Safety Quick-Guide

For Arc Welding and Cutting the Safe Way!

Visit our websites at

www.MillerWelds.com

www.HobartWelders.com

Be sure this guide reaches the operator.

Thank you **for using Miller or Hobart arc welding and cutting equipment.**

We ask you to work like a pro — and pros weld and cut safely. Please read and comply with the sample safety procedures outlined in this guide and the equipment Owner's Manual.

Always read and follow the Owner's Manual, the safety labels on the product, and all applicable safety standards, especially ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes* (we recommend you get a copy and keep it handy). A list of the safety standards and where to get them is located in Section 7 of this guide.

Thank you for working safely.

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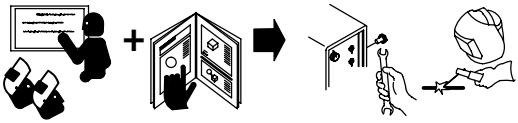
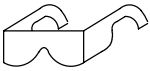
1. General Safe Practices



Become trained and read the instructions before working on the machine or welding or cutting. Read Material Safety Data Sheets (MSDSs) for metals, consumables, and coatings.



Wear approved safety glasses with side shields under your welding helmet or face shield and at all times in the work area.

Read and follow all labels and the Owner's Manual carefully before installing, operating, or servicing unit. Read the safety information at the beginning of the manual and in each section.

Wear a safety harness if working above floor level.

Keep children away from all equipment and processes.

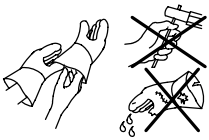
Do not install or place machine on or over combustible surfaces.

Use only genuine replacement parts from the manufacturer.

Perform maintenance and service according to the Owner's Manuals, industry standards, and national, state, and local codes.

2. Arc Welding Hazards

Electric shock from welding electrode or wiring can kill.



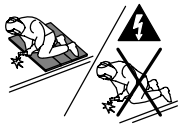
Wear dry, hole-free insulating gloves and body protection. Do not touch electrode with bare hand. Do not wear wet or damaged gloves.

Do not touch live electrical parts.

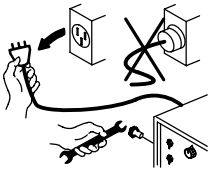
Do not use AC weld output in damp, wet, or confined spaces, or if their is a danger of falling.

Use AC output ONLY if required for the welding process.

If AC output is required, use remote output control if present on unit.



Protect yourself from electric shock by insulating yourself from work and ground. Use non-flammable, dry insulating material if possible, or use dry rubber mats, dry wood or plywood, or other dry insulating material big enough to cover your full area of contact with the work or ground, and watch for fire.



Disconnect input plug or power before working on machine.

Do not make input connections if color blind.

Frequently inspect input power cord for damage or bare wiring — repair or replace cord immediately if damaged. Keep cords dry, free of oil and grease, and protected from hot metal and sparks. Be sure input ground wire is properly connected to a ground terminal in disconnect box or receptacle.

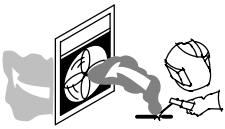
Properly install and ground all equipment according to its Owner's Manual and national, state, and local codes.

Breathing welding fumes can be hazardous to your health.

Keep your head out of the fumes. Do not breathe the fumes. Use enough ventilation, exhaust at the arc, or both, to keep fumes and gases from your breathing zone and the general area.

Read Material Safety Data Sheets (MSDSs) for metals, consumables, and coatings.

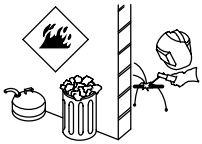
Use enough forced ventilation or local exhaust (forced suction) at the arc to remove the fumes from your breathing area.



Use a ventilating fan to remove fumes from the breathing zone and welding area.

If adequacy of ventilation or exhaust is uncertain, have your exposure measured and compared to the Threshold Limit Values (TLV) in the Material Safety Data Sheet (MSDS).

Welding can cause fire or explosion.



Do not weld near flammable material or where the atmosphere may contain flammable dust, gas, or liquid vapors (such as gasoline). Move flammables at least 35 feet (11 meters) away or protect them with flame-proof covers (see NFPA 51B listed in Section 7).

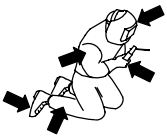
Welding sparks can cause fires. Have a fire extinguisher nearby, and have a trained fire watcher ready to use it. After completion of work, inspect area to ensure it is free of sparks, glowing embers, and flames.

Do not weld on drums, tanks, or any closed containers unless a qualified person has tested it and declared it or prepared it to be safe (see AWS F4.1 listed in Section 7).

Arc rays can burn eyes and skin.

Use welding helmet with correct shade of filter (see Section 8 to choose the correct shade).

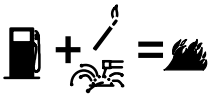
Wear welders cap and safety glasses with side shields. Use ear protection when welding out of position or in confined spaces. Button shirt collar.



Wear complete body protection. Wear oil-free protective clothing such as leather gloves, heavy shirt, cuffless pants, and high boots.

3. Engine Hazards

Fuel can cause fire or explosion.

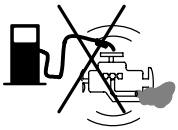


Engine fuel plus flames or sparks can cause fire or explosion.

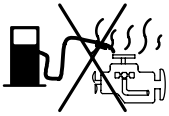
Do not weld near engine fuel.

Do not spill fuel. If fuel is spilled, clean it up and do not start engine until fumes are gone.

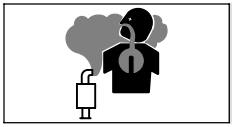
Do not smoke while fueling or if near fuel or fumes.



Stop engine before fueling.



Do not fuel a hot engine. Stop engine and let it cool off before checking or adding fuel.



Using a generator indoors CAN KILL YOU IN MINUTES.

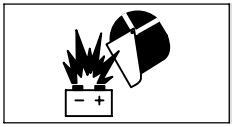
Generator exhaust contains carbon monoxide. This is a poison you cannot see or smell.

NEVER use inside a home or garage, EVEN IF doors and windows are open.

Only use OUTSIDE and far away from windows, doors, and vents.

Moving parts can injure.

Keep hands, hair, loose clothing, and tools away from moving parts such as fans, belts, and rotors. Keep all doors, panels, and guards closed and secured.

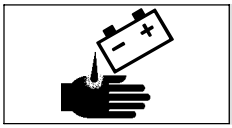


Battery explosion can injure.

Sparks can cause battery gases to explode.

Do not smoke and keep matches and flames away from battery.

Wear a face shield or safety glasses when working near or on a battery.



Battery acid can burn skin and eyes.

Do not spill acid.

Wear rubber gloves and a face shield or safety glasses when working on a battery.

Steam and hot coolant can burn.

Check coolant level when engine is cold to avoid scalding.

If the engine is warm and checking is needed, wear safety glasses and gloves and put a rag over radiator cap. Turn cap slightly and let pressure escape slowly before completely removing cap.

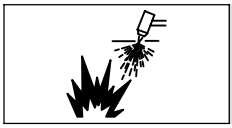
Exhaust sparks can cause fire.

Use approved engine exhaust spark arrestor in required areas — see applicable codes.

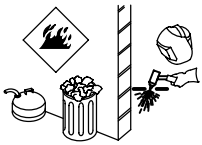
Keep exhaust and exhaust pipes away from flammables.

Do not locate unit near flammables.

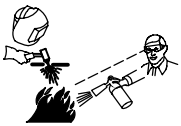
4. Plasma Arc Cutting Hazards



Cutting sparks can cause fire or explosion.

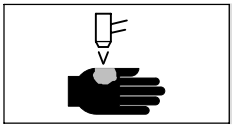


Do not cut near flammable material or where the atmosphere may contain flammable dust, gas, or liquid vapors (such as gasoline).. Move flammables at least 35 feet (11 meters) away or protect them with flame-proof covers (see NFPA 51B listed in Section 7).

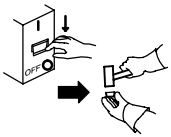


Cutting sparks can cause fires. Have a fire extinguisher nearby, and have a trained fire watch ready to use it. After completion of work, inspect area to ensure it is free of sparks, glowing embers, and flames.

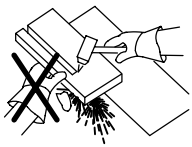
Do not cut on drums, tanks, or any closed containers unless a qualified person has tested it and declared it or prepared it to be safe (see AWS F4.1 listed in Section 7).



Plasma arc can injure.



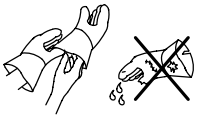
Turn off power before disassembling torch.



Do not grip material near cutting path.

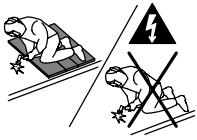
Do not touch hot parts bare-handed.

Electric shock from torch or wiring can kill.

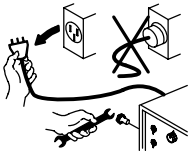


Wear dry insulating gloves. Do not wear wet or damaged gloves.

Do not touch live electrical parts.



Protect yourself from electric shock by insulating yourself from work and ground. Use non-flammable, dry insulating material if possible, or use dry rubber mats, dry wood or plywood, or other dry insulating material big enough to cover your full area of contact with the work or ground, and watch for fire.



Disconnect input plug or power before working on machine.

Do not make input connections if color blind.

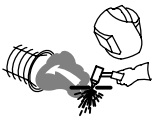
Frequently inspect input power cord for damage or bare wiring — repair or replace cord immediately if damaged. Keep cords dry, free of oil and grease, and protected from hot metal and sparks. Be sure input ground wire is properly connected to a ground terminal in disconnect box or receptacle.

Properly install and ground this equipment according to its Owner's Manual and national, state, and local codes.

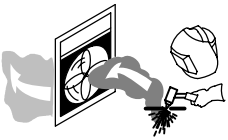
Breathing cutting fumes can be hazardous to your health.

Keep your head out of the fumes. Do not breathe the fumes. Use enough ventilation, exhaust at the arc, or both, to keep fumes and gases from your breathing zone and the general area.

Read Material Safety Data Sheets (MSDSs) for metals, consumables, and coatings.



Use enough forced ventilation or local exhaust (forced suction) at the arc to remove the fumes from your breathing area.



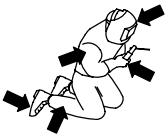
Use a ventilating fan to remove fumes from the breathing zone and cutting area.

If adequacy of ventilation or exhaust is uncertain, have your exposure measured and compared to the Threshold Limit Values (TLV) in the Material Safety Data Sheet (MSDS).

Arc rays can burn eyes and skin.

Use welding helmet or face shield with correct shade of filter (see Section 8 to choose the correct shade).

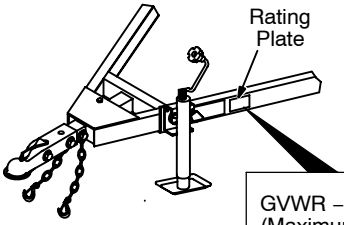
Wear welders cap and safety glasses with side shields. Use ear protection when cutting out of position or in confined spaces. Button shirt collar.



Wear complete body protection. Wear oil-free protective clothing such as leather gloves, heavy shirt, cuffless pants, and high boots.

5. Trailer Safety

Overloading can injure, and damage equipment.



Know the capacity of the trailer.

Do not overload the trailer.

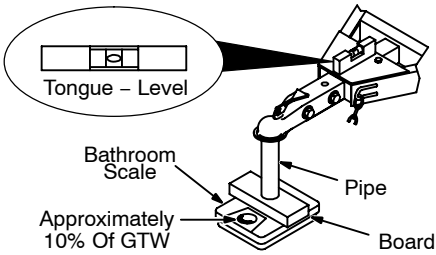
Select a proper towing vehicle.

GVWR – Gross Vehicle Weight Rating (Maximum Total Trailer Weight Including Its Load)

GAWR – Gross Axle Weight Rating

VIN NO – Vehicle Identification Number

Incorrect tongue weight can cause fishtailing and loss of control of towing vehicle resulting in injury and equipment damage.



Install generator according to Owner's Manual with engine end toward hitch end of trailer.

Ground generator frame to trailer frame — see Owner's Manual.

Distribute weight so that trailer tongue weight is approximately 10% of the gross trailer weight (GTW).

Do not let tongue weight exceed coupler and hitch rating.

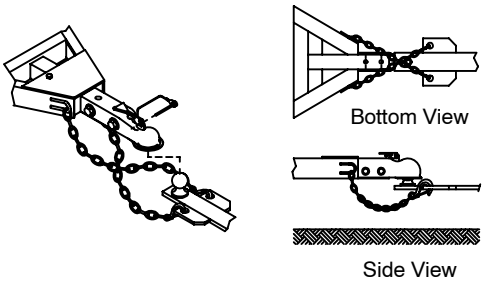
Trailer And Coupler Class[1]	Gross Vehicle Weight Rating GVWR lb (kg)	Gross Trailer Weight GTW[2] lb (kg)	Maximum Tongue Weight[3] lb (kg)
1	Up to 2000 (Up to 910)	1000 (455) 2000 (910)	100 (45) 200 (90)
2	2000 to 3500 (910 to 1590)	2000 (910) 3500 (1590)	200 (90) 350 (158)
3	3500 to 5000 (1590 to 2270)	3500 (1590)	350 (158)

1 Information From SAE J684 May 1987

2 Gross Trailer Weight (Actual Loaded Weight)

3 10% Of GTW Recommended

Safety chains can prevent runaway trailer in case hitch/coupler fails.

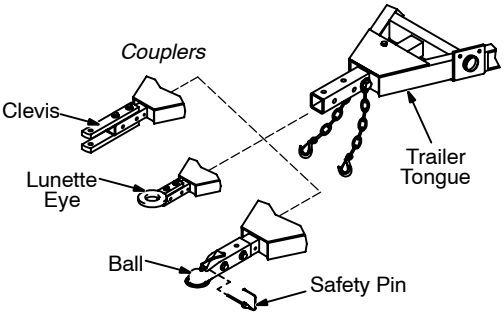


Always use safety chains when towing.

Cross safety chains under coupling to prevent tongue from dropping to ground.

Allow only enough slack for tight turns.

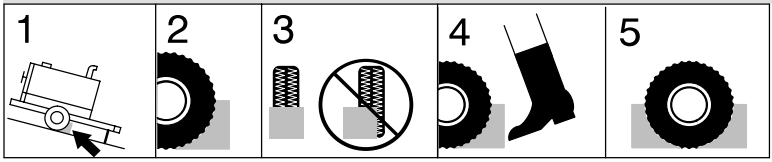
Incorrect size or rating of hitch can cause trailer to break loose from towing vehicle.



Make sure hitch and ball are properly sized, match each other, and are fully engaged.

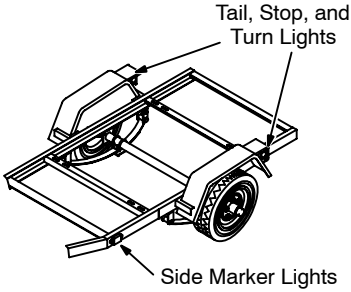
On optional ball couplers, always insert hitch safety pin before towing.

Chock wheels when trailer is uncoupled from vehicle.



1. Chock in direction of grade.
2. Position chock snugly behind tire.
3. Place chock square to the tire.
4. Tap chock into place.
5. For added protection, chock both sides of tire.

Incorrectly working lights can cause accidents.

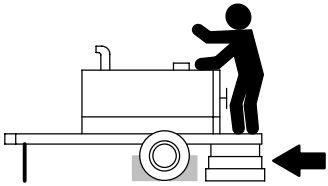


Be sure vehicle and trailer light connectors match and are securely pushed together.

Check all lights for proper operation before using the trailer.

Check condition of wiring harness leads, plugs, bulbs, and connections regularly. Repair or replace damaged bulbs, parts, or wires.

Unexpected tilting of trailer can injure, and damage equipment.

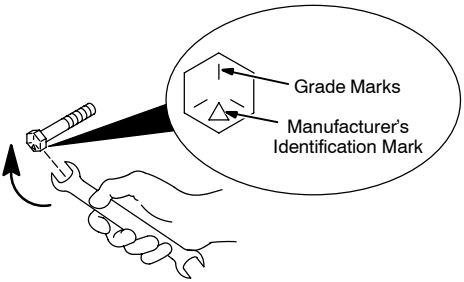


When trailer is uncoupled from towing vehicle, use jack on front and blocks under rear to prevent tilting.

Use proper blocks that are large enough and able to support the necessary weight.

Always chock the wheels when uncoupled.

Loose or incorrect hardware and fasteners can injure, and damage equipment.



Periodically double-check all nuts and bolts for tightness and condition.

If necessary, always replace any fastener with one of equal size, grade, and type.

Be sure the grade marks on replacement fastener match the original bolt. The manufacture's identification mark is not critical and does not matter for the replacement fastener.

6. Special Situations & Equipment

Confined spaces can be hazardous.

Confined spaces are areas which lack room for full movement and often lack ventilation, such as storage tanks, vats, tunnels, boilers, pipes, hold of a ship, corners of a room, near a ceiling or floor corner, or in a pit. Gases can collect and form dangerous concentrations.

Always open all covers, remove any hazardous or toxic materials, provide forced ventilation, and provide a means to turn off power and gas from the inside.

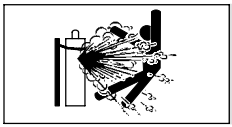
Never work alone — have constant communication with someone outside who can quickly turn off power and gas, is trained in rescue procedures, and is able to pull you out in case of emergency.

Do not use AC weld output in confined spaces.

Insulate yourself from work and ground using non-flammable, dry insulating material if possible, or use dry rubber mats, dry wood or plywood, or other dry insulating material big enough to cover your full area of contact with the work or ground, and watch for fire.

Always check and monitor the air quality in the space. Welding or cutting fumes and gases can displace air and lower the oxygen level — use ventilation and, if needed, an air-supplied respirator. Be sure the breathing air is safe.

Always remember: All normal arc welding and cutting hazards are amplified in confined spaces (see ANSI Z49.1 listed in Section 7).



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 and may be part of the cutting process, be sure to treat them carefully.

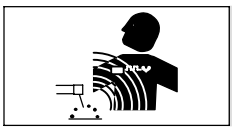
Protect compressed gas cylinders from excessive heat, mechanical shocks, slag, open flames, sparks, and arcs.

Install cylinders in an upright position by securing them to a stationary support or cylinder rack to prevent falling or tipping.

Keep protective cap in place over valve except when cylinder is in use or connected for use.

Cylinders can be heavy — use lifting device and proper methods to prevent back injury.

Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards (see Section 7).



Magnetic fields can affect Implanted Medical Devices.

Wearers of Pacemakers and other Implanted Medical Devices should keep away.

Implanted Medical Device wearers should consult their doctor and the device manufacturer before going near arc welding, spot welding, gouging, plasma arc cutting, or induction heating operations.

Hot parts can burn.

Do not touch hot welded or cut parts with bare hand. If handling is needed, use proper tools and/or wear heavy, insulated welding gloves to prevent burns.

Allow cooling period before handling parts or working on equipment.

FALLING EQUIPMENT can injure, and damage equipment.

Use lifting eye to lift unit only, NOT running gear, gas cylinders, trailer, or any other accessories.

Use equipment of adequate capacity to lift and support unit.

If using lift forks to move unit, be sure forks are long enough to extend beyond opposite side of unit.

Do not place unit where it may easily tip over or fall.

7. Principal Safety Standards

Safety in Welding, Cutting, and Allied Processes, ANSI Standard Z49.1, from Global Engineering Documents (phone: 1-877-413-5184, website: www.global.ihs.com).

Safe Practices for the Preparation of Containers and Piping for Welding and Cutting, American Welding Society Standard AWS F4.1, from Global Engineering Documents (phone: 1-877-413-5184, website: www.global.ihs.com).

National Electrical Code, NFPA Standard 70, from National Fire Protection Association, Quincy, MA 02269 (phone: 1-800-344-3555, website: www.nfpa.org and www. sparky.org).

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association, 4221 Walney Road, 5th Floor, Chantilly, VA 20151 (phone: 703-788-2700, website:www.cganet.com).

Safety in Welding, Cutting, and Allied Processes, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 5060 Spectrum Way, Suite 100, Ontario, Canada L4W 5NS (phone: 800-463-6727, website: www.csa-international.org).

Safe Practice For Occupational And Educational Eye And Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 25 West 43rd Street, New York, NY 10036 (phone: 212-642-4900, website: www.ansi.org).

Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, NFPA Standard 51B, from National Fire Protection Association, Quincy, MA 02269 (phone: 1-800-344-3555, website: www.nfpa.org.

OSHA, Occupational Safety and Health Standards for General Industry, Title 29, Code of Federal Regulations (CFR), Part 1910, Subpart Q, and Part 1926, Subpart J, from U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 (phone: 1-866-512-1800) (there are 10 OSHA Regional Offices—phone for Region 5, Chicago, is 312-353-2220, website: www.osha.gov).

Booklet, *TLVs, Threshold Limit Values…,* from American Conference of Governmental Industrial Hygienists (ACGIH), 1330 Kemper Meadow Drive, Cincinnati, OH 45240 (phone: 513–742–3355, website: www.acgih.org).

Towing a Trailer – Being Equipped for Safety, Publication from U.S. Department of Transportation, National Highway Traffic Safety Administration, 400 Seventh Street, SW, Washington, D.C. 20590

U.S. Consumer Product Safety Commission (CPSC), 4330 East West Highway, Bethesda, MD 20814 (phone: 301-504-7923, website: www.cpsc.gov).

Applications Manual for the Revised NIOSH Lifting Equation, The National Institute for Occupational Safety and Health (NIOSH), 1600 Clifton Rd, Atlanta, GA 30333 (phone: 1-800-232-4636, website: www.cdc.gov/NIOSH).

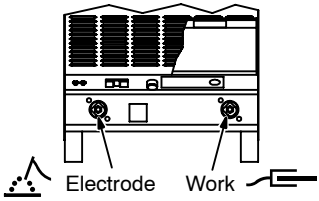
8. Lens Shade Selector Guide

Operation/Process	Electrode Size in. (mm)	Arc Current (Amperes)	Minimum Protective Shade	Suggested* Shade No. (Comfort)
Shielded metal arc welding (SMAW)	Less than 3/32 (2.5) 3/32–5/32 (2.5–4) 5/32–1/4 (4–6.4) More than 1/4 (6.4)	Less than 60 60–160 160–250 250–550	7 8 10 11	— 10 12 14
Gas metal arc welding (GMAW) and flux cored arc welding (FCAW)		Less than 60 60–160 160–250 250–550	7 10 10 10	— 11 12 14
Gas tungsten arc welding (GTAW)		Less than 50 50–150 150–500	8 8 10	10 12 14
Air carbon arc cutting (CAC–A)	(Light) (Heavy)	Less than 500 500–1000	10 11	12 14
Plasma arc welding (PAW)		Less than 20 20–100 100–400 400–800	6 8 10 11	6 to 8 10 12 14
Plasma arc cutting (PAC)		Less than 20 20–40 40–60 60–80 80–300 300–400 400–800	4 5 6 8 8 9 10	4 5 6 8 9 12 14
Torch brazing (TB)		—	—	3 or 4
Torch soldering (TS)		—	—	2
Carbon arc welding (CAW)		—	—	14
	Plate thickness			
	in.	mm		
Oxyfuel gas welding (OFW) Light Medium Heavy	 Under 1/8 1/8 to 1/2 Over 1/2	 Under 3.2 3.2 to 12.7 Over 12.7		 4 or 5 5 or 6 6 or 8
Oxygen Cutting (OC) Light Medium Heavy	 Under 1 1 to 6 Over 6	 Under 25 25 to 150 Over 150		 3 or 4 4 or 5 5 or 6

* As a rule of thumb, start with a shade that is too dark to see the weld or cut zone. Then go to a lighter shade which gives sufficient view of the weld or cut zone without going below the minimum. In oxyfuel gas welding, cutting, or brazing where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.

Guide adapted from ANSI Z49.1, 2005.
Low Current Plasma arc cutting data (0–80 Amperes) supplied by Miller Electric Mfg. Co.

9. Weld Cable Selector Guide*



Turn Off power before connecting to weld output terminals.

Do not use worn, damaged, under-sized, or poorly spliced cables.

Welding Amperes	Weld Cable Size** And Total Cable (Copper) Length In Weld Circuit Not Exceeding***			
	100 ft (30 m) Or Less		150 ft (45 m)	200 ft (60 m)
	10 – 60% Duty Cycle	60 – 100% Duty Cycle	10 – 100% Duty Cycle	
100	4	4	4	3
150	3	3	2	1
200	3	2	1	1/0
250	2	1	1/0	2/0
300	1	1/0	2/0	3/0
350	1/0	2/0	3/0	4/0
400	1/0	2/0	3/0	4/0
500	2/0	3/0	4/0	2 ea. 2/0
600	3/0	4/0	2 ea. 2/0	2 ea. 3/0
700	4/0	2 ea. 2/0	2 ea. 3/0	2 ea. 4/0
800	4/0	2 ea. 2/0	2 ea. 3/0	2 ea. 4/0
900	2 ea. 2/0	2 ea. 3/0	2 ea. 4/0	3 ea. 3/0
1000	2 ea. 2/0	2 ea. 3/0	2 ea. 4/0	3 ea. 3/0
1250	2 ea. 3/0	2 ea. 4/0	3 ea. 3/0	4 ea. 3/0

*This chart is a general guideline and may not suit all applications. If cable overheating occurs (normally you can smell it), use next size larger cable.

**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. Contact your distributor for the mm^2 equivalent weld cable sizes.

***For distances longer than those shown in this Guide, call a factory applications representative at 920-735-4505.

Miller Electric Mfg. Co.
An Illinois Tool Works Company
1635 West Spencer Street
Appleton, WI 54914 USA

Hobart Welding Products
An Illinois Tool Works Company
600 West Main Street
Troy, OH 45373 USA

For additional **FREE** copies, call 920–735–4356, or fax 920–735–4011.

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