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Kazakstan
Operations & Maintenance
Manual
Welding Equipment

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TRAINING DEPT.

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SECTION 1 – SAFETY PRECAUTIONS FOR ARC WELDING

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1-1. Symbol Usage

	Means Warning! Watch Out! There are possible hazards with this procedure! The possible hazards are shown in the adjoining symbols.		Marks a special safety message.
			
This group of symbols means Warning! Watch Out! possible ELECTRIC SHOCK, MOVING PARTS, and HOT PARTS hazards. Consult symbols and related instructions below for necessary actions to avoid the hazards.			

1-2. Arc Welding Hazards

WARNING

The symbols shown below are used throughout this manual to call attention to and identify possible hazards. When you see the symbol, watch out, and follow the related instructions to avoid the hazard. The safety information given below is only a summary of the more complete safety information found in the Safety Standards listed in Section 1-5. Read and follow all Safety Standards.

Only qualified persons should install, operate, maintain, and repair this unit.

During operation, keep everybody, especially children, away.

	ELECTRIC SHOCK can kill. Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.	terminal in disconnect box or that cord plug is connected to a properly grounded receptacle outlet.
	<ol style="list-style-type: none">1. Do not touch live electrical parts.2. Wear dry, hole-free insulating gloves and body protection.3. Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground.4. Disconnect input power or stop engine before installing or servicing this equipment. Lockout/tagout input power according to OSHA 29 CFR 1910.147 (see Safety Standards).5. Properly install and ground this equipment according to its Owner's Manual and national, state, and local codes.6. Always verify the supply ground – check and be sure that input power cord ground wire is properly connected to ground	<ol style="list-style-type: none">7. When making input connections, attach proper grounding conductor first – double-check connections.8. Frequently inspect input power cord for damage or bare wiring – replace cord immediately if damaged – bare wiring can kill.9. Turn off all equipment when not in use.10. Do not use worn, damaged, undersized, or poorly spliced cables.
		<ol style="list-style-type: none">11. Do not drape cables over your body.12. If earth grounding of the workpiece is required, ground it directly with a separate cable – do not use work clamp or work cable.13. Do not touch electrode if you are in contact with the work, ground, or another electrode from a different machine.14. Use only well-maintained equipment. Repair or replace damaged parts at once. Maintain unit according to manual.15. Wear a safety harness if working above floor level.16. Keep all panels and covers securely in place.17. Clamp work cable with good metal-to-metal contact to workpiece or worktable as near the weld as practical.

	ARC RAYS can burn eyes and skin; NOISE can damage hearing; FLYING SLAG OR SPARKS can injure eyes. Arc rays from the welding process produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin. Noise from some processes can damage hearing. Chipping, grinding, and welds cooling throw off pieces of metal or slag.	ARC RAYS
NOISE	<ol style="list-style-type: none">1. Use approved ear plugs or ear muffs if noise level is high.	<ol style="list-style-type: none">2. Wear a welding helmet fitted with a proper shade of filter to protect your face and eyes when welding or watching (see ANSI Z49.1 and Z87.1 listed in Safety Standards).3. Wear approved safety glasses with side shields.4. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.5. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.

	FUMES AND GASES can be hazardous to your health. Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.	<ol style="list-style-type: none">5. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Always have a trained watchperson nearby. Welding fumes and gases can displace air and lower the oxygen level causing injury or death. Be sure the breathing air is safe.6. Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.7. Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.
<ol style="list-style-type: none">1. Keep your head out of the fumes. Do not breathe the fumes.2. If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.3. If ventilation is poor, use an approved air-supplied respirator.4. Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for metals, consumables, coatings, cleaners, and degreasers.		

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**CYLINDERS can explode if damaged.**

Shielding gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.

1. Protect compressed gas cylinders from excessive heat, mechanical shocks, slag, open flames, sparks, and arcs.
2. Install cylinders in an upright position by securing to a stationary support or cylinder rack to prevent falling or tipping.
3. Keep cylinders away from any welding or other electrical circuits.

4. Never drape a welding torch over a gas cylinder.
5. Never allow a welding electrode to touch any cylinder.
6. Never weld on a pressurized cylinder -- explosion will result.
7. Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
8. Turn face away from valve outlet when opening cylinder valve.
9. Keep protective cap in place over valve except when cylinder is in use or connected for use.
10. Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards.

**WELDING can cause fire or explosion.**

Welding on closed containers, such as tanks, drums, or pipes, can cause them to blow up. Sparks can fly off from the welding arc. The flying sparks, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode to metal objects can cause sparks, explosion, overheating, or fire. Check and be sure the area is safe before doing any welding.

1. Protect yourself and others from flying sparks and hot metal.
2. Do not weld where flying sparks can strike flammable material.
3. Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
4. Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
5. Watch for fire, and keep a fire extinguisher nearby.

6. Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
7. Do not weld on closed containers such as tanks, drums, or pipes, unless they are properly prepared according to AWS F4.1 (see Safety Standards).
8. Connect work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock and fire hazards.
9. Do not use welder to thaw frozen pipes.
10. Remove stick electrode from holder or cut off welding wire at contact tip when not in use.
11. Wear oil-free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.
12. Remove any combustibles, such as a butane lighter or matches, from your person before doing any welding.

1-3. Engine Hazards**⚠ WARNING****ENGINE EXHAUST GASES can kill.**

Engines produce harmful exhaust gases.

1. Use equipment outside in open, well-ventilated areas.
2. If used in a closed area, vent engine exhaust outside and away from any building air intakes.

**ENGINE FUEL can cause fire or explosion.**

Engine fuel is highly flammable.

1. Stop engine and let it cool off before checking or adding fuel.

2. Do not add fuel while smoking or if unit is near any sparks or open flames.
3. Do not overfill tank -- allow room for fuel to expand.
4. Do not spill fuel. If fuel is spilled, clean up before starting engine.

**MOVING PARTS can cause injury.**

Moving parts, such as fans, rotors, and belts can cut fingers and hands and catch loose clothing.

1. Keep all doors, panels, covers, and guards closed and securely in place.
2. Stop engine before installing or connecting unit.

3. Have only qualified people remove guards or covers for maintenance and troubleshooting as necessary.
4. To prevent accidental starting during servicing, disconnect negative (-) battery cable from battery.
5. Keep hands, hair, loose clothing, and tools away from moving parts.
6. Reinstall panels or guards and close doors when servicing is finished and before starting engine.

**SPARKS can cause BATTERY GASES TO EXPLODE; BATTERY ACID can burn eyes and skin.**

Batteries contain acid and generate explosive gases.

1. Always wear a face shield when working on a battery.
2. Stop engine before disconnecting or connecting battery cables.
3. Do not allow tools to cause sparks when working on a battery.
4. Do not use welder to charge batteries or jump start vehicles.
5. Observe correct polarity (+ and -) on batteries.

**STEAM AND PRESSURIZED HOT COOLANT can burn face, eyes, and skin.**

It is best to check coolant level when engine is cold to avoid scalding.

1. If the engine is warm and checking is needed, follow steps 2 and 3.
2. Wear safety glasses and gloves and put a rag over cap.
3. Turn cap slightly and let pressure escape slowly before completely removing cap.

1-4. Additional Installation, Operation, And Maintenance Hazards

 WARNING			
	<p>MOVING PARTS can cause injury.</p> <ol style="list-style-type: none"> 1. Before working of generator, remove spark plugs or injectors to keep engine from kicking back or starting. 2. Block flywheel so that it will not turn while working on generator components. 		<p>READ INSTRUCTIONS.</p> <ol style="list-style-type: none"> 1. Use only genuine MILLER replacement parts. 2. Reinstall injectors and bleed air from fuel system according to engine manual.
	<p>FLYING PIECES OF METAL or DIRT can injure eyes.</p> <ol style="list-style-type: none"> 1. Wear safety glasses with side shields or face shield. 		<p>DO NOT LET ENGINE EXHAUST SPARKS CAUSE FIRE.</p> <ol style="list-style-type: none"> 1. Use approved engine exhaust spark arrestor in required areas – see applicable codes.
	<p>STATIC ELECTRICITY can damage parts on circuit boards.</p> <ol style="list-style-type: none"> 1. Put on grounded wrist strap BEFORE handling boards or parts. 2. Use proper static-proof bags and boxes to store, move, or ship PC boards. 		<p>LOW VOLTAGE AND FREQUENCY CAN DAMAGE electrical equipment such as MOTORS.</p> <ol style="list-style-type: none"> 1. Turn off or unplug equipment before starting or stopping engine.
	<p>MAGNETIC FIELDS FROM HIGH CURRENTS can affect pacemaker operation.</p> <ol style="list-style-type: none"> 1. Pacemaker wearers keep away. 2. Wearers should consult their doctor before going near arc welding, gouging, or spot welding operations. 		<p>OVERUSE can cause OVERHEATED EQUIPMENT.</p> <ol style="list-style-type: none"> 1. Allow cooling period. 2. Reduce current or reduce duty cycle before starting to weld again. 3. Follow rated duty cycle.
	<p>HOT PARTS can cause severe burns.</p> <ol style="list-style-type: none"> 1. Allow cooling period before maintaining. 2. Wear protective gloves and clothing when working on a hot engine. 		<p>TILTING OF TRAILER can cause injury.</p> <ol style="list-style-type: none"> 1. Use tongue jack or blocks to support weight. 2. Properly install welding generator onto trailer according to instructions supplied with trailer.
	<p>FALLING EQUIPMENT can cause serious personal injury and equipment damage.</p> <ol style="list-style-type: none"> 1. Use lifting eye to lift unit only, NOT running gear, gas cylinders, or any other accessories. 2. Use equipment of adequate capacity to lift unit. 		<p>BATTERY ACID can BURN SKIN AND EYES.</p> <ol style="list-style-type: none"> 1. Do not tip. 2. Replace damaged battery. 3. Flush eyes and skin immediately with water.

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ELECTRICAL FUNDAMENTALS

BASIC TERMS:

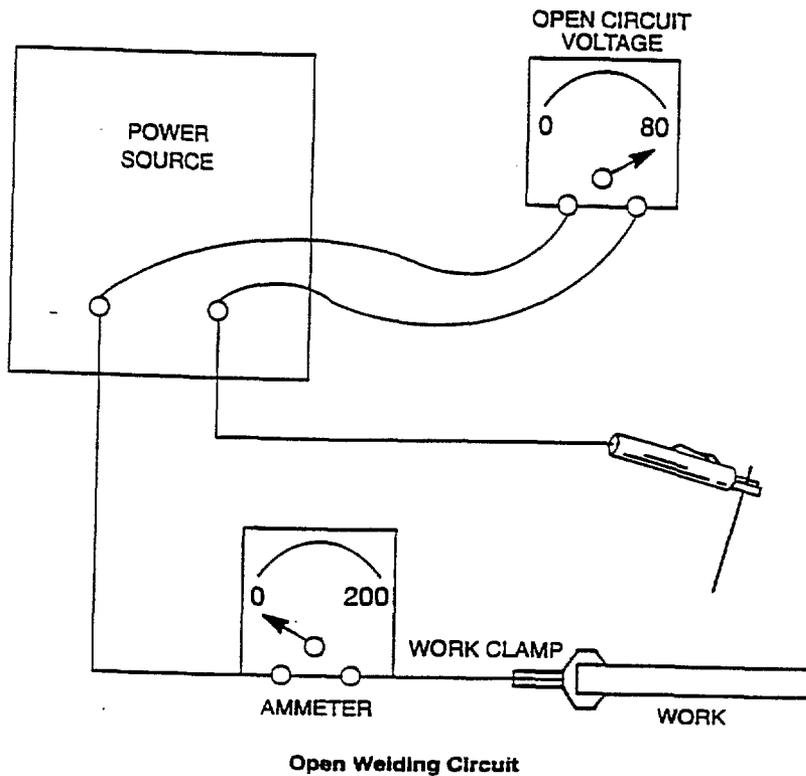
1. **VOLTS** -Electrical pressure that causes current to flow in an electrical conductor.

- Voltage - Electrical pressure
- CV = Constant Voltage
- Voltage does not flow
- Voltage is the force that causes current flow

1. OCV - Open Circuit Voltage - Machine turned on, but no load. (No welding being done).
2. Arc Voltage - Actual voltage force or electrical pressure, measured across the welding arc between the electrode tip and the base metal surface.
3. Load Voltage - The total voltage load, including arc voltage and the voltage drop through the welding cables, that the power source senses.

HOW TO MEASURE VOLTAGE

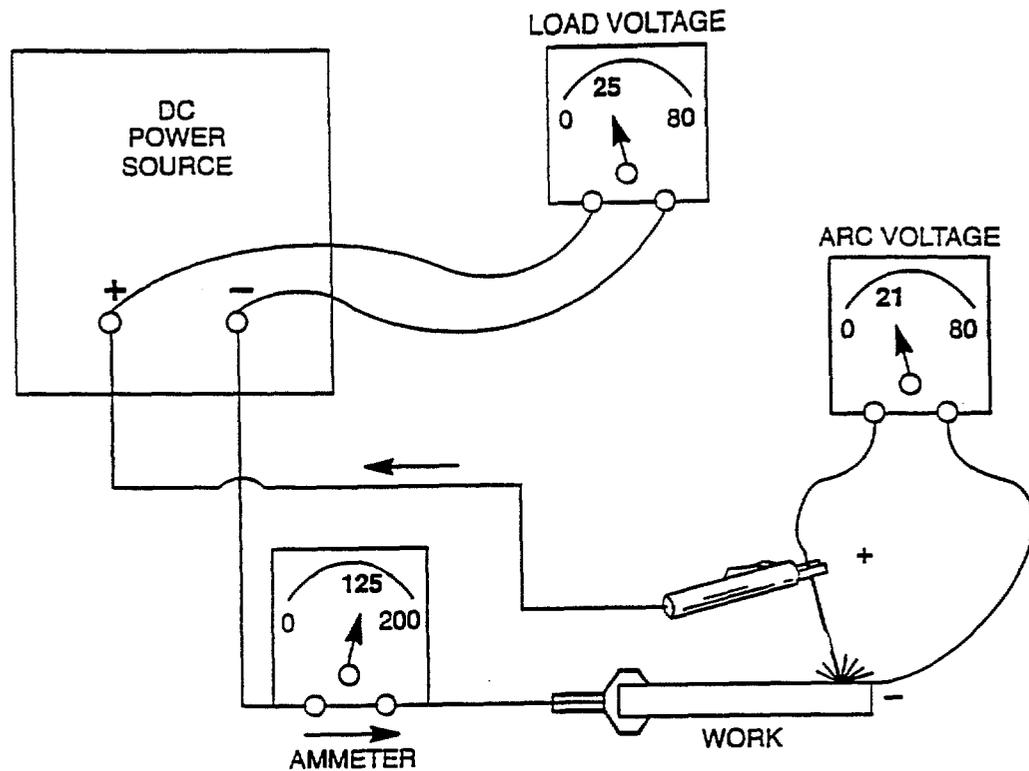
1. Open Circuit Voltage (OCV) - Measured across output lugs with the machine turned on, but under no load. Measured with a volt meter.
 - a. Meter on the machine.
 - b. VOM - Volt/Ohm Meter



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2. Load Volts – Measured at the output terminals on the machine while under load. Measured with a voltmeter.
 - a. Meter on the machine.
 - b. VOM

3. Arc Volts – Measured as close to the arc as possible while welding.
 - a. Meter on the machine.
 - b. In line voltmeter.



Direct Current Electrode Positive (DCEP)

A basic fact for electric arc welding processes is this: As arc length increases, voltage goes up; and as arc length decreases, voltage goes down. When a welder is using a constant current machine, he is controlling load voltage by controlling the arc length.

Figure 1 shows that changing the voltage will change the size of a weld

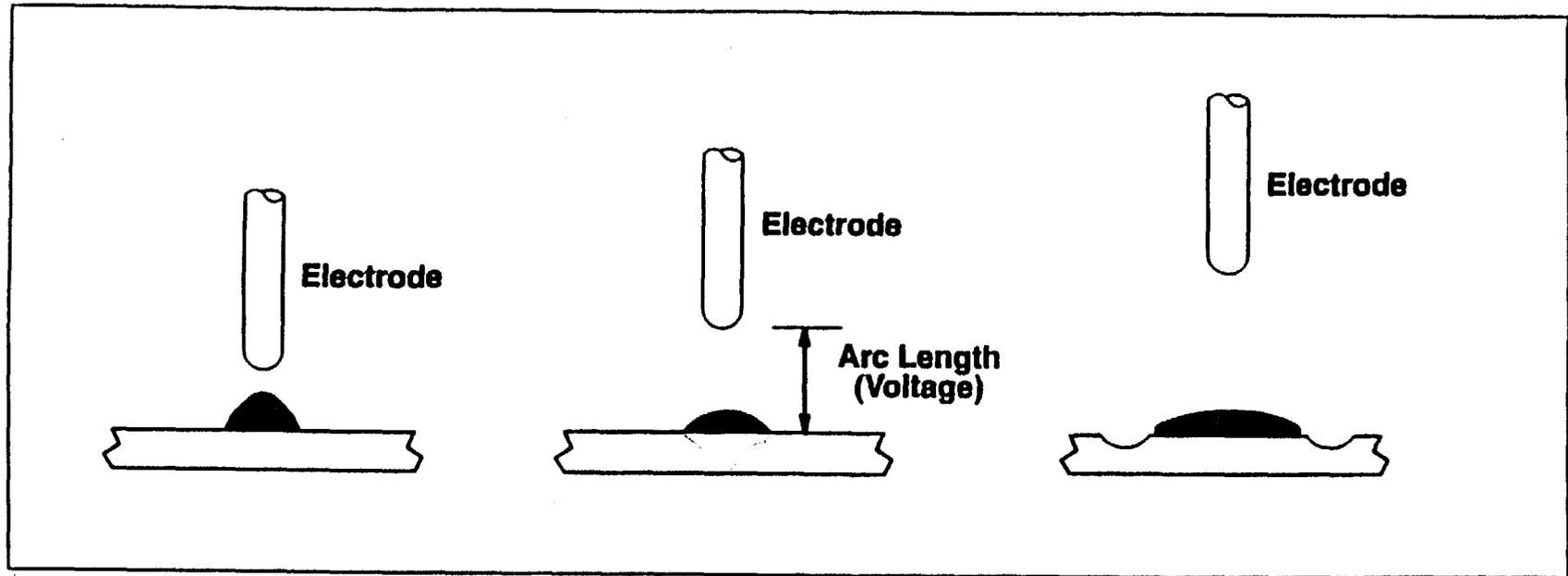


Figure 1. Voltage – Bead Changes

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II. **AMPS** – Another name for electrical current. It is the unit of electrical rate measurement or electron movement.

Amperage controls the depth of penetration into the base metal.

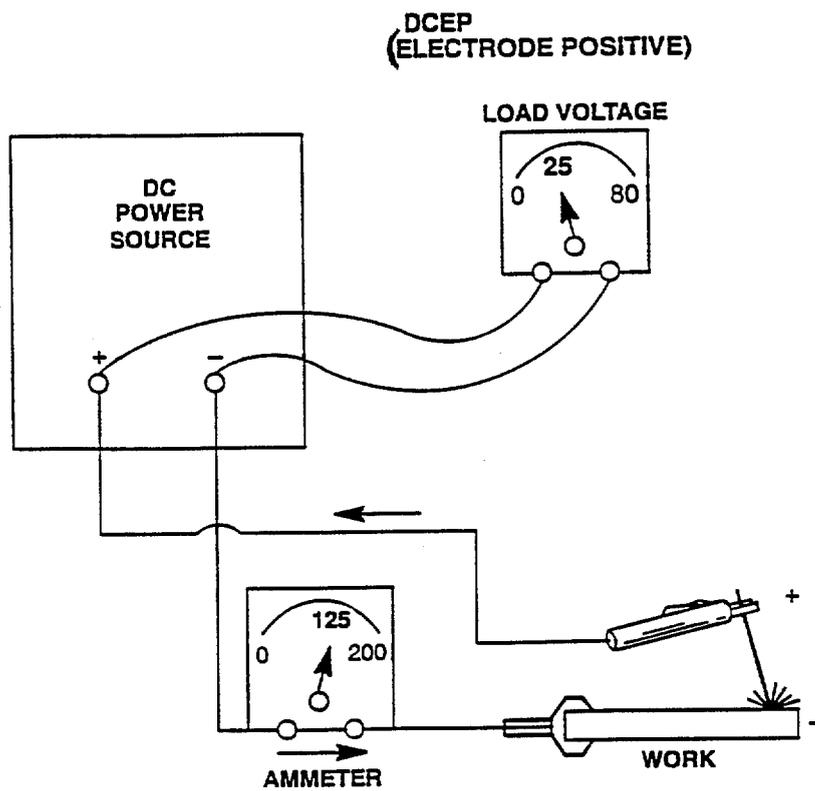
Amps and current are synonymous and means – flow of electrons

Direct Current

Electric Current that flows in one direction.

DC current can be either electrode negative or electrode positive.

Electrode positive produces deeper penetration.



Direct Current Electrode Positive

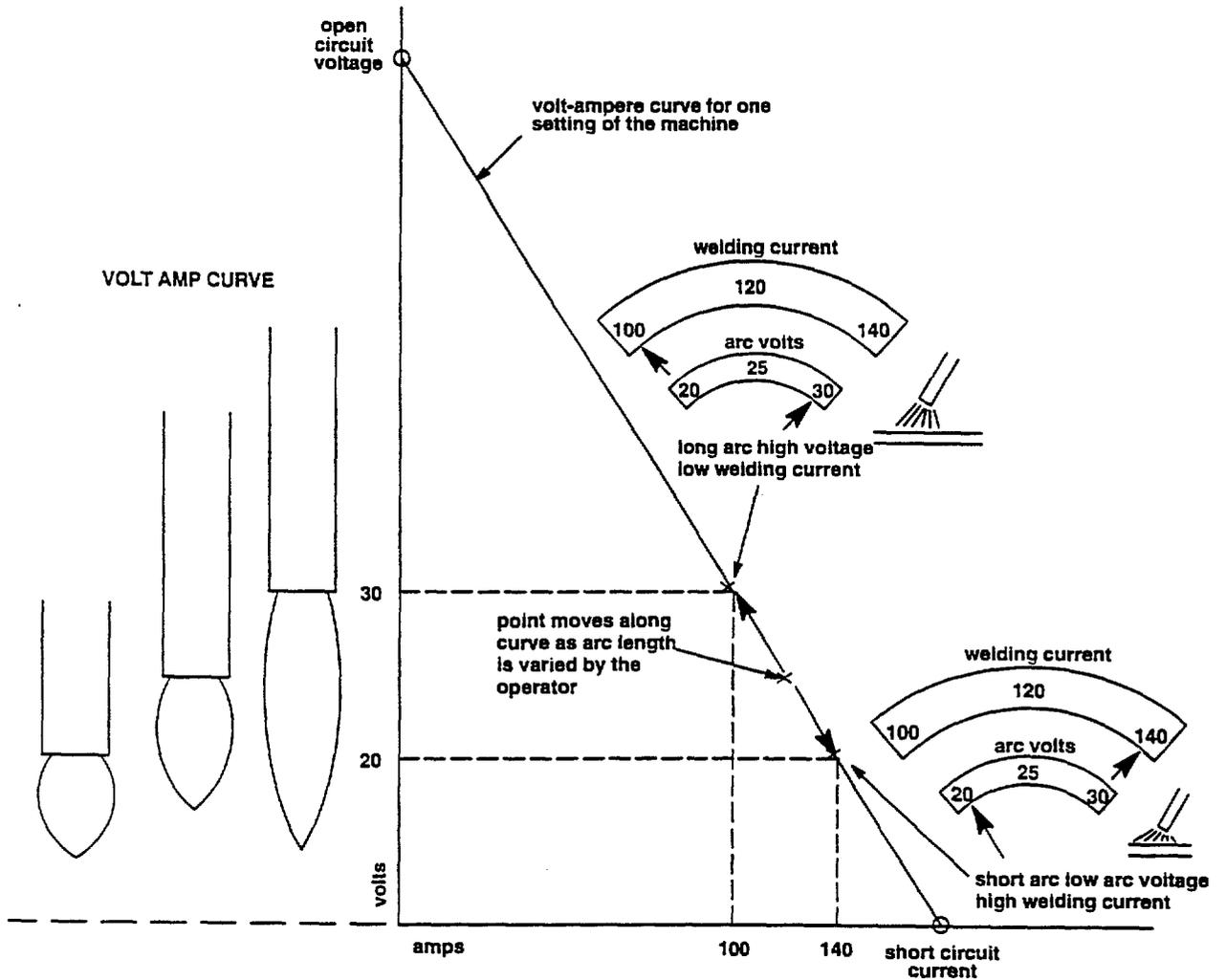
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Arc voltage has a direct relationship to arc length.

Long Arc – High Voltage

Short Arc – Low Voltage

Arc voltage controls the height and width of the weld deposit bead shape. It “wets out” the weld bead.



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Primary Voltage – Voltage that is supplied by the power company or auxiliary power unit.

This voltage has a constant voltage or potential at every receptacle.

Primary voltage could be 120 volts, 230 volts, 460 volts, or 575 volts etc. If primary voltage is high or low, the open circuit voltage (OCV) will be affected accordingly. **“Input affects output!”**

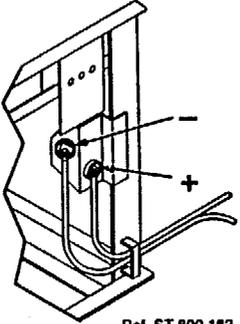
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III. RESISTANCE

Resistance is the opposition to current flow. any electrical conductor. circuit, the results can be weld defects such as lack of penetration, lack of fusion and cold lapping.

Resistance causes heat buildup in If resistance losses are excessive in a welding

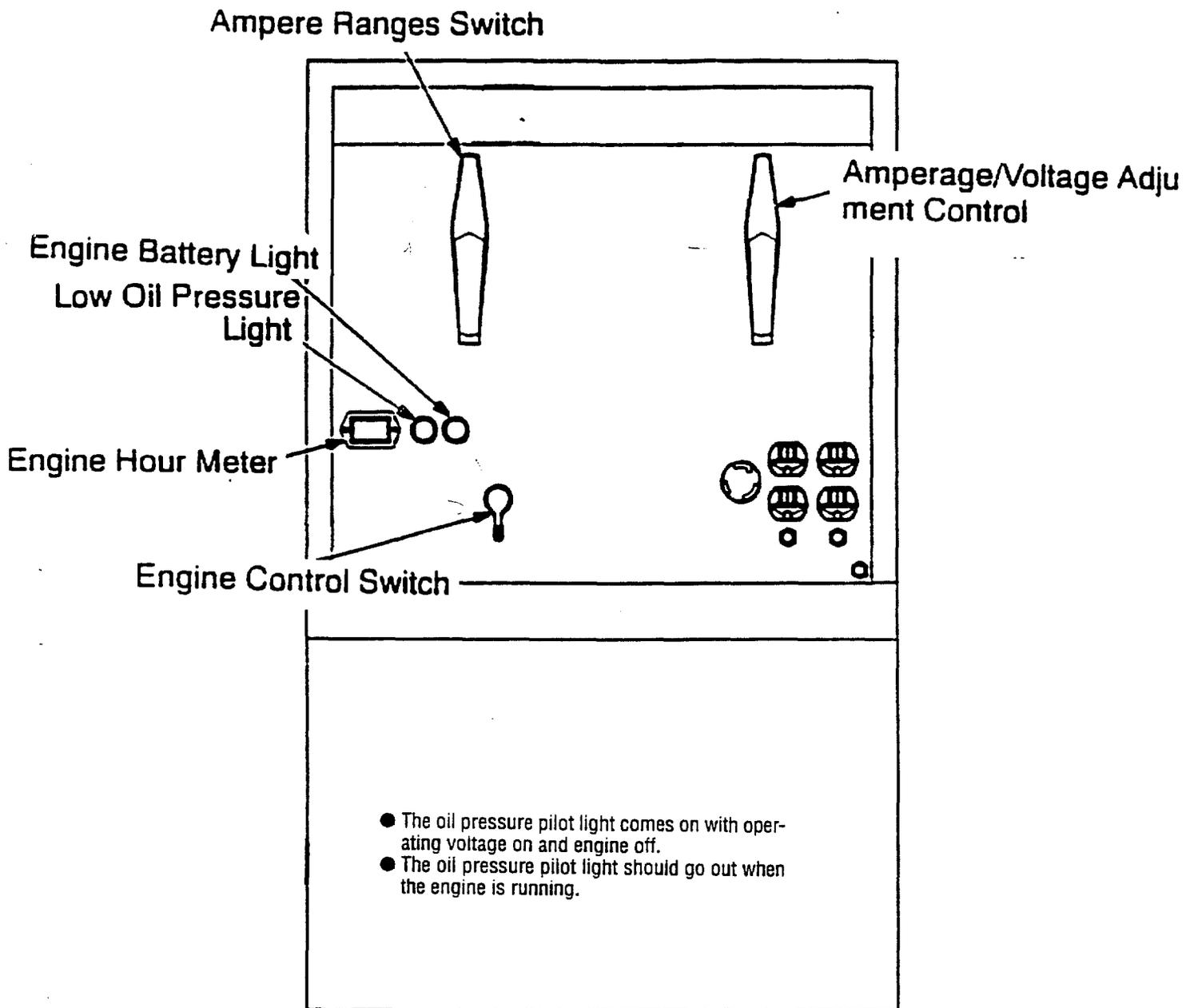
Weld Output Terminals And Selecting Cable Sizes

 Weld Output Terminals	Welding Amperes	..Total Cable (Copper) Length In Weld Circuit Not Exceeding						
		100 ft (30 m) Or Less	150 ft (45 m)	200 ft (60 m)	250 ft (70 m)	300 ft (90 m)	350 ft (105 m)	400 ft (120 m)
		10 - 100% Duty Cycle	10 - 100% Duty Cycle					
 Ref. ST-800 182-A	100	19mm	19mm	32mm	46mm	50mm	50mm	
	150	32mm	32mm	40mm	50mm	62mm	81mm	
	200	32mm	40mm	50mm	62mm	81mm	103mm	
	250	1	50mm	62mm	81mm	103mm	103mm	
	300	1/0	62mm	81mm	103mm	103mm	103mm	
	350	2/0	81mm	103mm	103mm	103mm	103mm	
	400	2/0	81mm	103mm	103mm	103mm	103mm	
	500	3/0	103mm	103mm	103mm	103mm	103mm	

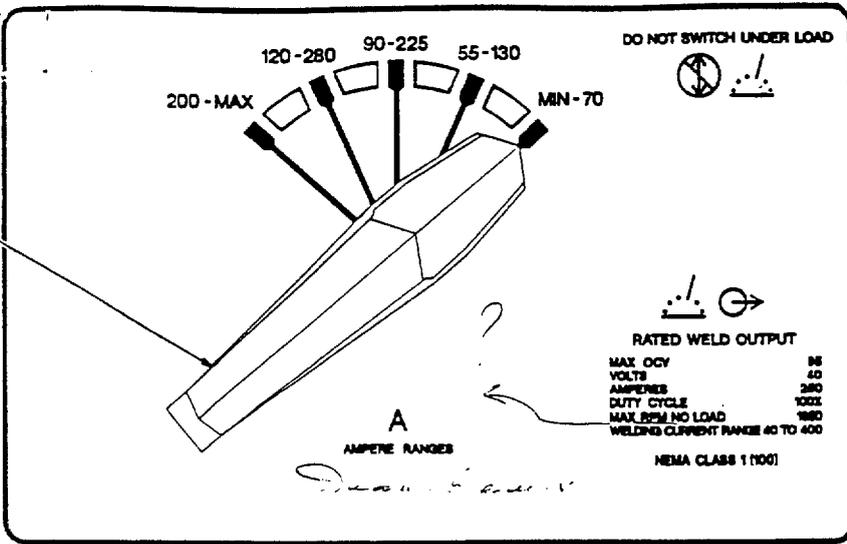
Weld cable size (AWG) is based on either a 4 volts or less drop or a current density of at least 300 circular mils per ampere.

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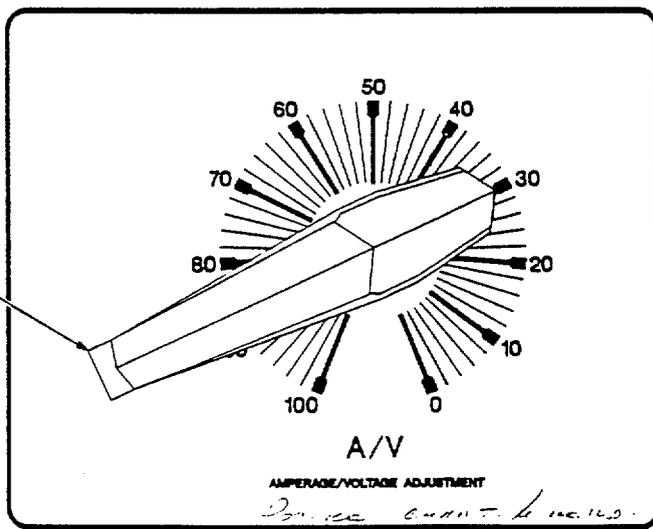


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1 Ampere Ranges Switch
Use switch to select weld amperage range.

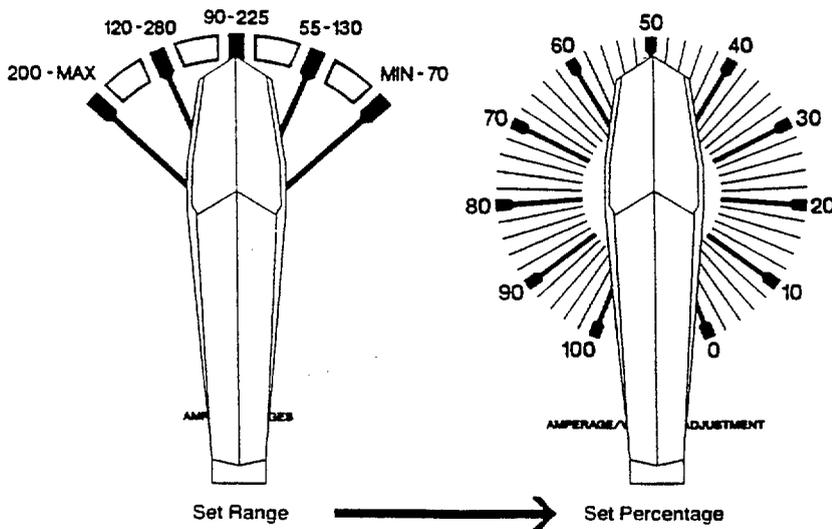
Ampere Ranges Switch



1 Amperage/Voltage Adjustment Control
Use control to adjust amperage within range selected by Ampere Ranges switch. Numbers around control are for reference only.

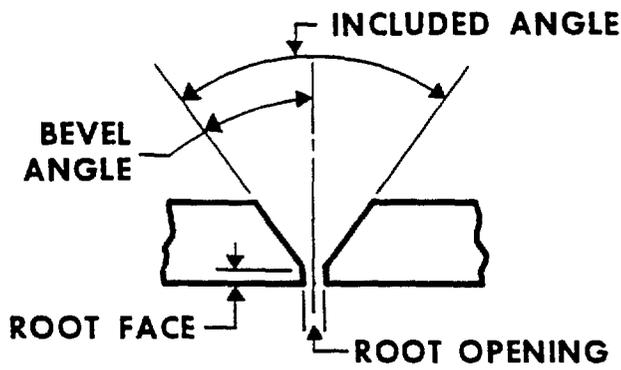
Amperage/Voltage Adjustment Control

In Example:
Min = 90 A DC
Percentage Of Range = 50%
Max = 158 A DC (50% of 90 to 225)

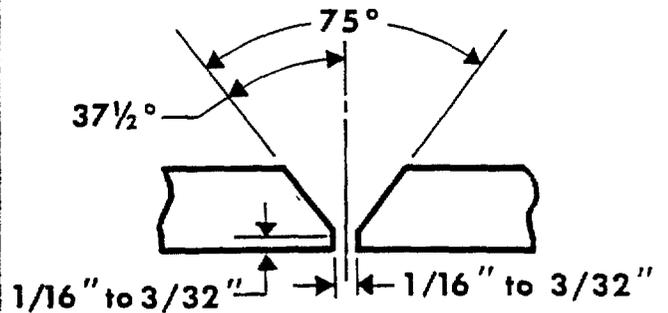


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① GRIND PIPE NIPPLES TO FOLLOWING SPECIFICATIONS:

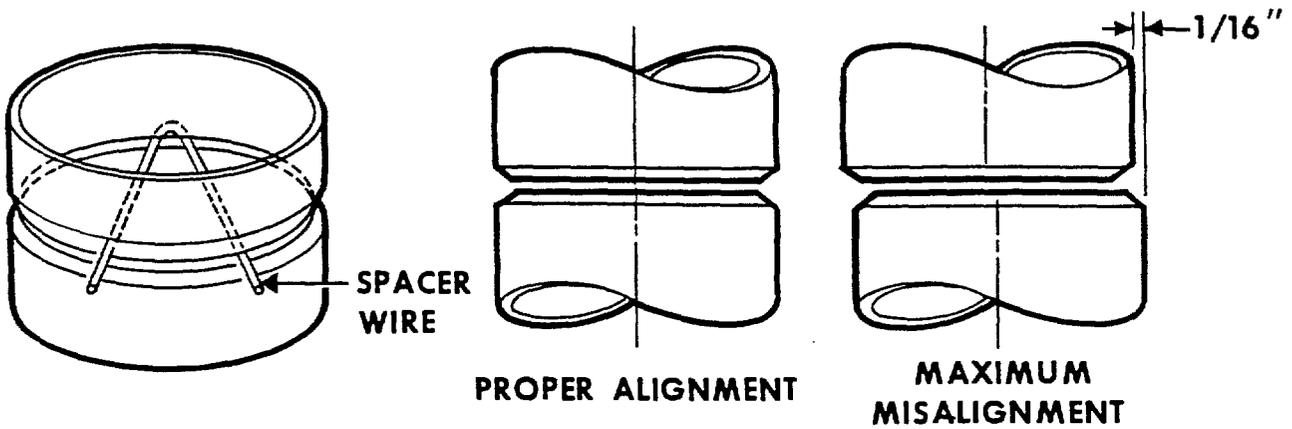


WELD JOINT DEFINITIONS



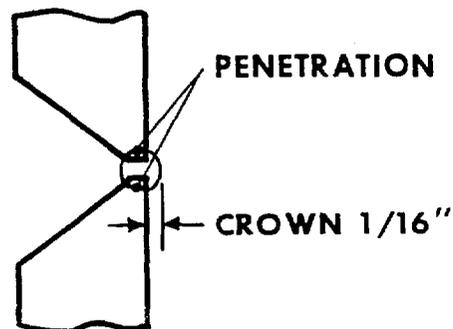
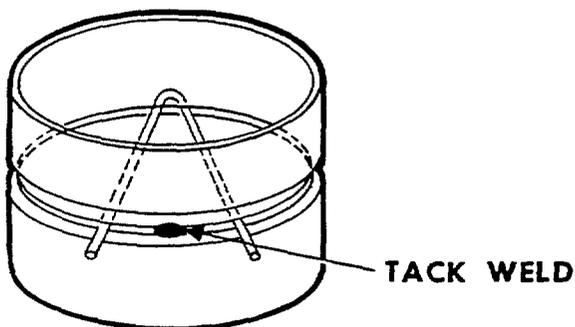
STANDARD JOINT SPECIFICATIONS

- FILE OFF BURRS CAUSED BY GRINDING.
- ASME CODE ALLOWS 1/16" MAXIMUM MISALIGNMENT



② WELD 1/2" TO 3/4" LONG TACK BETWEEN SPACER WIRE ENDS.

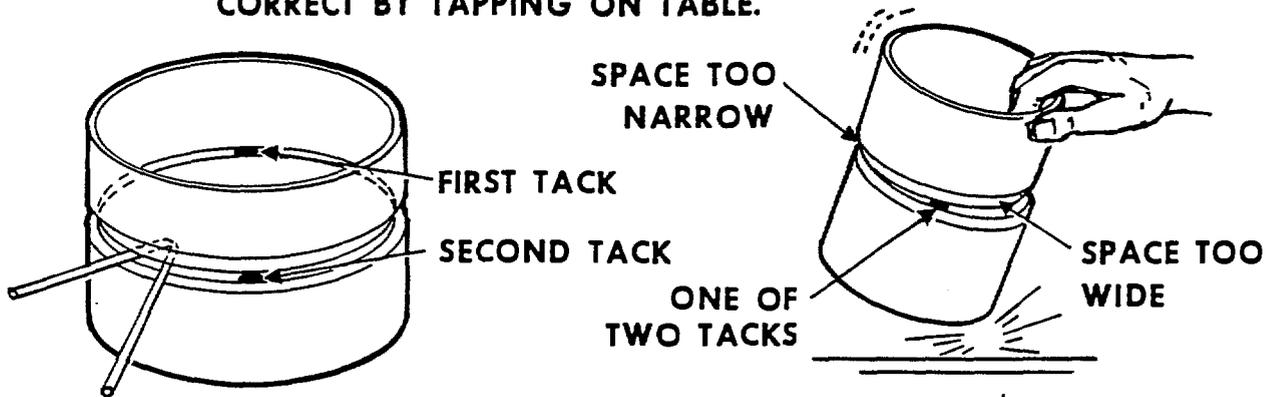
- TACK WELD SHOULD PENETRATE WELL INTO ROOT AND SIDES OF JOINT.
- BACK SIDE OF ROOT BEAD SHOULD HAVE NO MORE THAN 1/16" CROWN.



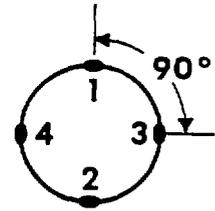
③ REMOVE SPACER WIRE. INSERT WIRE END IN JOINT AS SHOWN BELOW. DEPOSIT SECOND TACK.

④ REMOVE SPACER WIRE.

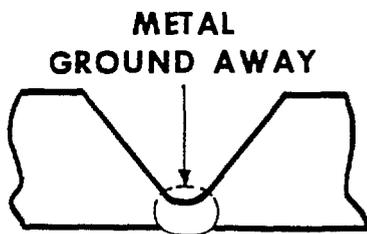
- IF ONE SPACE IS WIDER THAN THE OTHER, DEPOSIT THIRD TACK IN WIDE SPACE. SHRINKING OF TACK WILL EQUALIZE SPACING. IF SPACE IS STILL TOO WIDE TO TACK, CORRECT BY TAPPING ON TABLE.



⑤ DEPOSIT THIRD AND FOURTH TACKS 90° FROM TACKS ONE AND TWO.

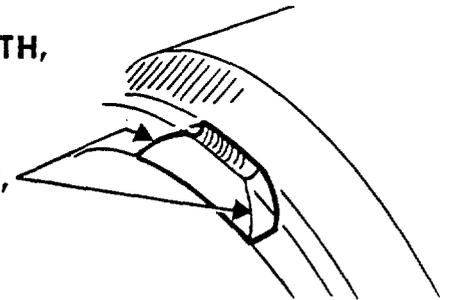


⑥ GRIND TACKS TO MINIMUM ($1/16''$) THICKNESS TO HOLD ALIGNMENT.



- GRIND SIDES TO SMOOTH, ROUND EDGE.

- GRIND ENDS TO SHARP, FEATHERED EDGE.



Start the arc on the tack weld, then move down onto the feathered edge of the tack with a long arc. This preheats the pipe and tack and allows for proper penetration and fusion. Watch for the keyhole to form, use a whipping or circular motion and a short arc length. Keyhole size can be controlled by:

1. Amount of amperage used -- the higher the amperage, the larger the keyhole.
2. Joint design -- A thin root face will tend to cause a larger keyhole, a thicker root face -- a smaller keyhole. A root opening that is too wide causes a large keyhole while a tight root opening makes a smaller keyhole.
3. Travel speed -- The slower the travel speed, the larger the keyhole.
4. Arc length -- A long arc will tend to produce a larger keyhole.
5. Electrode angle -- See Figure 1-70

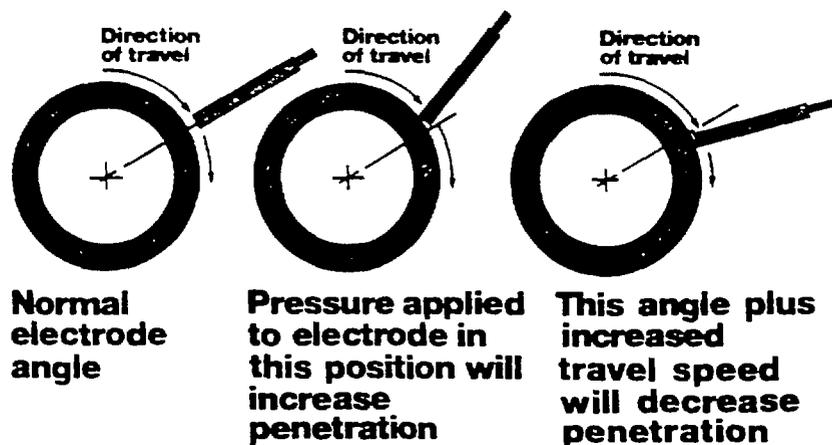


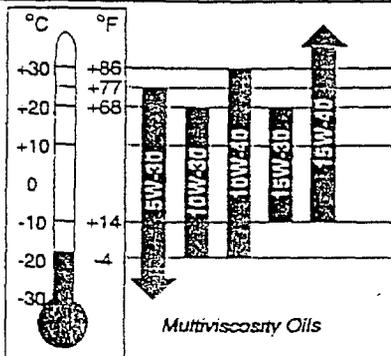
FIG. 1-70

Symbols And Definitions

	Stop		Run Speed		Idle Speed		Start
	Run/Idle Speed		Battery		Oil Pressure		Oil
	Fuel Injectors/ Pump		Adjust Valves		Fuel		Ground
	Positive		Negative		Certified/Trained Mechanic		Welding Arc
	Amperes		Volts		Panel		Remote
	Read Instructions		Engine		Temperature		Output
	Alternating Current		Time				

DEUTZ BLDH17F DIESEL ENGINE

See Engine Manual for complete engine care.
Give Engine Specification and Serial Number when ordering parts.



Recommended Oil ...	API Service Classification	
	CC/SE, CC/SF	CD/SE, CD/SF
Oil Change & Filter ...		
dirty conditions ...	250 hours	375 hours
normal conditions ...	500 hours	750 hours
Oil Filter ...	MILLER 067 265, Deutz 116-4626	
Oil Capacity ...	5.8 qt (5.5 L) or 6.2 qt (5.9 L) with filter change	

Fuel Capacity 11.3 gal (42.8 L)
Fuel Grade 1-D or 2-D Cetane No. 45 min.
Primary Fuel Filter/
Water Separator MILLER 106 467, Nelson 85254A, Fram P3522
Secondary
Fuel Filter MILLER 066 217, Deutz 117-4696
Fill filter with clean fuel before installing - read instructions on filter.

Air Filter Service 50 hours or less - see Owner's Manual
Air Filter Element AC A297C, Donaldson P10-1275,
Fram CAK 256, Nelson 70206, MILLER 126 BE

Blower Belt MILLER 067 266, Deutz 117-9565
Avoid recirculation of air from hot air exit to blower intake.

Battery BCI Group 45
Cranking Performance at 0°F (-18°C) 520 Amps

Engine RPM - No Load
Weld 1850
Valve Clearance - Cold
Intake ... 0.012 in (0.3 mm)
Exhaust . 0.020 in (0.5 mm)

Injectors MILLER 067 267, Deutz 417-8015
Nozzle MILLER 067 268, Deutz 417-8021
Have only trained technician maintain injection pump and injectors. If WATER, or GASOLINE will harm the injection system. If tank is run out of fuel or fuel filter is changed, bleeding of air is required.

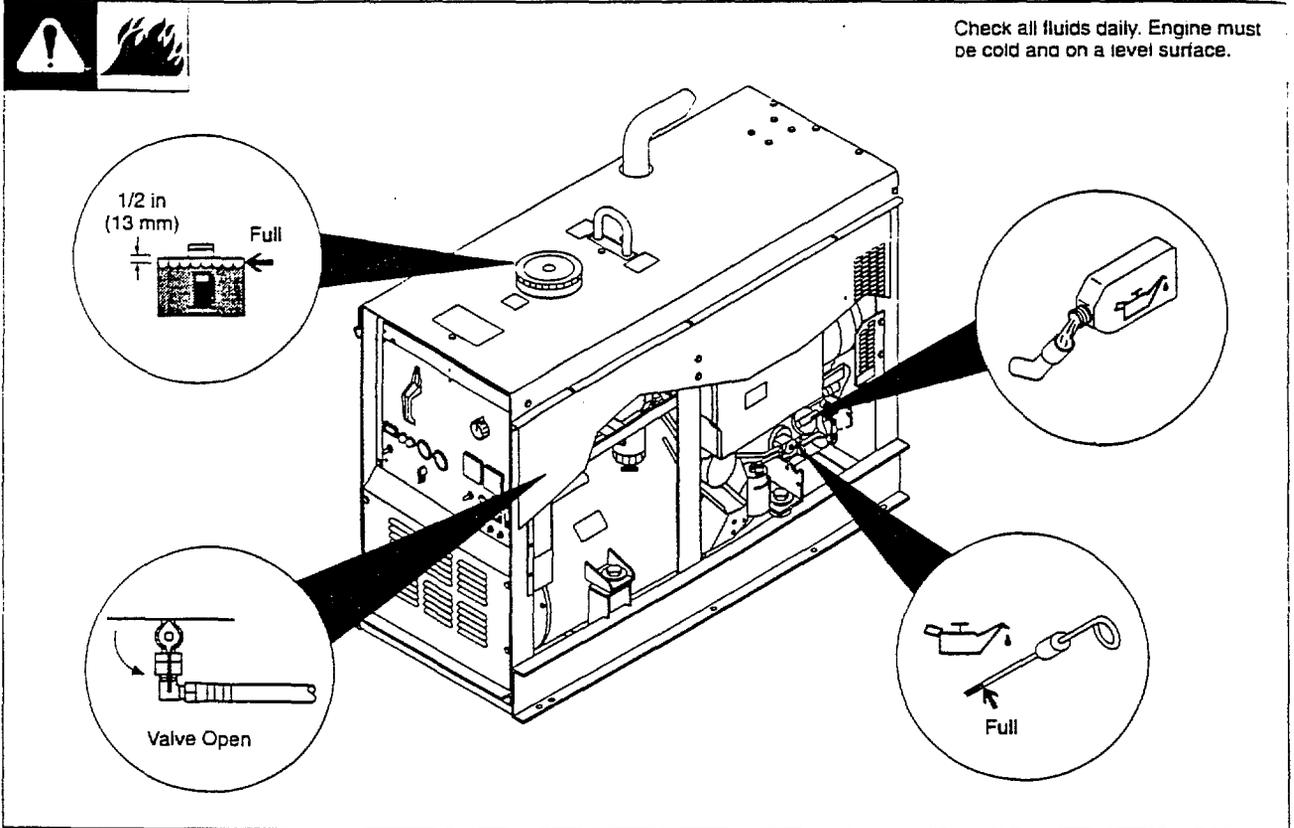
Spark Arrestor Inspection And Service 250 operating hou.
see Owner's Manu.
S-173 E

Routine Maintenance

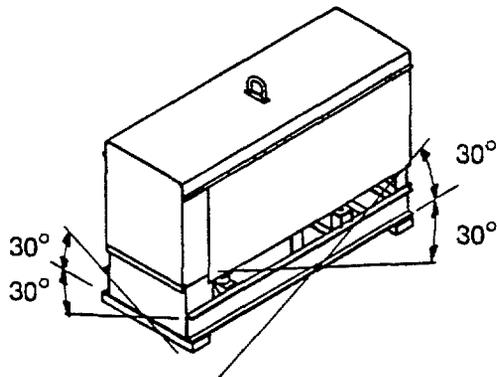
		Recycle engine fluids.		▲ Stop engine before maintaining.	
<p style="text-align: right;">☰ See also Engine Manual and Maintenance Label. Service engine more often during severe conditions.</p>					
8 Hours					
Wipe Up Spills		Check Fluid Levels. See Section 2-5.		FUEL WATER Drain Water From Fuel System. See Section 5-4.	
50 Hours					
Clean Air Filter. See Section 5-3.			Clean And Tighten Weld Terminals		
100 Hours					
Clean Cooling System			Clean And Tighten Battery Connections		
200 Hours			250 Hours		
Replace Unreadable Labels			Check And Clean Spark Arrestor. See Section 5-7.		
500 Hours					
Change Oil. See Section 5-4.		Change Oil Filter. See Section 5-4.		Repair Or Replace Cracked Cables	
1000 Hours					
Blow Out Or Vacuum Inside. During Heavy Service. Clean Monthly.			Change Fuel Filter. See Section 5-4.		
Check Belt Tension 1/2 in. (13 mm)		FUEL SLUDGE Drain Sludge From Fuel Tank. See Section 5-4.		Check Valve Clearance	
3000 Hours					
Clean/Set Injectors					

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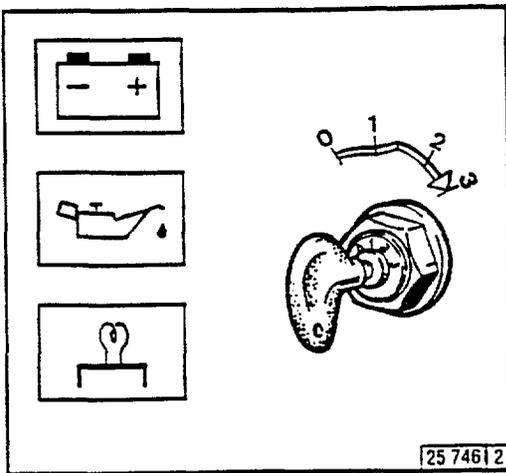
Engine Prestart Checks



▲ Do not exceed operating angles while running or engine damage will occur.



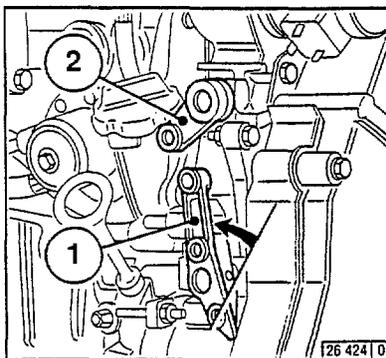
Starting without Cold-Start Aid



Do not actuate the starter for more than 20 seconds. If the engine does not catch, wait a minute then try again.

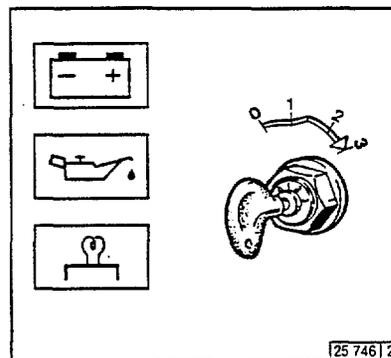
- Insert key.
 - Position 0 = no operating voltage
- Turn key clockwise
 - Position 1 = operating voltage
 - Pilot lights come on
- Push the key in and turn it further clockwise against spring pressure
 - Position 2 = no function
 - Position 3 = start
- Release key as soon as engine fires
 - Pilot lights go out

Mechanical Shutdown



- Move speed control lever 1 to low idle.
- Operate shutdown lever 2 until the engine comes to a stop. The charge pilot light and the oil pressure pilot light will come on when the engine stops.
- Turn key counterclockwise (to position 0) and remove. The pilot lights will go out.

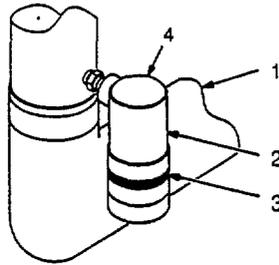
Electrical Shutdown (Ignition Key)



- Turn key counterclockwise (to position 0) and remove. The pilot lights will go out.

If possible, do not suddenly switch off the engine when under full load.

Servicing Air Cleaner



- 1 Intake Manifold
- 2 Service Indicator
- 3 Window
- 4 Reset Button

Service air cleaner element if red band appears in window. A green band means air cleaner is okay. Press button to reset indicator.

▲ **Do not run engine without air cleaner or with dirty element.**

Clean or replace element if dirty or damaged. Replace element yearly or after six cleanings.

- 5 Dust Cap
- 6 Baffle
- 7 Element
- 8 Plastic Fins
- 9 Housing

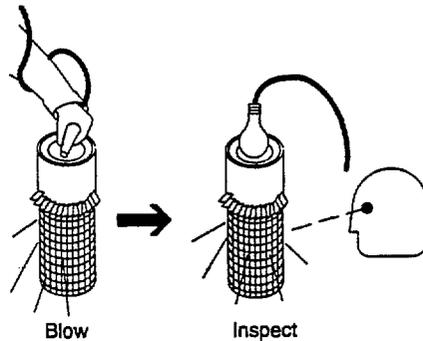
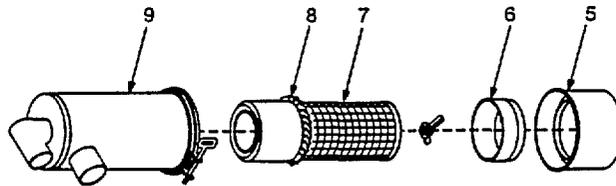
To Clean air filter:

Wipe off cap and housing. Remove cap and dump out dust. Wipe dust from inside cap and housing with damp cloth. Remove element and reinstall cap.

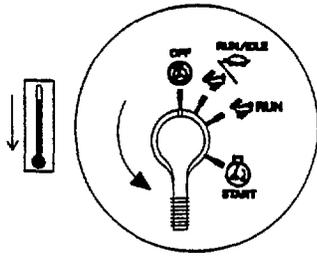
▲ **Do not clean housing with air hose.**

Clean element with compressed air only. Keep nozzle at least 1 in (25 mm) from inside of element. Max. air pressure: 100 psi (690 kPa). Do not remove plastic fins. Replace element if it has holes or damaged gaskets. Replace element yearly or after six cleanings.

Reinstall element and cap (cap arrows pointing up).



Oil And Fuel System Components



Stop engine, and allow to cool.

- 1 Fuel Shutoff Valve
- 2 Primary Fuel Filter
- 3 Petcock
- 4 Secondary Fuel Filter

To drain water from fuel system, open petcock and drain into metal container. Close petcock when fuel appears.

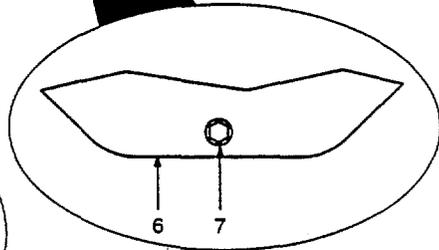
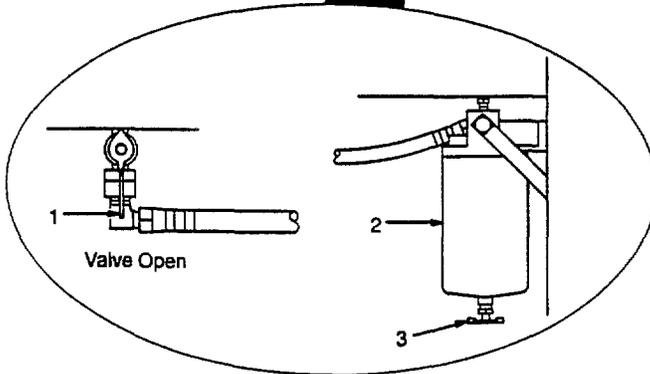
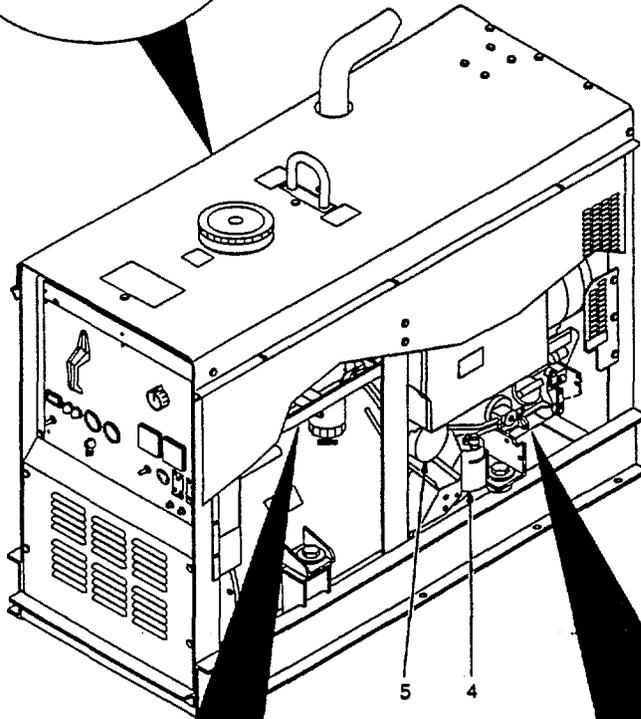
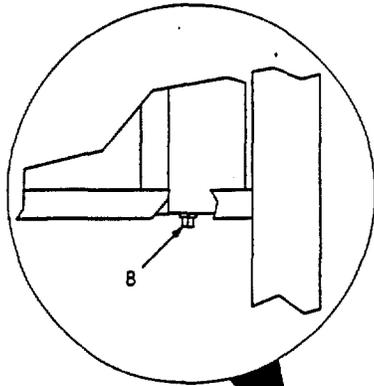
See engine manual for fuel filter replacement procedure.

- 5 Oil Filter
- 6 Oil Pan
- 7 Oil Drain

See engine manual for oil change procedure.

- 8 Sludge Drain Plug

To drain sludge, remove plug and drain into metal container. Reinstall plug.



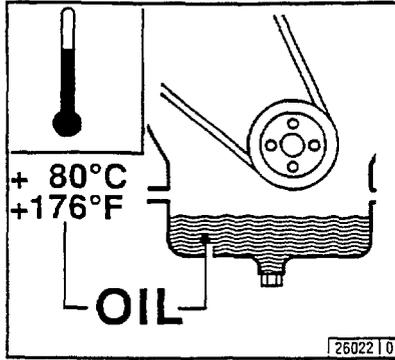
Tools Needed:



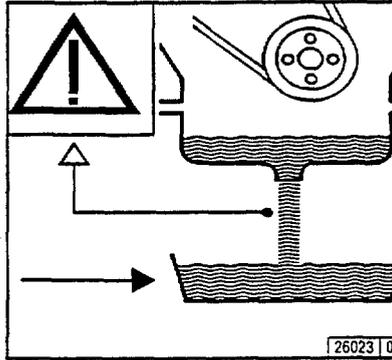
Ref. ST-800 159-C / Ref. ST-176 708

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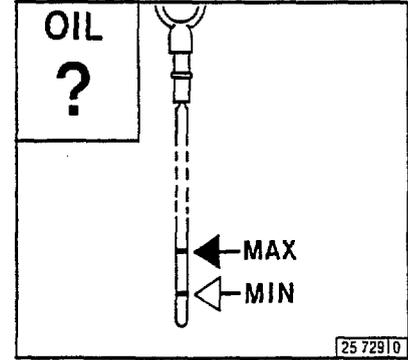
Changing Engine Oil, Checking Oil Level



- Ensure that the engine or vehicle is on a level surface.
- Allow the engine to warm up.
 - Lube oil temperature approx. 80 °C.
- Turn the engine off



- Place oil tray under the engine.
- Unscrew drain plug.
- Drain oil.
- Fit oil drain plug, with the new gasket and tighten firmly (for torque, see 9.2)
- Fill with lube oil
 - For grade / viscosity, see 4.1
 - For quantity, see 9.1
- Start the engine and run at low idle.

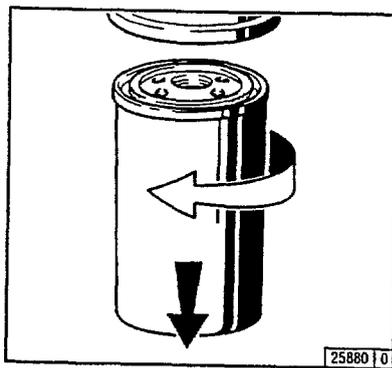


- Turn the engine off.
- Check oil level.
 - If necessary, top up with oil as far as the upper bar.

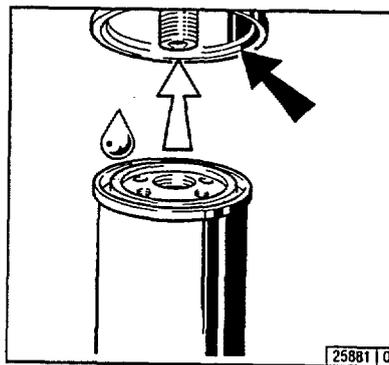


Be careful when draining hot oil – danger of scalds!
Do not let used oil run into the soil but catch it in a container ready for proper disposal!

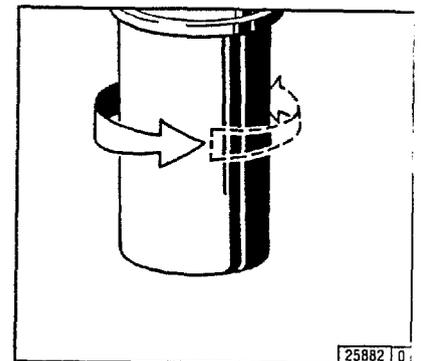
Changing Oil Filter



- Undo the filter cartridge using a commercial tool and spin off.
- Catch any dripping oil.



- Clean any dirt from the filter carrier rim.
- Lightly oil the rubber gasket of the new oil filter cartridge.
- Screw in the new cartridge finger tight against the gasket.

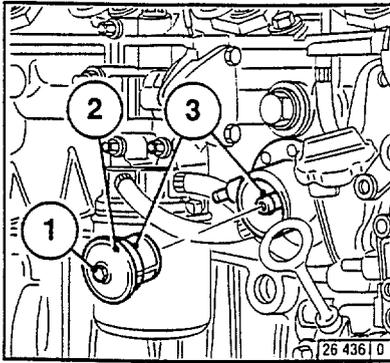


- Tighten the oil filter cartridge with another half-turn.
- Check oil level, see 6.1.2.
- Check oil pressure, see 3.3.1.
- Check cartridge seal for leaks.



Beware of burns from hot oil.

Fuel Pump Cleaning the Strainer

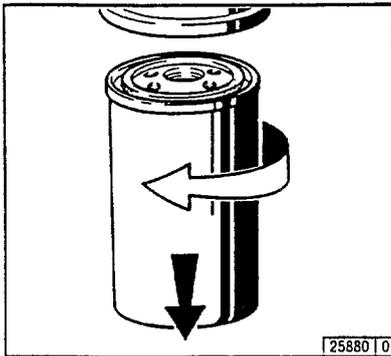


- Close the fuel shut-off valve.
- Loosen and unscrew the hexagonal nut 1.
- Remove the fuel strainer cover 2 (cover and strainer, one unit)
- Clean the fuel strainer with diesel fuel. Replace if necessary.
- Place seals 3 in position.
- Mount the fuel strainer cover 2.
- Tighten the hexagonal screw 1.
- Check for leaks.

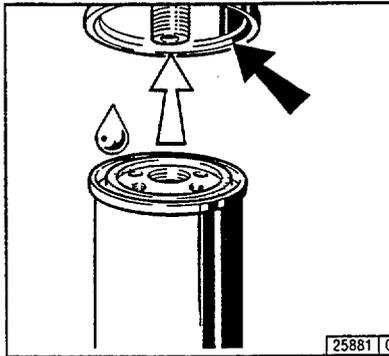


Keep naked flames away when working on the fuel system.
Do not smoke!

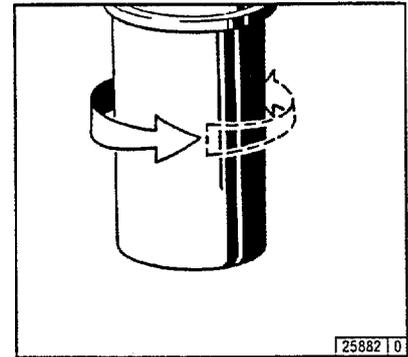
Changing Fuel Filter



- Close fuel stopcock.
- Undo fuel filter cartridge with commercial tool and spin off.
- Catch any fuel.



- Clean any dirt from the filter cartridge with a final half-turn.
- Apply light film of oil or diesel fuel to the rubber gasket of the new fuel filter cartridge.
- Screw in the new cartridge finger tight against the gasket.



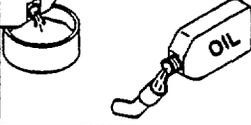
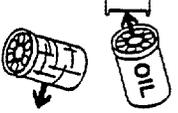
- Tighten the fuel filter cartridge with a final half-turn.
- Open fuel stopcock.
- Check for leaks.

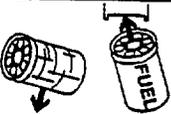
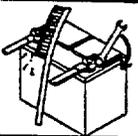
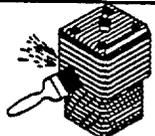
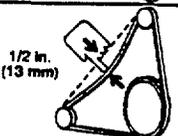
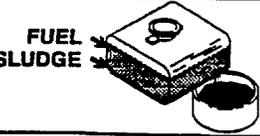


Keep naked flames away when working on the fuel system. Do not smoke.

The fuel system does not need to be bled.

Maintenance Log

	Hours					Notes
 <p>OIL full</p> <p>FUEL</p> <p>Check Fluid Levels</p>						
 <p>FUEL WATER</p> <p>Drain Water From Fuel System</p>						
 <p>AIR</p> <p>Clean Air Filter</p>						
 <p>OIL</p> <p>Change Oil</p>						
 <p>OIL</p> <p>Change Oil Filter</p>						

 <p>FUEL</p> <p>Change Fuel Filter</p>						
 <p>Clean And Tighten Battery Connections</p>						
 <p>Check Cooling System</p>						
 <p>1/2 in. (13 mm)</p> <p>Check Belt Tension</p>						
 <p>FUEL SLUDGE</p> <p>Drain Sludge From Fuel Tank</p>						

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26.



The Environmental Policy and Technology (EPT) Project: Environmental degradation and natural resource mismanagement threaten public health, biodiversity and economic vitality in the New Independent States (NIS). To assist the NIS in alleviating these problems, the U.S. Agency for International Development (USAID) began the EPT Project in 1993. EPT provides technical assistance and policy advice in the environmental sector and promotes environmentally sound economic development through public and private, U.S. and NIS partnerships. The EPT Project is managed by USAID with support from the U.S. Environmental Protection Agency (USEPA). For assistance in project design, management and implementation, USAID has agreements with CH2M HILL International, Harvard Institute for International Development and ISAR. As the primary EPT contractor, CH2M HILL International has the lead role in delivering technical assistance, logistical support and policy support for selected projects. EPT Regional Offices are located in: Washington, D.C.; Moscow, Russia; Kyiv, Ukraine; and Almaty, Kazakhstan.

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