE 8							
Size	Ft.Lb.	Nm	Ft.Lb.	Nm	Ft.Lbs.	Nm	Inch	Metric	Inch	Metric
No.4	*6	0.7	*14	1.0	*12	1.4	1/4	5.5	3/32	-
No.6	*12	1.4	*17	1.9	*21	2.4	5/16	8	7/64	-
No.8	*22	2.5	*31	3.5	*42	4.7	11/32	9	9/64	-
No.10	*32	3.6	*45	5.1	*60	6.8	3/8	-	5/32	-
1/4	6	8.1	9	12	12	16	7/16	-	3/32	-
5/16	13	18	19	26	24	33	1/2	13	1/4	-
3/8	23	31	33	45	43	58	9/16	-	5/16	-
7/16	37	50	52	71	69	94	5/8	16	3/8	-
1/2	57	77	80	109	105	142	3/4	19	3/8	-
9/16	82	111	115	156	158	214	13/16	-	-	-
5/8	112	152	159	216	195	265	15/16	24	1/2	-
3/4	200	271	282	383	353	479	1-1/8	-	5/8	-

1 Ft.Lb. = 1.357 Nm

* = In.Lb.

1 Inch = 25.4 mm

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