Processes
- Stick (SMAW) Welding
- MIG (GMAW) Welding
- Non-Critical TIG (GTAW) Welding

Description
- Engine Driven Welding Generator

Bobcat™ 225 NT

OM-405
February 1997
Effective with Serial Number KH329624
Thank you and congratulations on choosing Miller. Now you can get the job done and get it done right. We know you don’t have time to do it any other way.

That’s why when Neils Miller first started building arc welders in 1929, he made sure his products offered long-lasting value and superior quality. Like you, his customers couldn’t afford anything less. Miller products had to be more than the best they could be. They had to be the best you could buy.

Today, the people that build and sell Miller products continue the tradition. They’re just as committed to providing equipment and service that meets the high standards of quality and value established in 1929.

This Owner’s Manual is designed to help you get the most out of your Miller products. Please take time to read the Safety precautions. They will help you protect yourself against potential hazards on the worksite. We’ve made installation and operation quick and easy.

With Miller you can count on years of reliable service with proper maintenance. And if for some reason the unit needs repair, there’s a Troubleshooting section that will help you figure out what the problem is. The parts list will then help you to decide which exact part you may need to fix the problem. Warranty and service information for your particular model are also provided.

Miller Electric manufactures a full line of welders and welding related equipment. For information on other quality Miller products, contact your local Miller distributor to receive the latest full line catalog or individual catalog sheets. To locate your nearest distributor call 1-800-4-A-Miller.
The engineered exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

WARNING

Your distributor gives you...

Service
You always get the fast, reliable response you need. Most replacement parts can be in your hands in 24 hours.

Support
Need fast answers to the tough welding questions? Contact your distributor. The expertise of the distributor and Miller is there to help you, every step of the way.

Bobcatcat 225 NT

Description

The Bobcat 225 NT begins a new tradition in portable engine-driven welding generators. The new tradition (NT) design includes all the proven capabilities of the famous Bobcat 225 Plus combined with innovative features that meet the multi-purpose needs of contractors at the job sites.

Features

- New full case, rugged housing. Protects engine and internal components from potential damage. 60% more sheet metal built into this durable design compared to the previous model.
- Enlarged, 10 gallon fuel tank and new fuel gauge. 18% more capacity than the previous Bobcat series. Larger capacity means more running time before refueling. Standard fuel gauge is accurate and easy to read.
- Top fuel/oil fill. Fuel fill located on top of unit allows for easier, more convenient refueling, plus an overflow cavity directs any spillage away from the unit. Oil dipstick and fill cap are easily accessed on top of unit. Fastex oil drain does not require tools.
- New "smart" fuel tank design. Patent-pending design of the reservoir minimizes the chance of fuel backflow.
- Rotatable exhaust pipe. Adjust exhaust pipe in any direction – 360 degree rotation possible. The new muffler design provides quieter, improved sound quality.

8000 watts of AC auxiliary power. Dual purpose welder and power generator provides needed power at job sites. Auxiliary power receptacle supplies up to 35 amps of 120 or 240 volts ac to a single load. (Optional GFCI kits available.)

Processes

- Stick (SMAW) Welding
- MIG (GMAW) Welding
- Non-Critical TIG (GTAW) Welding

The following terms are used interchangeably in this manual: Stick = SMAW, TIG = GTAW, MIG = GMAW or Wire

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Miller offers a Technical Manual which provides more detailed service and parts information for your unit. To obtain a Technical Manual, contact your local distributor. Your distributor can also supply you with Welding Process Manuals such as SMAW, GTAW, GMAW, and GMAW-P.
1. Safety Precautions – Read Before Using

1.1 Symbol Usage

⚠️ Marks a special safety message.

⚠️ Means “Note”; not safety related.

Means Warning! Watch Out! There are possible hazards with this procedure! The possible hazards are shown in the adjoining symbols.

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

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.

- Do not touch live electrical parts.
- Wear dry, hole-free insulating gloves and body protection.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground.
- 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).
- Properly install and ground this equipment according to its Owner’s Manual and national, state, and local codes.
- Always verify the supply ground – check and be sure that input power cord ground wire is properly connected to ground terminal in disconnect box or that cord plug is connected to a properly grounded receptacle outlet.
- When making input connections, attach proper grounding conductor first – double-check connections.
- Frequently inspect input power cord for damage or bare wiring – replace cord immediately if damaged – bare wiring can kill.
- Turn off all equipment when not in use.
- Do not use worn, damaged, undersized, or poorly spliced cables.
- Do not drape cables over your body.
- If earth grounding of the workpiece is required, ground it directly with a separate cable – do not use work clamp or work cable.
- Do not touch electrode if you are in contact with the work, ground, or another electrode from a different machine.
- Use only well-maintained equipment. Repair or replace damaged parts at once. Maintain unit according to manual.
- Wear a safety harness if working above floor level.

Keep all panels and covers securely in place.

Clamp work cable with good metal-to-metal contact to workpiece or worktable as near the weld as practical.

SIGNIFICANT DC VOLTAGE exists after removal of input power on inverters.

- Turn Off inverter, disconnect input power, and discharge input capacitors according to instructions in Maintenance Section before touching any parts.

ARC RAYS can burn eyes and skin.

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.

- 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).
- Wear approved safety glasses with side shields.
- Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
- Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.

FUMES AND GASES can be hazardous.

Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

- Keep your head out of the fumes. Do not breathe the fumes.
- If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
- If ventilation is poor, use an approved air-supplied respirator.
- Read the Material Safety Data Sheets (MSDSs) and the manufacturer’s instructions for metals, consumables, coatings, cleaners, and degreasers.
- Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Always have a trained watch-person nearby. Welding fumes and gases can displace air and lower the oxygen level causing injury or death. Be sure the breathing air is safe.
- 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.
- 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.
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.

- Protect yourself and others from flying sparks and hot metal.
- Do not weld where flying sparks can strike flammable material.
- Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
- Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
- Watch for fire, and keep a fire extinguisher nearby.
- Be aware that welding on a ceiling, floor, bulkhead, or partition can easily go through small cracks and openings to adjacent areas.
- 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).
- 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.
- Do not use welder to thaw frozen pipes.
- Remove stick electrode from holder or cut off welding wire at contact tip when not in use.
- Wear oil-free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.
- Remove any combustibles, such as a butane lighter or matches, from your person before doing any welding.

1.3 Engine Hazards

FUEL can cause fire or explosion.

- Stop engine and let it cool off before checking or adding fuel.
- Do not add fuel while smoking or if unit is near any sparks or open flames.
- Do not overfill tank – allow room for fuel to expand.
- Do not spill fuel. If fuel is spilled, clean up before starting engine.
- Dispose of rags in a fireproof container.

MOVING PARTS can cause injury.

- Keep away from fans, belts, and rotors.
- Keep all doors, panels, covers, and guards closed and securely in place.
- Stop engine before installing or connecting unit.
- Have only qualified people remove guards or covers for maintenance and troubleshooting as necessary.
- To prevent accidental starting during servicing, disconnect negative (−) battery cable from battery.
- Keep hands, hair, loose clothing, and tools away from moving parts.
- Reinstall panels or guards and close doors when servicing is finished and before starting engine.
- Before working on generator, remove spark plugs or injectors to keep engine from kicking back or starting.
- Block flywheel so that it will not turn while working on generator components.

STEAM AND HOT COOLANT can burn.

- If possible, check coolant level when engine is cold to avoid scalding.
- If the engine is warm and checking is needed, follow the next two statements.
- Wear safety glasses and gloves and put a rag over radiator cap.
- Turn cap slightly and let pressure escape slowly before completely removing cap.

BATTERY EXPLOSION can BLIND.

- Always wear a face shield, rubber gloves, and protective clothing when working on a battery.
- Stop engine before disconnecting or connecting battery cables or servicing battery.
- Do not allow tools to cause sparks when working on a battery.
- Do not use welder to charge batteries or jump start vehicles.
- Observe correct polarity (+ and −) on batteries.

ENGINE HEAT can cause fire.

- Do not locate unit on, over, or near combustible surfaces or flammables.
- Keep exhaust and exhaust pipes way from flammables.
1.4 Additional Installation, Operation, and Maintenance Hazards

Engine Exhaust Gases can kill.
- Use equipment outside in open, well-ventilated areas.
- If used in a closed area, vent engine exhaust outside and away from any building air intakes.

Battery Acid can burn skin and eyes.
- Do not tip battery.
- Replace damaged battery.
- Flush eyes and skin immediately with water.

Flying Metal or Slag can injure eyes.
Chipping and grinding cause flying metal. As welds cool, they can throw off pieces of metal or slag.
- Wear a face shield to protect eyes and skin.

Overuse can cause overheating.
- Allow cooling period; follow rated duty cycle.
- Reduce current or reduce duty cycle before starting to weld again.
- Do not block or filter airflow to unit.

Hot Parts can cause severe burns.
- Allow cooling period before maintaining.
- Wear protective gloves and clothing when working on a hot engine.
- Do not touch hot engine parts or just-welded parts bare-handed.

Magnetic Fields can affect pacemakers.
- Pacemaker wearers keep away.
- Wearers should consult their doctor before going near arc welding, gouging, or spot welding operations.

Noise can damage hearing.
Noise from some processes or equipment can damage hearing.
- Wear approved ear protection if noise level is high.

Static (ESD) can damage PC boards.
- Put on grounded wrist strap BEFORE handling boards or parts.
- Use proper static-proof bags and boxes to store, move, or ship PC boards.

Flying Metal or Dirt can injure eyes.
- Wear approved safety glasses with side shields or wear face shield.

Buildup of gas can injure or kill.
- Shut off shielding gas supply when not in use.

Exhaust Sparks can cause fire.
- Do not let engine exhaust sparks cause fire.
- Use approved engine exhaust spark arrestor in required areas — see applicable codes.

Falling Unit can cause injury.
- 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.

Overheating can damage motors.
- Turn off or unplug equipment before starting or stopping engine.
- Do not let low voltage and frequency caused by low engine speed damage electric motors.

Tilting of trailer can cause injury.
- Use tongue jack or blocks to support weight.
- Properly install welding generator onto trailer according to instructions supplied with trailer.

Read Instructions.
- Use only genuine MILLER replacement parts.
- Perform engine maintenance and service according to this manual and the engine manual.
1.5 Principal Safety Standards

Safety in Welding and Cutting, ANSI Standard Z49.1, from American Welding Society, 550 N.W. LeJeune Rd, Miami FL 33126


National Electrical Code, NFPA Standard 70, from National Fire Protection Association, Battymarch Park, Quincy, MA 02269.


Safe Practices For Occupation And Educational Eye And Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 1430 Broadway, New York, NY 10018.


1.6 EMF Information

Considerations About Welding And The Effects Of Low Frequency Electric And Magnetic Fields

The following is a quotation from the General Conclusions Section of the U.S. Congress, Office of Technology Assessment, Biological Effects of Power Frequency Electric & Magnetic Fields — Background Paper, OTA-BP-E-53 (Washington, DC: U.S. Government Printing Office, May 1989): “. . . there is now a very large volume of scientific findings based on experiments at the cellular level and from studies with animals and people which clearly establish that low frequency magnetic fields can interact with, and produce changes in, biological systems. While most of this work is of very high quality, the results are complex. Current scientific understanding does not yet allow us to interpret the evidence in a single coherent framework. Even more frustrating, it does not yet allow us to draw definite conclusions about questions of possible risk or to offer clear science-based advice on strategies to minimize or avoid potential risks.”

To reduce magnetic fields in the workplace, use the following procedures:

1. Keep cables close together by twisting or taping them.
2. Arrange cables to one side and away from the operator.
3. Do not coil or drape cables around the body.
4. Keep welding power source and cables as far away from operator as practical.
5. Connect work clamp to workpiece as close to the weld as possible.

About Pacemakers:
The above procedures are also recommended for pacemaker wearers. Consult your doctor for complete information.
1. Consignes de Sécurité – Lire Avant Utilisation

1.1 Signification des symboles

⚠️ Signifie Mise en garde! Soyez vigilant! Cette procédure présente des risques de danger! Ceux-ci sont identifiés par des symboles adjacents aux directives.

▲ Identifie un message de sécurité particulier.

◻️ Signifie NOTA; n’est pas relatif à la sécurité.

1.2 Dangers relatifs au soudage à l’arc

▲ Les symboles présentés ci-après sont utilisés tout au long du présent manuel pour attirer votre attention et identifier les risques de danger. Lorsque vous voyez un symbole, soyez vigilant et suivez les directives mentionnées afin d’éviter tout danger. Les consignes de sécurité présentées ci-après ne sont que des rappels à l’information contenue dans les normes de sécurité énumérées à la section 1-5. Veuillez lire et respecter toutes ces normes de sécurité.

▲ L’installation, l’utilisation, l’entretien et les réparations ne doivent être confiés qu’à des personnes qualifiées.

▲ Au cours de l’utilisation, tenir toute personne à l’écart et plus particulièrement les enfants.

UN CHOC ÉLECTRIQUE peut tuer.

Un simple contact avec des pièces électriques peut provoquer une électrocution ou des blessures graves. Lélectrode et le circuit de soudage sont sous tension dès que l’appareil est sur ON. Le circuit d’entrée et les circuits internes de l’appareil sont également sous tension à ce moment-là. En soudage semi-automatique ou automatique, le fil, le dévidoir, le logement des gâts d’entraînement et les pièces métalliques en contact avec le fil de soudage sont sous tension. Des matériaux mal installés ou mal mis à la terre présentent un danger.

- Ne jamais toucher les pièces électriques sous tension.
- Porter des gants et des vêtements de protection secs ne comportant pas de tissus conducteurs.
- S’isoler de la pièce et de la terre au moyen de tapis ou d’autres moyens isolants suffisamment grands pour empêcher le contact physique éventuel avec la pièce ou la terre.
- Installer et mettre à la terre correctement cet appareil conformément à son manuel d’utilisation et au codes nationaux, provinciaux et municipaux.
- Toujours vérifier la terre du cordon d’alimentation – Vérifier et s’assurer que le fil de terre du cordon d’alimentation est bien raccordé à la borne de terre du sectionneur ou que la fiche du cordon est raccordée à une prise correctement mise à la terre.
- En effectuant les raccordements d’entrée fixer d’abord le conducteur de mise à la terre approprié et contre-vérifier les connexions.
- Vérifier fréquemment le cordon d’alimentation pour voir s’il n’est pas endommagé ou dénudé – remplacer le cordon immédiatement s’il est endommagé – un câble dénudé peut provoquer une électrocution.
- Mettre l’appareil hors tension quand on le n’utilise pas.
- Ne pas utiliser des câbles usés, endommagés, de grosseur insuffisante ou mal épissés.
- Ne pas enrouler les câbles autour du corps.
- Si la pièce soudée doit être mise à la terre, le faire directement avec un câble distinct – ne pas utiliser le connecteur de picce ou le câble de retour.
- Ne pas toucher l’électrode quand on est en contact avec la pièce, la terre ou une électrode provenant d’une autre machine.
- N’utiliser qu’un matériel en bon état. Réparer ou remplacer sur-le-champ les pièces endommagées. Entretien l’appareil conformément à ce manuel.

LE RAYONNEMENT DE L’ARC peut brûler les yeux et la peau.

L’arc de soudage produit des rayons visibles et invisibles intensifs (ultraviolets et infrarouges) qui peuvent brûler les yeux et la peau. Le bruit produit par certains procédés peut endommager l’oreille.

- Porter un masque à serre-tête muni d’un verre filtrant de nuance appropriée pour protéger le visage et les yeux quand on soude ou observe la travail de soudage (voir les normes ANSI Z49.1 et Z87.1 données sous la rubrique Principales normes de sécurité).
- Porter des lunettes de sécurité approuvées avec écrans latéraux.
- Utiliser des pare-vents ou des barrières de protection pour protéger les personnes à proximité contre les coups d’arc et l’éblouissement; avertir les autres personnes de ne pas regarder l’arc.
- Porter des vêtements de protection en tissu ignifuge durable (laine et cuir) et des chaussures de sécurité.

LES VAPEURS ET LES FUMÉES peuvent être dangereuses.

Le soudage produit des vapeurs et des fumées qu’il est dangereux de respirer.

- Garder la tête à l’extérieur des vapeurs et des fumées et ne pas les respirer.
- À l’intérieur, ventiler le poste de travail ou utiliser un dispositif placé au niveau de l’arc pour évacuer les vapeurs et fumées de soudage.
- Si la ventilation est mauvaise, utiliser un appareil respiratoire à aduction d’air pur approuvé.
- Consulter les fiches signalétiques et les consignes du fabricant relatives au métal, produits d’apport, revêtements, nettoyants et dégraissants.
- Ne travailler dans un espace confiné que si l’il est bien ventilé, ou en portant un appareil respiratoire à aduction d’air pur. Demander à un observateur ayant reçu la bonne formation de toujours se tenir à proximité. Les vapeurs et fumées de soudage peuvent déplacer l’air et abaisser le niveau d’oxygène et causer des blessures graves voire mortelles. S’assurer que l’air est propre à la respiration.
- Ne pas souder à proximité d’opérations de dégraisseage, de nettoyage ou de pulvérisation. La chaleur et les rayons de l’arc peuvent réagir avec les vapeurs pour former des gaz hautement toxiques et irritants.
- Ne pas souder sur des métaux revêtus comme l’acier galvanisé, au plomb ou cadmium à moins que la pièce n’ait été entièrement décapsée, que le poste de travail soit bien ventilé. S’il y a lieu, porter un appareil respiratoire à ad-
d'air pur. Les revêtements et les métaux qui contiennent de tels éléments peuvent dégager des vapeurs toxiques lors du soudage.

**LE SOUDAGE peut causer un incendie ou une explosion.**

Ne pas souder sur des récipients fermés comme des réservoirs, des fûts ou des tuyaux : ils peuvent exploser. L'arc de soudage peut produire des étincelles. Des étincelles, une pièce chaude et un matériau chaud peuvent provoquer des incendies et des blessures. Le contact accidentel de l'électrode sur des objets métalliques peut produire des étincelles, l'explosion, la surchauffe ou un incendie. S'assurer que le lieu ne présente pas de danger avant d'effectuer le soudage.

- Se protéger et protéger les personnes à proximité des étincelles et du métal chaud.
- Ne pas souder dans un endroit où les étincelles peuvent atteindre des matériaux inflammables.
- Enlever toutes les matières inflammables dans un rayon de moins de 10 m de l'arc. Si cela n'est pas possible, bien les recouvrir en utilisant des bâches approvisionnées.
- Prendre garde que les étincelles et les projections ne pénétrant dans des zones adjacentes en s'infiltrant dans des petites fissures et ouvertures.
- Prendre garde aux incendies et toujours avoir un extincteur à proximité.
- Se rappeler que si l'on soude sur une bouteille sous pression : elle exploserait.
- Ne pas souder sur des récipients fermés comme des réservoirs, des fûts ou des tuyaux à moins qu'ils ne soient préparés de façon appropriée conformément à la norme F4.1 de l'AWS (voir la rubrique Principales normes de sécurité).
- Raccorder le câble de retour à la pièce, le plus près possible de la zone de soudage, pour empêcher que le courant de soudage ne suive une trajectoire longue et éventuellement inconnue et qu'il ne provoque des risques d'électrocution et d'incendie.
- Ne pas utiliser le chalumeau soudeur pour dégeler des tuyaux.
- Enlever l'électrode enrobée du porte-électrode ou couper le fil de soudage au ras du bec contact quand on ne l'utilise pas.
- Porter des vêtements de protection non huileux comme des gants en cuir, une chemise longue et un pantalon sans revers, des chaussures montantes et un casque.
- Ne pas porter des matières combustibles sur soi comme un briquet à gaz ou des allumettes quand on soude.

1.3 Dangers relatifs au moteur

**LE CARBURANT peut causer un incendie ou une explosion.**

- Arrêter le moteur avant de vérifier le niveau de carburant ou de faire le plein.
- Ne pas faire le plein en fumant ou proche d'une source d'étincelles ou d'une flamme nue.
- Ne pas faire le plein de carburant à ras bord; prévoir de l'espace pour son expansion.
- Faire attention de ne pas renverser de carburant. Nettoyer tout carburant renversé avant de faire démarrer le moteur.
- Jeter les chiffons dans un récipient ignifuge.

**LES PIÈCES EN MOUVEMENT peuvent causer des blessures.**

- Ne pas approcher les mains des ventilateurs, courroies et autres pièces en mouvement.
- S'assurer que les portes, les panneaux, les capots et les protecteurs sont bien fermés.
- Avant d'utiliser ou de connecter un système, arrêter le moteur.
- Seules des personnes qualifiées doivent démonter des protecteurs ou des capots pour faire l'entretien ou le dépannage nécessaire.
- Pour empêcher un démarrage accidentel d'un système pendant l'entretien, débrancher le câble d'accumulateur à la borne négative.
- Ne pas approcher les mains ou les cheveux de pièces en mouvement; elles peuvent aussi accrocher des vêtements amples et des outils.
- Réinstaller les capots ou les protecteurs et fermer les portes après des travaux d'entretien et avant de faire démarrer le moteur.
- Avant d'intervenir, déposez les bougies ou injecteurs pour éviter la mise en route accidentelle du moteur.
- Bloquer le volant moteur pour éviter sa rotation lors d'une intervention sur le générateur.

**LES BOUTEILLES peuvent exploser si elles sont endommagées.**

Les bouteilles contenant des gaz de protection sont à haute pression. Une bouteille endommagée peut exploser. Étant donné que les bouteilles de gaz font normalement partie du matériel de soudage, les traiter avec le plus grand soin.

- Protéger les bouteilles de gaz comprimé contre la chaleur intense, les chocs, le laitier, les flammes nues, les étincelles et l'arc.
- Placer les bouteilles à la verticale en les fixant à un support fixe ou à un chariot pour éviter qu'elles ne tombent ou ne basculent.
- Tenir les bouteilles à l'écart du poste de soudage ou d'autres circuits électriques.
- Ne jamais poser un chalumeau soudeur sur une bouteille de gaz.
- Ne jamais laisser une électrode de soudage toucher une bouteille.
- Ne jamais souder sur une bouteille sous pression : elle exploserait.
- N'utiliser que des bouteilles de gaz de protection, des détendeurs, des tuyaux souples et des raccords appropriés conçus pour l'application parti-culière; conserver ces matériaux et leurs pièces en bon état.
- Éloigner le visage de la sortie du robinet de la bouteille quand on l'ouvre.
- Replacer le chapeau sur la bouteille après utilisation.
- Lire et suivre les consignes relatives aux bouteilles de gaz comprimé, au matériel connexe ainsi que la publication P-1 de la CGA donnée sous la rubrique Principales normes de sécurité.
**LA VAPEUR ET LE LIQUIDE DE REFROIDISSEMENT CHAUD peuvent provoquer des brûlures.**
- Il est préférable de vérifier le liquide de refroidissement une fois le moteur refroidi.
- Si le moteur est chaud et que le liquide doit être vérifié, opérer comme suivant :
  - Mettre des lunettes de sécurité et des gants, placer un torchon sur le bouchon du radiateur.
  - Dévisser le bouchon légèrement et laisser la vapeur s'échapper avant d'enlever le bouchon.

**L’EXPLOSION DE LA BATTERIE peut RENDRE AVEUGLE.**
- Toujours porter une protection faciale, des gants en caoutchouc et vêtements de protection lors d’une intervention sur la batterie.
- Arrêter le moteur avant de débrancher ou de brancher les câbles de batterie.
  - Utiliser uniquement des outils anti-étincelles pour travailler sur un accumulateur.
  - Ne pas utiliser un poste de soudage pour charger un accumulateur ou pour faire démarrer un véhicule.
  - Ne pas intervertir la polarité d’un accumulateur.

**LA CHALEUR DU MOTEUR peut provoquer un incendie.**
- Ne pas placer l’appareil sur, au-dessus ou à proximité de surfaces inflammables.
- Tenir à distance les produits inflammables de l’échappement.
1.4 Autres dangers relatifs à l’installation, l’utilisation et l’entretien

UNE SURUTILISATION peut SURCHAUFFER L’ÉQUIPEMENT.

- Laisser l’équipement refroidir.; respecter le facteur de marche nominal.
- Réduire le courant ou le facteur de marche avant de poursuivre le soudage.
- Ne pas obstruer les passages d’air du poste.

LES PIÈCES CHAUDES peuvent causer des brûlures sévères.

- Laisser refroidir avant d’effectuer l’entretien.
- Porter des gants et des vêtements de protection lorsque vous devez toucher à un moteur chaud.
- Ne pas toucher à mains nues les parties chaudes du moteur ni les pièces récemment soudées.

LES CHAMPS MAGNÉTIQUES peuvent affecter les stimulateurs cardiaques.

- Les personnes qui portent un stimulateur cardiaque doivent se tenir éloignées des postes de soudage.
- Elles devraient consulter leur médecin avant de s’approcher d’un poste de soudage à l’arc, de gougeage ou de soudage par points.

LE BRUIT peut affecter l’ouïe

Le bruit des processus et des équipements peut affecter l’ouïe.

- Porter des protections approuvées pour les oreilles si le niveau sonore est trop élevé.

LES CHARGES ÉLECTROSTATIQUES peuvent endommager les circuits imprimés

- Porter un bracelet antistatique AVANT de manipuler une carte ou une pièce.
- Utiliser des sacs et des boîtes antistatiques approuvés pour ranger, déplacer ou expédier des cartes PC.

DES ÉCLATS DE MÉTAL ou DE LAITIER peuvent causer des blessures aux yeux.

- Meuler ou extraire le laitier peuvent provoquer des particules volantes. Lors du refroidissement des soudures des éclats de laitier peuvent se dégager.
- Porter un écran facial pour protéger le visage et les yeux.

DES PARTICULES VOLANTE peuvent blesser les yeux.

- Porter des lunettes de sécurité avec écrans latéraux ou un écran facial.

L’ACCUMULATION DE GAZ PROTECTEUR peut être dangereuse pour la santé ou peut provoquer des accidents mortels.

- Fermer l’alimentation du gaz protecteur en cas de non utilisation.

LES ÉTINCELLES À L’ÉCHAPPEMENT peuvent provoquer un incendie.

- Empêcher les étincelles d’échappement du moteur de provoquer un incendie.
- Utiliser uniquement un pare-étincelles approuvé – voir codes en vigueur.

LA CHUTE DE L’APPAREIL peut blesser

- Utiliser l’anneau de levage uniquement pour soulever l’appareil lui-même; sans chariot, de bouteilles de gaz, remorque, ou autres accessoires.
- Utiliser un équipement de levage de capacité suffisante pour lever l’appareil.
- En cas de manipulation avec un chariot élévateur s’assurer que les bout opposé de l’appareil.

LE SURCHAUFFEMENT peut endommager le moteur électrique

- Mettre hors tension ou débrancher l’équipement avant de démarrer ou d’arrêter le moteur.
- Ne pas laisser tourner le moteur trop lentement sous risque d’endommager le moteur électrique a cause d’une tension et d’une fréquence trop faible.
UNE REMORQUE QUI BASCULE peut entraîner des blessures.

- Utiliser les supports de la remorque ou des blocs pour soutenir le poids.
- Installer convenablement le poste sur la remorque comme indiqué dans le manuel s’y rapportant.

LIRE LES INSTRUCTIONS.

- Utiliser uniquement des pièces de rechange MILLER.
- Effectuer la maintenance et la mise en service d’après le manuel et celui du moteur.
1.5 Principales normes de sécurité

Safety in Welding and Cutting, norme ANSI Z49.1, de l’American Welding Society, 550 N.W. Lejeune Rd, Miami FL 33126


Recommended Safe Practice for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, norme AWS F4.1, de l’American Welding Society, 550 N.W. Lejeune Rd, Miami FL 33126

National Electrical Code, NFPA Standard 70, de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.


Règles de sécurité en soudage, coupage et procédés connexes, norme CSA W117.2, de l’Association canadienne de normalisation, vente de normes, 178 Rexdale Boulevard, Rexdale (Ontario) Canada M9W 1R3.


1.6 Information sur les champs électromagnétiques

Données sur le soudage électrique et sur les effets, pour l’organisme, des champs magnétiques basse fréquence


Afin de réduire les champs électromagnétiques dans l’environnement de travail, respectez les consignes suivantes :
3. Ne courbez pas et n’entourez pas les câbles autour de vous.
4. Gardez le poste de soudage et les câbles le plus loin possible de vous.
5. Reliez la pince de masse le plus près possible de la zone de soudure.

Consignes relatives aux stimulateurs cardiaques :
Les consignes mentionnées précédemment font partie de celles destinées aux personnes ayant recours à un stimulateur cardiaque. Veuillez consulter votre médecin pour obtenir plus de détails.
2. Definitions

2.1 Symbol Definitions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Stop Engine" /></td>
<td>Stop Engine</td>
</tr>
<tr>
<td><img src="image" alt="Fast" /></td>
<td>Fast (Run, Weld/Power)</td>
</tr>
<tr>
<td><img src="image" alt="Fast/Slow" /></td>
<td>Fast/Slow (Run/Idle)</td>
</tr>
<tr>
<td><img src="image" alt="Start Engine" /></td>
<td>Start Engine</td>
</tr>
<tr>
<td><img src="image" alt="Read Operator’s Manual" /></td>
<td>Read Operator’s Manual</td>
</tr>
<tr>
<td><img src="image" alt="Amperes" /></td>
<td>Amperes (A)</td>
</tr>
<tr>
<td><img src="image" alt="Volts" /></td>
<td>Volts (V)</td>
</tr>
<tr>
<td><img src="image" alt="Engine Oil" /></td>
<td>Engine Oil</td>
</tr>
<tr>
<td><img src="image" alt="Fuel" /></td>
<td>Fuel</td>
</tr>
<tr>
<td><img src="image" alt="Battery (Engine)" /></td>
<td>Battery (Engine)</td>
</tr>
<tr>
<td><img src="image" alt="Engine" /></td>
<td>Engine</td>
</tr>
<tr>
<td><img src="image" alt="Engine Choke" /></td>
<td>Engine Choke</td>
</tr>
<tr>
<td><img src="image" alt="Check Valve Clearance" /></td>
<td>Check Valve Clearance</td>
</tr>
<tr>
<td><img src="image" alt="Do not switch while welding" /></td>
<td>Do not switch while welding</td>
</tr>
<tr>
<td><img src="image" alt="Work Connection" /></td>
<td>Work Connection</td>
</tr>
<tr>
<td><img src="image" alt="Positive" /></td>
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<tr>
<td><img src="image" alt="Negative" /></td>
<td>Negative</td>
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<tr>
<td><img src="image" alt="Alternating Current (AC)" /></td>
<td>Alternating Current (AC)</td>
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<tr>
<td><img src="image" alt="Output" /></td>
<td>Output</td>
</tr>
<tr>
<td><img src="image" alt="Welding Arc (Electrode)" /></td>
<td>Welding Arc (Electrode)</td>
</tr>
<tr>
<td><img src="image" alt="MIG (GMAW), Wire" /></td>
<td>MIG (GMAW), Wire</td>
</tr>
<tr>
<td><img src="image" alt="Stick (SMAW)" /></td>
<td>Stick (SMAW)</td>
</tr>
<tr>
<td><img src="image" alt="TIG (GTAW)" /></td>
<td>TIG (GTAW)</td>
</tr>
<tr>
<td><img src="image" alt="Hours" /></td>
<td>Hours (h)</td>
</tr>
<tr>
<td><img src="image" alt="Seconds" /></td>
<td>Seconds (s)</td>
</tr>
<tr>
<td><img src="image" alt="Time" /></td>
<td>Time</td>
</tr>
<tr>
<td><img src="image" alt="Protective Earth (Ground)" /></td>
<td>Protective Earth (Ground)</td>
</tr>
<tr>
<td><img src="image" alt="Circuit Breaker" /></td>
<td>Circuit Breaker</td>
</tr>
<tr>
<td><img src="image" alt="Temperature" /></td>
<td>Temperature</td>
</tr>
</tbody>
</table>

3. Specifications

3.1 Weld, Power, and Engine Specifications

Note: This unit uses either an Onan or a Kohler engine. Differences between models are noted throughout this manual.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CC/DC</td>
<td>50 – 210 A</td>
<td>210 A, 25 V, 100% Duty Cycle</td>
<td>72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CV/DC</td>
<td>17 – 28 V</td>
<td>200 A, 20 V, 100% Duty Cycle</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2 Dimensions, Weights, and Operating Angles

Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>33-1/2 in (851 mm)</td>
</tr>
<tr>
<td>Width</td>
<td>18-3/4 in (476 mm)</td>
</tr>
<tr>
<td>Depth</td>
<td>46 in (1164 mm)</td>
</tr>
<tr>
<td>A</td>
<td>18 in (457 mm)</td>
</tr>
<tr>
<td>B</td>
<td>16-1/2 in (419 mm)</td>
</tr>
<tr>
<td>C</td>
<td>3/4 in (19 mm)</td>
</tr>
<tr>
<td>D</td>
<td>3-1/8 in (79 mm)</td>
</tr>
<tr>
<td>E</td>
<td>32-3/4 in (832 mm)</td>
</tr>
<tr>
<td>F</td>
<td>45-1/2 in (1156 mm)</td>
</tr>
<tr>
<td>G</td>
<td>13/32 in (10 mm) Dia.</td>
</tr>
</tbody>
</table>

⚠️ Do not exceed operating angles while running or engine damage will occur.
⚠️ Do not move or operate unit where it could tip.

Weight

Onan-Powered Unit: 573 lb (260 kg)
Kohler-Powered Unit: 565 lb (256 kg)

3.3 Auxiliary Power Curve

The auxiliary power curve shows the auxiliary power in amperes available at the receptacles.
3.4 Fuel Consumption (Onan-Powered Units)

3.5 Fuel Consumption (Kohler-Powered Units)
3.6 Duty Cycle

Duty cycle is the percentage of 10 minutes that unit can weld at rated load without overheating.

⚠️ Exceeding duty cycle can damage unit and void warranty.

Continuous Welding

100% Duty Cycle at 225 Amperes CC/AC, 210 Amperes CC/DC, 200 Amperes CV/DC

3.7 Volt-Ampere Curves

The volt-ampere curve shows the minimum and maximum voltage and amperage output capabilities of the welding generator. Curves of all other settings fall between the curves shown.

A. For CC/AC Mode

B. For CC/DC Mode

C. For CV/DC Mode
4. Installation

4.1 Installing Welding Generator

1 Generator Base
2 Metal Vehicle Frame
3 Equipment Grounding Terminal
4 Grounding Cable

Use #10 AWG or larger insulated copper wire.

▲ If unit does not have GFCI receptacles, use GFCI-protected extension cord.

Movement

▲ Do not lift unit from end.

Airflow Clearance

18 in (460 mm)

Location

Grounding

Electrically bond generator frame to vehicle frame by metal-to-metal contact.

18 in (460 mm)

18 in (460 mm)

18 in (460 mm)

18 in (460 mm)

4.2 Engine Prestart Checks (Onan-Powered Units)

Check all fluids daily. Engine must be cold and on a level surface. Unit is shipped with 10W30 engine oil.

Engine stops if oil pressure gets too low.

▲ Follow run-in procedure in engine manual.

Full

Full

Gasoline
4.3 Engine Prestart Checks (Kohler-Powered Units)

Check all fluids daily. Engine must be cold and on a level surface. Unit is shipped with 10W30 engine oil. Engine stops if oil pressure gets too low.

Follow run-in procedure in engine manual.

4.4 Connecting the Battery

Connect negative (−) cable last.

Tools Needed:
3/8, 1/2 in
### 4.5 Installing Exhaust Pipe

- **Point exhaust pipe in desired direction.** If unit is truck or trailer mounted, point pipe away from direction of travel.

### 4.6 Connecting to Weld Output Terminals

1. Work Weld Output Terminal
2. Electrode Weld Output Terminal

Connect work cable to Work terminal.

Connect electrode holder cable or electrode weld cable to Electrode terminal for Stick and MIG welding.

Connect torch cable to Electrode terminal for TIG welding.

Use Process Selector switch to select type of weld output (see Section 5.1).

### 4.7 Selecting Weld Cable Sizes

<table>
<thead>
<tr>
<th>Welding Amperes</th>
<th>Total Cable (Copper) Length in Weld Circuit Not Exceeding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 ft (30 m) or Less</td>
</tr>
<tr>
<td></td>
<td>10 – 60% Duty Cycle</td>
</tr>
<tr>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>150</td>
<td>3</td>
</tr>
<tr>
<td>200</td>
<td>3</td>
</tr>
<tr>
<td>250</td>
<td>2</td>
</tr>
<tr>
<td>300</td>
<td>1</td>
</tr>
<tr>
<td>350</td>
<td>1/0</td>
</tr>
</tbody>
</table>

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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ST-800 396-A / Ref. ST-183 175-A

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ST-801 681 / Ref. ST-183 175-A
5. Operating Welding Generator

5.1 Front Panel Controls

1. Engine Control Switch
   Use switch to start engine, select speed, and stop engine. In Run/Idle position, engine runs at idle speed at no load, and weld/power speed under load. In Run position, engine runs at weld/power speed.

2. Engine Choke Control
   Use control to change engine air-fuel mix.
   **To Start:** pull out choke and turn Engine Control switch to Start position. Release switch and slowly push choke in when engine starts. Do not crank engine if engine is still turning.

3. Engine Hour Meter

4. Weld Process Selector Switch
   - Do not switch under load.
   Use switch to select type of weld output.
   Use a positive (+) position for Direct Current Electrode Positive (DCEP) and a negative (–) position for Direct Current Electrode Negative. Use AC position for alternating current.

5. Coarse Adjust Switch
   - Do not switch under load.
   Use switch to select weld amperage range when Weld Process Selector switch is in Stick/Tig position, or voltage range when switch is in Wire position.

   **WARNING:** Electric shock can kill. Do not use at output in damp/wet area. If moisture is present, do not use. Use at output only if required for the welding process.

6. Fine Adjust Control
   Use control to select weld amperage (Stick/Tig) or voltage (Wire) within the range selected by the Coarse Adjust switch. Control may be adjusted while welding. Weld output would be 110 A DC based on control settings shown (50% of 70 to 150 A). Set control at 10 for maximum auxiliary power.
6. Operating Auxiliary Equipment

6.1 Standard Receptacles

⚠️ If unit does not have GFCI receptacles, use GFCI-protected extension cord.

⚠️ Auxiliary power decreases as weld current increases.

Set Fine Adjust control R1 at 10 for full auxiliary power.

1 240 V 50 A AC Receptacle RC1
RC1 supplies 60 Hz single-phase power at weld/power speed. Maximum output is 8 kVA/kW.

2 120 V 15 A AC Duplex Receptacle RC2

3 120 V 15 A AC Duplex Receptacle RC3
RC2 and RC3 supply 60 Hz single-phase power at weld/power speed. Maximum output from RC2 or RC3 is 2.4 kVA/kW. (CSA: 1.8 kVA/kW).

4 Circuit Breakers CB1 and CB2
CB1 and CB2 protect RC1 from overload. If CB1 or CB2 opens, RC1 and one of the 120 volt receptacles does not work. 120 volts may still be present at RC1.

5 Circuit Breaker CB3

6 Circuit Breaker CB4
CB3 protects RC2 and CB4 protects RC3 from overload. If a circuit breaker opens, the receptacle does not work.

Press button to reset circuit breaker. If breaker continues to open, contact Factory Authorized Service Agent.

Combined output of all receptacles limited to 8 kVA/kW rating of the generator.

EXAMPLE: If 20 A is drawn from each 120 V duplex receptacle, only 13 A is available at the 240 V receptacle:

\[2 \times (120 \text{ V} \times 20 \text{ A}) + (240 \text{ V} \times 13 \text{ A}) = 7.9 \text{ kVA/kW}\]

7 Auxiliary Power While Welding Label

---

**AC POWER**

**SIMULTANEOUS WELDING AND POWER WITH FINE ADJUST SET AT 10**

<table>
<thead>
<tr>
<th>Weld Current In Amperes</th>
<th>Total Power In Watts</th>
<th>120V Receptacle Amperes</th>
<th>240V Receptacle Amperes</th>
</tr>
</thead>
<tbody>
<tr>
<td>210</td>
<td>1000</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>140</td>
<td>4300</td>
<td>36</td>
<td>18</td>
</tr>
<tr>
<td>90</td>
<td>6000</td>
<td>50</td>
<td>25</td>
</tr>
</tbody>
</table>

See Owner’s Manual for additional information.

S-166 360-A
6.2 Optional Auxiliary Power Receptacles

If unit does not have GFCI receptacles, use GFCI-protected extension cord.

Auxiliary power decreases as weld current increases.

Set Fine Adjust control R1 at 10 for full auxiliary power.

Combined output of all receptacles limited to 8 kVA/kW rating of the generator.

GFCI Receptacle Option

1 120 V 15 A AC GFCI Receptacles GFCI2 and GFCI3

GFCI2 and GFCI3 supply 60 Hz single-phase power at weld/power speed. Maximum output from GFCI2 or GFCI3 is 2.4 kVA/kW. Circuit breaker protection is the same as standard receptacles.

If a ground fault is detected, the GFCI Reset button pops out and the circuit opens to disconnect the faulty equipment. Check for damaged tools, cords, plugs, etc. connected to the receptacle. Press button to reset receptacle and resume operation.

At least once a month, run engine at weld/power speed and press Test button to verify GFCI is working properly.

South African And Australian Receptacle Options

2 240 V 16 A AC South African Receptacles RC1, RC2, and RC3

3 240 V 15 A AC Australian Receptacles RC1, RC2, and RC3

Receptacles supply 60 Hz single-phase power at weld/power speed. Maximum output from each receptacle is 3.6 kVA/kW.

4 Circuit Breakers CB1, CB2, CB3

CB1, CB2, and CB3 protect RC1, RC2, and RC3 from overload. If a circuit breaker opens, the receptacle does not work.

5 Circuit Breaker CB4

CB4 protects all the receptacles from overload. If CB4 opens, none of the receptacles work.

Press button to reset circuit breaker. If breaker continues to open, contact Factory Authorized Service Agent.
The plug can be wired for a 240 V, 2-wire load or a 120/240 V, 3-wire load. See circuit diagram.

1. Plug Wired for 120/240 V, 3-Wire Load
When wired for 120 V loads, each duplex receptacle shares a load with one half of 240 V receptacle.

2. Plug Wired for 240 V, 2-Wire Load

3. Neutral (Silver) Terminal
4. Load 1 (Brass) Terminal
5. Load 2 (Brass) Terminal
6. Ground (Green) Terminal
7. Amperes Available Using 120/240 V Plug

### Tools Needed:

![Tools Needed Image]

### Current Available in Amperes

<table>
<thead>
<tr>
<th>240 V Receptacle*</th>
<th>Each 120 V Duplex Receptacle</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

\[ V \times A = \text{Watts} \]

*One 240 V load or two 120 V loads.
7. Maintenance (Onan-Powered Units)

7.1 Routine Maintenance (Onan-Powered Units)

Recycle engine fluids.

▲ Stop engine before maintaining.

See also Engine Manual and maintenance label. Service engine more often if used in severe conditions.

8 h

Check fluid levels. See Section 4.2.

Wipe up spills.

20 h

Check and clean spark arrestor screen. See Section 7.7.

25 h

Service air cleaner wrapper (foam element). See Section 7.3.

50 h

Clean and tighten weld terminals.

Clean cooling system. See Engine Manual.

100 h

Change oil. See Section 7.5 and maintenance label.

Change oil filter. See Section 7.5 and maintenance label.

Clean and tighten battery connections.

Service air cleaner element. See Section 7.3.

200 h

Check valve clearance.

Replace fuel filter. See Section 7.5.

Check spark plugs.

Replace unreadable labels.

500 h

Repair or replace cracked cables.

1000 h

Remove cylinder head deposits.

Clean crankcase breather valve.

Blow out or vacuum inside. During heavy service, clean monthly.

OR Clean crankcase breather valve.
### 7.2 Maintenance Label (Onan-Powered Units)

**ONAN P216/P220 GAS ENGINE**


- **Check daily.**
- **To Drain Oil:**
  - **Push And Turn CCW**
  - **1/2 in. ID Hose**

#### Recommended Oil
- API Service Classification: SF/CC, SG/CE, SH

#### Oil & Filter Change CONDITIONS
- **Normal**
  - P216: 100 hours, 50 hours
  - P220: 50 hours, 50 hours
- **Severe**
  - P216: 50 hours, 50 hours
  - P220: 50 hours, 50 hours

- **Oil Filter**
  - MILLER 065 251, Onan 122-0645
- **Oil Capacity**
  - 1.5 qt (1.4 L) or 1.75 qt (1.6 L) with filter change

- **Fuel Grade**
  - Regular or Unleaded
- **Fuel Filter**
  - MILLER 066 113, Onan 149-2206-01, Fram G10E1

- **Air Filter Service**
  - 100 hours or less – see Owner’s Manual
- **Air Filter Element**
  - MILLER 064 617, Onan 140-2628-01
- **Air Filter Wrapper**
  - MILLER 065 653, Onan 140-1496

- **12 Volt Battery**
  - BCI Group 58
- **Cranking Performance at 0°F (-18°C)**
  - 430 Amps min.

- **Engine RPM – No Load**
  - Weld/Power: 3700
  - Idle: 2200

- **Valve Clearance – Cold**
  - In.: 0.005 in (0.13 mm)
  - Ex.: 0.013 in (0.33 mm)

- **Spark Plug Gap**
  - 0.025 in. (0.6 mm)
- **Spark Plug**
  - Champion RS17YX Preferred or RS14YC
  - Use only resistor spark plugs and wires.

- **Spark Arrestor Inspection And Service**
  - 20 operating hours - see Owner’s Manual
7.3 Servicing Air Cleaner (Onan-Powered Units)

Stop engine.

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

1 Wrapper (Foam Element)
   Wash wrapper with soap and water solution. Allow wrapper to air dry completely.
   Spread 1 tablespoon SAE 30 oil evenly into wrapper. Squeeze out excess oil.

2 Element
   Replace element if dirty, oily, or damaged.

7.4 Overload Protection (Onan-Powered Units)

Stop engine. Disconnect negative (−) battery cable.

1 Fuse F1 (See Parts List)
   F1 protects the exciter excitation winding from overload. If F1 opens, there is no/low weld and auxiliary power output.

2 Fuse F6 (See Parts List)
   F6 protects the engine wiring system from overload. If F6 opens, engine will not crank.
   Replace any open fuses. Reinstall cover before operating.

If any fuse continues to open, contact Factory Authorized Service Agent.

Tools Needed:

3/8 in
Stop engine and let cool.

1. Oil Drain Valve
2. 1/2 ID x 12 in Hose
3. Oil Filter

Change engine oil and filter according to engine owner's manual.

Close valve and valve cap before adding oil and running engine.

Fill crankcase with new oil to full mark on dipstick (see Section 7.2).

4. Fuel Filter
5. Fuel Line

Replace line if cracked or worn. Install new filter. Wipe up any spilled fuel.

Start engine, and check for fuel leaks.

Stop engine, tighten connections as necessary, and wipe up fuel.

Tools Needed:
7.6 Adjusting Engine Speed (Onan-Powered Units)

After tuning engine, check engine speeds with a tachometer (see table). If necessary, adjust speeds as follows:

Start engine and run until warm. Turn Fine Adjust control to 10. Remove top cover to access speed adjustments.

**Idle Speed Adjustment**

1. Throttle Solenoid
2. Mounting Screw
Loosen two mounting screws.
3. Governor Arm
4. Carburetor
5. Idle Speed Screw
Pull governor arm away from carburetor and hold while making the following adjustment:

Turn idle speed screw until engine runs at idle speed (see table). Release governor arm. Place Engine Control switch in Run/Idle position.

6. Carburetor Stop
With solenoid energized, slide solenoid until idle speed screw just touches carburetor stop. Tighten solenoid mounting screws.

7. Governor Arm Extension
Check for smooth operation, and readjust solenoid position if necessary.

**Weld/Power Speed Adjustment**

Place Engine Control switch in Run position.

8. Weld/Power Speed Rod
9. Locking Nut
Loosen nut.
10. Adjustment Nut
Turn adjustment nut until engine runs at weld/power speed. Tighten locking nut.

▲ Stop engine.

11. Sensitivity Spring
See engine manual for governor sensitivity adjustment.
Reinstall top cover.

**Tools Needed:**

- 1/4, 3/8 in
7.7 Servicing Optional Spark Arrestor (Onan-Powered Units)

Stop engine and let cool.

1 Spark Arrestor Screen
Clean and inspect screen. Replace spark arrestor if screen wires are broken or missing.

Tools Needed:

1/4 in
8. Maintenance (Kohler-Powered Units)

### 8.1 Routine Maintenance (Kohler-Powered Units)

- **Stop engine before maintaining.**
- Recycle engine fluids.
- See also Engine Manual and maintenance label. Service engine more often if used in severe conditions.

- **8 h**
  - Wipe up spills.
  - Check fluid levels. See Section 4.2.

- **20 h**
  - Check and clean optional spark arrestor screen. See Section 8.7.

- **25 h**
  - Service air cleaner wrapper (foam element). See Section 8.3.

- **50 h**
  - Clean and tighten weld terminals.

- **100 h**
  - Change oil. See Section 8.4 and maintenance label.
  - Check air cleaner element. See Section 8.3.
  - Clean cooling system. See Engine Manual.
  - Clean and tighten battery connections.

- **200 h**
  - Change oil filter. See Section 8.4 and maintenance label.
  - Replace fuel filter. See Section 8.4.
  - Check spark plugs.
  - Replace unreadable labels.

- **500 h**
  - Repair or replace cracked cables.

- **1000 h**
  - Blow out or vacuum inside. During heavy service, clean monthly.
  - OR
8.2 Maintenance Label (Kohler-Powered Units)

<table>
<thead>
<tr>
<th>KOHLER CH18 GAS ENGINE</th>
</tr>
</thead>
</table>

- **Check daily.**
- **To Drain Oil:**
  - Push And Turn CCW
  - 1/2 in. ID Hose
  - Pull

**Recommended Oil**

- API Service Classification SF-SG/CC-CD
- (if using optional LP gas fuel, use synthetic oil after first oil change)

**Oil Change**

- 100 hours

**Oil Filter Change**

- 200 hours

**Oil Filter**

- MILLER 066 698, Kohler 1205001

**Oil Capacity**

- 1.75 qt (1.7 L) or 2 qt (1.9 L) with filter change

**Fuel Grade**

- Unleaded, 87 Octane min.

**Fuel Filter**

- MILLER 066 113, Kohler 2505003

**Gasoline**

**Air Filter Service**

- 100 hours or less – see Owner’s Manual

**Air Filter Element**

- MILLER 067 272, Kohler 4708303

**Air Filter Wrapper**

- MILLER 067 273, Kohler 2408302

**Engine RPM – No Load**

- Weld/Power: 3700
- Idle: 2200

**Spark Plug Gap**

- 0.040 in. (1.02 mm)

**Spark Plug**

- Champion RC-12YC

- Use only resistor spark plugs and wires.

**Spark Arrestor Inspection And Service**

- 20 operating hours - see Owner’s Manual

---

8.3 Servicing Air Cleaner (Kohler-Powered Units)

⚠ **Stop engine.**

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

1. **Wrapper (Foam Element)**

   - Wash wrapper with soap and water solution. Allow wrapper to air dry completely.
   - Spread 1 tablespoon SAE 30 oil evenly into wrapper. Squeeze out excess oil.

2. **Element**

   - Replace element if dirty, oily, or damaged.
8.4 Changing Engine Oil, Oil Filter, and Fuel Filter (Kohler-Powered Units)

▲ Stop engine and let cool.
1 Oil Drain Valve
2 1/2 ID x 12 in Hose
3 Oil Filter
4 Oil Fill Cap/Dipstick
Change engine oil and filter according to engine owner’s manual.
▲ Close valve and valve cap before adding oil and running engine.
Fill crankcase with new oil to full mark on dipstick (see Section 7.2).
5 Fuel Filter
6 Fuel Line
Replace line if cracked or worn. Install new filter. Wipe up any spilled fuel.
Start engine, and check for fuel leaks.
▲ Stop engine, tighten connections as necessary, and wipe up fuel.

Tools Needed:
8.5 Adjusting Engine Speed (Kohler-Powered Units)

After tuning engine, check engine speeds with a tachometer (see table). If necessary, adjust speeds as follows:

Start engine and run until warm.
Turn Fine Adjust control to 10.
Remove top cover to access speed adjustments.

**Idle Speed Adjustment**
Move Engine Control switch to Run/Idle position.

1. Throttle Solenoid
2. Mounting Screws
3. Idle Speed Screw

Loosen mounting screws. Adjust solenoid position so engine runs at idle speed. If necessary, back out idle speed screw so solenoid can be moved to correct position. Tighten mounting screws. Be sure solenoid linkage works smoothly.

Turn idle speed screw for fine adjustments.

**Weld/Power Speed Adjustment**
Move Engine Control switch to Run position.

4. Weld/Power Speed Adjustment Nut
5. Lock Nut

Loosen lock nut. Turn adjustment nut until engine runs at weld/power speed. Tighten lock nut.

Reinstall top cover.

⚠ **Stop engine.**

---

**Tools Needed:**
- 1/4, 3/8 in

---

Ref. ST-801 188-B / ST-801 209
8.6 Overload Protection (Kohler-Powered Units)

▲ Stop engine.

1. Fuse F1 (See Parts List)
   F1 protects the generator excitation circuit. If F1 opens, there will be no/low weld and auxiliary power output.

2. Fuse F6 (See Parts List)
   F6 protects the engine wiring harness. If F6 opens, the engine does not crank.

Replace any open fuses. Reinstall panel before operating unit.

If any fuse continues to open, contact Factory Authorized Service Agent.

Tools Needed:

8.7 Servicing Optional Spark Arrestor (Kohler-Powered Units)

▲ Stop engine and let cool.

1. Spark Arrestor Screen
   Clean and inspect screen. Replace spark arrestor if screen wires are broken or missing.

Tools Needed:
## 9. Troubleshooting

### 9.1 Welding

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No weld output.</td>
<td>Check control settings.</td>
</tr>
<tr>
<td></td>
<td>Check weld connections.</td>
</tr>
<tr>
<td></td>
<td>Check fuse F1 and replace if open (see Section 7.4 or 8.6).</td>
</tr>
<tr>
<td></td>
<td>Be sure all equipment is disconnected from receptacles when starting unit.</td>
</tr>
<tr>
<td></td>
<td>Have Factory Authorized Service Agent check brushes, slip rings, and integrated rectifier SR2.</td>
</tr>
<tr>
<td></td>
<td>Check plug PLG6 connection.</td>
</tr>
<tr>
<td>Low weld output.</td>
<td>Check fuse F1 and replace if open (see Section 7.4 or 8.6).</td>
</tr>
<tr>
<td></td>
<td>Check control settings.</td>
</tr>
<tr>
<td></td>
<td>Check and adjust engine speed (see Section 7.6 or 8.5).</td>
</tr>
<tr>
<td></td>
<td>Service air cleaner according to engine manual.</td>
</tr>
<tr>
<td></td>
<td>Have Factory Authorized Service Agent check brushes and slip rings.</td>
</tr>
<tr>
<td>High weld output.</td>
<td>Check control settings.</td>
</tr>
<tr>
<td></td>
<td>Check and adjust engine speed (see Section 7.6 or 8.5).</td>
</tr>
<tr>
<td>Erratic weld output.</td>
<td>Check control settings.</td>
</tr>
<tr>
<td></td>
<td>Tighten and clean connections to electrode and workpiece.</td>
</tr>
<tr>
<td></td>
<td>Use dry, properly-stored electrodes for Stick and TIG welding.</td>
</tr>
<tr>
<td></td>
<td>Remove excessive coils from weld cables.</td>
</tr>
<tr>
<td></td>
<td>Clean and tighten connections both inside and outside welding generator.</td>
</tr>
<tr>
<td></td>
<td>Check and adjust engine speed (see Section 7.6 or 8.5).</td>
</tr>
<tr>
<td></td>
<td>Have Factory Authorized Service Agent check brushes and slip rings.</td>
</tr>
</tbody>
</table>

### 9.2 Auxiliary Power

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No output at auxiliary power receptacles.</td>
<td>Reset circuit breakers (see Section 6.1 or 6.2).</td>
</tr>
<tr>
<td></td>
<td>Press optional GFCI receptacle Reset button (see Section 6.2).</td>
</tr>
<tr>
<td>No output at auxiliary power receptacles.</td>
<td>Check fuse F1 and replace if open (see Section 7.4 or 8.6).</td>
</tr>
<tr>
<td></td>
<td>Check plug PLG6 connection.</td>
</tr>
<tr>
<td></td>
<td>Have Factory Authorized Service Agent check brushes, slip rings, and integrated rectifier SR2.</td>
</tr>
<tr>
<td>High power output.</td>
<td>Check and adjust engine speed (see Section 7.6 or 8.5).</td>
</tr>
<tr>
<td>Low power output.</td>
<td>Check fuse F1 and replace if open (see Section 7.4 or 8.6).</td>
</tr>
<tr>
<td></td>
<td>Increase Fine Adjust control R1 setting.</td>
</tr>
<tr>
<td>Erratic power output.</td>
<td>Check fuel level.</td>
</tr>
<tr>
<td></td>
<td>Check and adjust engine speed (see Section 7.6 or 8.5).</td>
</tr>
<tr>
<td>Erratic power output.</td>
<td>Check receptacle wiring and connections.</td>
</tr>
<tr>
<td></td>
<td>Have Factory Authorized Service Agent check brushes and slip rings.</td>
</tr>
</tbody>
</table>
## 9.3 Engine

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| Engine will not crank. | Check fuse F6, and replace if open (see Section 7.4 or 8.6).  
Check battery voltage.  
Check battery connections and tighten if necessary.  
Check plug PLG4 and plug PLG8 connections.  
Have Factory Authorized Service Agent check Engine Control switch S2. |
| Engine will not start. | Check fuel level.  
Check battery voltage.  
Check battery connections and tighten if necessary.  
Check oil level (see Section 4.2).  
Check low oil pressure shutdown switch (see Parts List for location).  
Have Factory Authorized Service Agent check fuel shutoff solenoid FS1 (FS1 optional on Onan-powered units). |
| Engine starts but stops when Engine Control switch returns to Run position. | Check oil level.  
Check and refill crankcase with proper viscosity oil for operating temperature, if necessary.  
Check low oil pressure shutdown switch (see Parts List for location). |
| Engine stopped during normal operation. | Check fuel level.  
Check oil level (see Section 4.2).  
Check low oil pressure shutdown switch (see Parts List for location)  
Periodically recharge battery (approximately every 3 months).  
Replace battery.  
Check voltage regulator and connections according to engine manual.  
Have Factory Authorized Service Agent check fuel shutoff solenoid FS1 (FS1 optional on Onan-powered units). |
| Battery Discharges between uses. | Clean battery, terminals, and posts with baking soda and water solution; rinse with clear water.  
Periodically recharge battery (approximately every 3 months).  
Replace battery.  
Check voltage regulator and connections according to engine manual. |
| Engine idles but does not come up to weld speed. | Have Factory Authorized Service Agent check auto idle module PC1, and current transformer CT1. |
| Unstable or sluggish engine speeds. | Readjust throttle linkage if necessary. Check throttle solenoid TS1 for smooth operation.  
Tune-up engine according to engine manual. |
| Engine does not return to idle speed. | Remove weld and auxiliary power loads.  
Check throttle linkage for smooth, non-binding operation.  
Have Factory Authorized Service Agent check idle module PC1, current transformer CT1, Engine Control switch S2, and throttle solenoid TS1. |
10. Electrical Diagrams

10.1 Circuit Diagram For Welding Generator (Onan-Powered Units)
10.2 Circuit Diagram For Welding Generator (Kohler-Powered Units)
11. Auxiliary Power Guidelines

11.1 Selecting Equipment

1. Auxiliary Power Receptacles
   - Neutral Bonded To Frame
2. 3-Prong Plug From Case
   - Grounded Equipment
3. 2-Prong Plug From Double Insulated Equipment

Be sure equipment has this symbol and/or wording.

11.2 Grounding Generator to Truck or Trailer Frame

1. Generator Base
2. Metal Vehicle Frame
3. Equipment Grounding Terminal
4. Grounding Cable

Use #10 AWG or larger insulated copper wire.

\[\text{If unit does not have GFCI receptacles, use GFCI-protected extension cord.}\]

Electrically bond generator frame to vehicle frame by metal-to-metal contact.
11.3 Grounding When Supplying Building Systems

1 Equipment Grounding Terminal
2 Grounding Cable
Use #10 AWG or larger insulated copper wire.
3 Ground Device

▲ Ground generator to system earth ground if supplying power to a premises (home, shop, farm) wiring system.

11.4 How Much Power Does Equipment Require?

1 Resistive Load
A light bulb is a resistive load and requires a constant amount of power.

2 Non-Resistive Load
Equipment with a motor is a non-resistive load and requires approximately six times more power while starting the motor than when running (see Section 11.8).

3 Rating Data
Rating shows volts and amperes, or watts required to run equipment.

EXAMPLE 1: If a drill uses 4.5 amperes at 115 volts, calculate its running power requirement in watts.

\[ 4.5 \text{ A} \times 115 \text{ V} = 520 \text{ W} \]

The load applied by the drill is 520 watts.

EXAMPLE 2: If three 200 watt flood lamps are used with the drill from Example 1, add the individual loads to calculate total load.

\[ (200 \text{ W} + 200 \text{ W} + 200 \text{ W}) + 520 \text{ W} = 1120 \text{ W} \]

The total load applied by the three flood lamps and drill is 1120 watts.

AMPERES x VOLTS = WATTS
### 11.5 Approximate Power Requirements for Industrial Motors

<table>
<thead>
<tr>
<th>Industrial Motors</th>
<th>Rating</th>
<th>Starting Watts</th>
<th>Running Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split Phase</td>
<td>1/8 HP</td>
<td>800</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>1/6 HP</td>
<td>1225</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>1/4 HP</td>
<td>1600</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>1/3 HP</td>
<td>2100</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>1/2 HP</td>
<td>3175</td>
<td>875</td>
</tr>
<tr>
<td>Capacitor Start-Induction Run</td>
<td>1/3 HP</td>
<td>2020</td>
<td>720</td>
</tr>
<tr>
<td></td>
<td>1/2 HP</td>
<td>3075</td>
<td>975</td>
</tr>
<tr>
<td></td>
<td>3/4 HP</td>
<td>4500</td>
<td>1400</td>
</tr>
<tr>
<td></td>
<td>1 HP</td>
<td>6100</td>
<td>1600</td>
</tr>
<tr>
<td></td>
<td>1-1/2 HP</td>
<td>8200</td>
<td>2200</td>
</tr>
<tr>
<td></td>
<td>2 HP</td>
<td>10550</td>
<td>2850</td>
</tr>
<tr>
<td></td>
<td>3 HP</td>
<td>15900</td>
<td>3900</td>
</tr>
<tr>
<td></td>
<td>5 HP</td>
<td>23300</td>
<td>6800</td>
</tr>
<tr>
<td>Capacitor Start-Capacitor Run</td>
<td>1-1/2 HP</td>
<td>8100</td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td>5 HP</td>
<td>23300</td>
<td>6000</td>
</tr>
<tr>
<td></td>
<td>7-1/2 HP</td>
<td>35000</td>
<td>8000</td>
</tr>
<tr>
<td></td>
<td>10 HP</td>
<td>46700</td>
<td>10700</td>
</tr>
<tr>
<td>Fan Duty</td>
<td>1/8 HP</td>
<td>1000</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>1/6 HP</td>
<td>1400</td>
<td>550</td>
</tr>
<tr>
<td></td>
<td>1/4 HP</td>
<td>1850</td>
<td>650</td>
</tr>
<tr>
<td></td>
<td>1/3 HP</td>
<td>2400</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>1/2 HP</td>
<td>3500</td>
<td>1100</td>
</tr>
</tbody>
</table>

### 11.6 Approximate Power Requirements for Farm/Home Equipment

<table>
<thead>
<tr>
<th>Farm/Home Equipment</th>
<th>Rating</th>
<th>Starting Watts</th>
<th>Running Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock Tank De-Icer</td>
<td></td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Grain Cleaner</td>
<td>1/4 HP</td>
<td>1650</td>
<td>650</td>
</tr>
<tr>
<td>Portable Conveyor</td>
<td>1/2 HP</td>
<td>3400</td>
<td>1000</td>
</tr>
<tr>
<td>Grain Elevator</td>
<td>3/4 HP</td>
<td>4400</td>
<td>1400</td>
</tr>
<tr>
<td>Milk Cooler</td>
<td></td>
<td>2900</td>
<td>1100</td>
</tr>
<tr>
<td>Milker (Vacuum Pump)</td>
<td>2 HP</td>
<td>10500</td>
<td>2800</td>
</tr>
<tr>
<td>FARM DUTY MOTORS</td>
<td>1/3 HP</td>
<td>1720</td>
<td>720</td>
</tr>
<tr>
<td>Std. (e.g. Conveyors, Feed Augers, Air Compressors)</td>
<td>1/2 HP</td>
<td>2575</td>
<td>975</td>
</tr>
<tr>
<td></td>
<td>3/4 HP</td>
<td>4500</td>
<td>1400</td>
</tr>
<tr>
<td>Compressors)</td>
<td>1 HP</td>
<td>6100</td>
<td>1600</td>
</tr>
<tr>
<td></td>
<td>1-1/2 HP</td>
<td>8200</td>
<td>2200</td>
</tr>
<tr>
<td></td>
<td>2 HP</td>
<td>10550</td>
<td>2850</td>
</tr>
<tr>
<td></td>
<td>3 HP</td>
<td>15900</td>
<td>3900</td>
</tr>
<tr>
<td></td>
<td>5 HP</td>
<td>23300</td>
<td>6800</td>
</tr>
<tr>
<td>High Torque (e.g. Barn Cleaners, Silo Unloaders, Silo Hoists, Bunk Feeders)</td>
<td>1-1/2 HP</td>
<td>8100</td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td>5 HP</td>
<td>23300</td>
<td>6000</td>
</tr>
<tr>
<td></td>
<td>7-1/2 HP</td>
<td>35000</td>
<td>8000</td>
</tr>
<tr>
<td></td>
<td>10 HP</td>
<td>46700</td>
<td>10700</td>
</tr>
<tr>
<td>3-1/2 cu. ft. Mixer</td>
<td>1/2 HP</td>
<td>3300</td>
<td>1000</td>
</tr>
<tr>
<td>High Pressure 1.8 Gal/Min</td>
<td>500 PSI</td>
<td>3150</td>
<td>950</td>
</tr>
<tr>
<td>Washer 2 gal/min</td>
<td>550 PSI</td>
<td>4500</td>
<td>1400</td>
</tr>
<tr>
<td></td>
<td>2 gal/min</td>
<td>700 PSI</td>
<td>1600</td>
</tr>
<tr>
<td>Refrigerator or Freezer</td>
<td></td>
<td>3100</td>
<td>800</td>
</tr>
<tr>
<td>Shallow Well Pump</td>
<td>1/3 HP</td>
<td>2150</td>
<td>750</td>
</tr>
<tr>
<td></td>
<td>1/2 HP</td>
<td>3100</td>
<td>1000</td>
</tr>
<tr>
<td>Sump Pump</td>
<td>1/3 HP</td>
<td>2100</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>1/2 HP</td>
<td>3200</td>
<td>1050</td>
</tr>
</tbody>
</table>
### 11.7 Approximate Power Requirements for Contractor Equipment

<table>
<thead>
<tr>
<th>Contractor</th>
<th>Rating</th>
<th>Starting Watts</th>
<th>Running Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Drill</td>
<td>1/4 in</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>3/8 in</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>1/2 in</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Circular Saw</td>
<td>6-1/2 in</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>7-1/4 in</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td></td>
<td>8-1/4 in</td>
<td>1400</td>
<td>1400</td>
</tr>
<tr>
<td>Table Saw</td>
<td>9 in</td>
<td>4500</td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>10 in</td>
<td>6300</td>
<td>1800</td>
</tr>
<tr>
<td>Band Saw</td>
<td>14 in</td>
<td>2500</td>
<td>1100</td>
</tr>
<tr>
<td>Bench Grinder</td>
<td>6 in</td>
<td>1720</td>
<td>720</td>
</tr>
<tr>
<td></td>
<td>8 in</td>
<td>3900</td>
<td>1400</td>
</tr>
<tr>
<td></td>
<td>10 in</td>
<td>5200</td>
<td>1600</td>
</tr>
<tr>
<td>Air Compressor</td>
<td>1/2 HP</td>
<td>3000</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>1 HP</td>
<td>6000</td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>1-1/2 HP</td>
<td>8200</td>
<td>2200</td>
</tr>
<tr>
<td></td>
<td>2 HP</td>
<td>10500</td>
<td>2800</td>
</tr>
<tr>
<td>Electric Chain Saw</td>
<td>1-1/2 HP, 12 in</td>
<td>1100</td>
<td>1100</td>
</tr>
<tr>
<td></td>
<td>2 HP, 14 in</td>
<td>1100</td>
<td>1100</td>
</tr>
<tr>
<td>Electric Trimmer</td>
<td>Standard 9 in</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>Heavy Duty 12 in</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Electric Cultivator</td>
<td>1/3 HP</td>
<td>2100</td>
<td>700</td>
</tr>
<tr>
<td>Electric Hedge Trimmer</td>
<td>18 in</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Flood Lights</td>
<td>HID</td>
<td>125</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Metal Halide</td>
<td>313</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>Mercury</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>Sodium</td>
<td>1400</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vapor</td>
<td>1250</td>
<td>1000</td>
</tr>
<tr>
<td>Submersible Pump</td>
<td>400 gph</td>
<td>600</td>
<td>200</td>
</tr>
<tr>
<td>Centrifugal Pump</td>
<td>900 gph</td>
<td>900</td>
<td>500</td>
</tr>
<tr>
<td>Floor Polisher</td>
<td>3/4 HP, 16 in</td>
<td>4500</td>
<td>1400</td>
</tr>
<tr>
<td></td>
<td>1 HP, 20 in</td>
<td>6100</td>
<td>1600</td>
</tr>
<tr>
<td>High Pressure Washer</td>
<td>1/2 HP</td>
<td>3150</td>
<td>950</td>
</tr>
<tr>
<td></td>
<td>3/4 HP</td>
<td>4500</td>
<td>1400</td>
</tr>
<tr>
<td></td>
<td>1 HP</td>
<td>6100</td>
<td>1600</td>
</tr>
<tr>
<td>55 gal Drum Mixer</td>
<td>1/4 HP</td>
<td>1900</td>
<td>700</td>
</tr>
<tr>
<td>Wet &amp; Dry Vac</td>
<td>1.7 HP</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td></td>
<td>2-1/2 HP</td>
<td>1300</td>
<td>1300</td>
</tr>
</tbody>
</table>
11.8 Power Required to Start Motor

1. Motor Start Code
2. Running Amperage
3. Motor HP
4. Motor Voltage

To find starting amperage:

**Step 1:** Find code and use table to find kVA/HP. If code is not listed, multiply running amperage by six to find starting amperage.

**Step 2:** Find Motor HP and Volts.

**Step 3:** Determine starting amperage (see example).

Welding generator amperage output must be at least twice the motor's running amperage.

---

### Single-Phase Induction Motor Starting Requirements

<table>
<thead>
<tr>
<th>Motor Start Code</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>KVA/HP</td>
<td>6.3</td>
<td>7.1</td>
<td>8.0</td>
<td>9.0</td>
<td>10.0</td>
<td>11.2</td>
<td>12.5</td>
<td>14.0</td>
</tr>
</tbody>
</table>

\[
\frac{kVA/HP \times HP \times 1000}{VOLTS} = STARTING AMPERAGE
\]

**EXAMPLE:** Calculate the starting amperage required for a 230 V, 1/4 HP motor with a motor start code of M.

\[
\frac{11.2 \times 1/4 \times 1000}{230} = 12.2 \text{ A}
\]

Starting the motor requires 12.2 amperes.

---

11.9 How Much Power Can Generator Supply?

1. Limit Load To 90% Of Generator Output

Always start non-resistive (motor) loads in order from largest to smallest, and add resistive loads last.

2. 5 Second Rule

If motor does not start within 5 seconds, turn off power to prevent motor damage. Motor requires more power than generator can supply.

---

Ref. ST-800 396-A / S-0625
11.10 Typical Connections to Supply Standby Power

1. Power Company Service Meter

2. Main and Branch Overcurrent Protection

3. Double-Pole, Double-Throw Transfer Switch
   Obtain and install correct switch. Switch rating must be same as or greater than the branch overcurrent protection.

4. Circuit Breakers or Fused Disconnect Switch
   Obtain and install correct switch.

5. Extension Cord
   Select as shown in Section 11.11.

6. Generator Connections
   Connect terminals or plug of adequate amperage capacity to cord. Follow all applicable codes and safety practices.
   Turn off or unplug all equipment connected to generator before starting or stopping engine. When starting or stopping, the engine has low speed which causes low voltage and frequency.

7. Load Connections

---

Customer-supplied equipment is required if generator is to supply standby power during emergencies or power outages.
# 11.11 Selecting Extension Cord (Use Shortest Cord Possible)

## Cord Lengths for 120 Volt Loads

▲ If unit does not have GFCI receptacles, use GFCI-protected extension cord.

<table>
<thead>
<tr>
<th>Current (Amperes)</th>
<th>Load (Watts)</th>
<th>Maximum Allowable Cord Length in ft (m) for Conductor Size (AWG)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>840</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1200</td>
<td>400 (122)</td>
</tr>
<tr>
<td>15</td>
<td>1800</td>
<td>300 (91)</td>
</tr>
<tr>
<td>20</td>
<td>2400</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>3600</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>4200</td>
<td>125 (38)</td>
</tr>
<tr>
<td>40</td>
<td>4800</td>
<td>112 (34)</td>
</tr>
<tr>
<td>45</td>
<td>5400</td>
<td>100 (30)</td>
</tr>
<tr>
<td>50</td>
<td>6000</td>
<td>87 (26)</td>
</tr>
</tbody>
</table>

*Conductor size is based on maximum 2% voltage drop

## Cord Lengths for 240 Volt Loads

▲ If unit does not have GFCI receptacles, use GFCI-protected extension cord.

<table>
<thead>
<tr>
<th>Current (Amperes)</th>
<th>Load (Watts)</th>
<th>Maximum Allowable Cord Length in ft (m) for Conductor Size (AWG)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>1200</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1680</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>2400</td>
<td>800 (244)</td>
</tr>
<tr>
<td>15</td>
<td>3600</td>
<td>600 (183)</td>
</tr>
<tr>
<td>20</td>
<td>4800</td>
<td>450 (137)</td>
</tr>
<tr>
<td>25</td>
<td>6000</td>
<td>350 (107)</td>
</tr>
<tr>
<td>30</td>
<td>7000</td>
<td>300 (91)</td>
</tr>
<tr>
<td>35</td>
<td>8400</td>
<td>250 (76)</td>
</tr>
<tr>
<td>40</td>
<td>9600</td>
<td>225 (69)</td>
</tr>
<tr>
<td>45</td>
<td>10,800</td>
<td>200 (61)</td>
</tr>
<tr>
<td>50</td>
<td>12,000</td>
<td>175 (53)</td>
</tr>
</tbody>
</table>

*Conductor size is based on maximum 2% voltage drop
12. Stick Welding (SMAW) Guidelines

12.1 Stick Welding Procedure

- Weld current starts when electrode touches workpiece.
- Weld current can damage electronic parts in vehicles. Disconnect both battery cables before welding on a vehicle. Place work clamp as close to the weld as possible.

1 Workpiece
Make sure workpiece is clean before welding.

2 Work Clamp

3 Electrode
A small diameter electrode requires less current than a large one. Follow electrode manufacturer's instructions when setting weld amperage (see Section 12.2).

4 Insulated Electrode Holder

5 Electrode Holder Position

6 Arc Length
Arc length is the distance from the electrode to the workpiece. A short arc with correct amperage will give a sharp, crackling sound.

7 Slag
Use a chipping hammer and wire brush to remove slag. Remove slag and check weld bead before making another weld pass.
12.2 Electrode and Amperage Selection Chart

Ref. S-067 985-A

12.3 Striking an Arc – Scratch Start Technique

1. Electrode
2. Workpiece
3. Arc

Drag electrode across workpiece like striking a match; lift electrode slightly after touching work. If arc goes out electrode was lifted to high. If electrode sticks to workpiece, use a quick twist to free it.

12.4 Striking an Arc – Tapping Technique

1. Electrode
2. Workpiece
3. Arc

Bring electrode straight down to workpiece; then lift slightly to start arc. If arc goes out, electrode was lifted too high. If electrode sticks to workpiece, use a quick twist to free it.
12.5 Positioning Electrode Holder

End View of Work Angle

End View of Work Angle

GROOVE WELDS

Side View of Electrode Angle

Side View of Electrode Angle

FILLET WELDS

12.6 Poor Weld Bead Characteristics

1. Large Spatter Deposits
2. Rough, Uneven Bead
3. Slight Crater During Welding
4. Bad Overlap
5. Poor Penetration

12.7 Good Weld Bead Characteristics

1. Fine Spatter
2. Uniform Bead
3. Moderate Crater During Welding

Weld a new bead or layer for each 1/8 in. (3.2 mm) thickness in metals being welded.
4. No Overlap
5. Good Penetration into Base Metal
12.8 Conditions That Affect Weld Bead Shape

Note: Weld bead shape is affected by electrode angle, arc length, travel speed, and thickness of base metal.

- **ELECTRODE ANGLE**
  - Angle Too Small
  - Correct Angle: 10° - 30°
  - Angle Too Large

- **ARC LENGTH**
  - Too Short
  - Normal
  - Too Long
  - Spatter

- **TRAVEL SPEED**
  - Slow
  - Normal
  - Fast

12.9 Electrode Movement During Welding

Note: Normally, a single stringer bead is satisfactory for most narrow groove weld joints; however, for wide groove weld joints or bridging across gaps, a weave bead or multiple stringer beads work better.

1. Stringer Bead – Steady Movement Along Seam
2. Weave Bead – Side to Side Movement Along Seam
3. Weave Patterns
   Use weave patterns to cover a wide area in one pass of the electrode. Do not let weave width exceed 2-1/2 times diameter of electrode.
### 12.10 Butt Joints

1. **Tack Welds**
   Prevent edges of joint from drawing together ahead of electrode by tack welding the materials in position before final weld.

2. **Square Groove Weld**
   Good for materials up to 3/16 in (5 mm) thick.

3. **Single V-Groove Weld**
   Good for materials 3/16 – 3/4 in (5-19 mm) thick. Cut bevel with oxy-acetylene or plasma cutting equipment. Remove scale from material after cutting. A grinder can also be used to prepare bevels.
   Create 30 degree angle of bevel on materials in V-groove welding.

4. **Double V-Groove Weld**
   Good for materials thicker than 3/16 in (5 mm).

### 12.11 Lap Joint

1. **Electrode**

2. **Single-Layer Fillet Weld**
   Move electrode in circular motion.

3. **Multi-Layer Fillet Weld**
   Weld a second layer when a heavier fillet is needed. Remove slag before making another weld pass. Weld both sides of joint for maximum strength.

### 12.12 Tee Joint

1. **Electrode**

2. **Fillet Weld**
   Keep arc short and move at definite rate of speed. Hold electrode as shown to provide fusion into the corner. Square edge of the weld surface.
   For maximum strength weld both sides of upright section.

3. **Multi-Layer Deposits**
   Weld a second layer when a heavier fillet is needed. Use any of the weaving patterns shown in Section 12.9. Remove slag before making another weld pass.
12.13 Weld Test

1. Vise
2. Weld Joint
3. Hammer

Strike weld joint in direction shown. A good weld bends over but does not break.

12.14 Troubleshooting – Porosity

Porosity – small cavities or holes resulting from gas pockets in weld metal.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arc length too long.</td>
<td>Reduce arc length.</td>
</tr>
<tr>
<td>Damp electrode.</td>
<td>Use dry electrode.</td>
</tr>
<tr>
<td>Workpiece dirty.</td>
<td>Remove all grease, oil, moisture, rust, paint, coatings, slag, and dirt from work surface before welding.</td>
</tr>
</tbody>
</table>

12.15 Troubleshooting – Excessive Spatter

Excessive Spatter – scattering of molten metal particles that cool to solid form near weld bead.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amperage too high for electrode.</td>
<td>Decrease amperage or select larger electrode.</td>
</tr>
<tr>
<td>Arc length too long or voltage too high.</td>
<td>Reduce arc length or voltage.</td>
</tr>
</tbody>
</table>
12.16 Troubleshooting – Incomplete Fusion

**Incomplete Fusion** – failure of weld metal to fuse completely with base metal or a preceding weld bead.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient heat input.</td>
<td>Increase amperage. Select larger electrode and increase amperage.</td>
</tr>
<tr>
<td>Improper welding technique.</td>
<td>Place stringer bead in proper location(s) at joint during welding.</td>
</tr>
<tr>
<td></td>
<td>Adjust work angle or widen groove to access bottom during welding.</td>
</tr>
<tr>
<td></td>
<td>Momentarily hold arc on groove side walls when using weaving technique.</td>
</tr>
<tr>
<td></td>
<td>Keep arc on leading edge of weld puddle.</td>
</tr>
<tr>
<td>Workpiece dirty.</td>
<td>Remove all grease, oil, moisture, rust, paint, coatings, slag, and dirt from work surface before welding.</td>
</tr>
</tbody>
</table>

12.17 Troubleshooting – Lack Of Penetration

**Lack Of Penetration** – shallow fusion between weld metal and base metal.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper joint preparation.</td>
<td>Material too thick. Joint preparation and design must provide access to bottom of groove.</td>
</tr>
<tr>
<td>Improper weld technique.</td>
<td>Keep arc on leading edge of weld puddle.</td>
</tr>
<tr>
<td>Insufficient heat input.</td>
<td>Increase amperage. Select larger electrode and increase amperage.</td>
</tr>
<tr>
<td></td>
<td>Reduce travel speed.</td>
</tr>
</tbody>
</table>

12.18 Troubleshooting – Excessive Penetration

**Excessive Penetration** – weld metal melting through base metal and hanging underneath weld.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive heat input.</td>
<td>Select lower amperage. Use smaller electrode.</td>
</tr>
<tr>
<td></td>
<td>Increase and/or maintain steady travel speed.</td>
</tr>
</tbody>
</table>
## 12.19 Troubleshooting – Burn-Through

**Burn-Through** – weld metal melting completely through base metal resulting in holes where no metal remains.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive heat input.</td>
<td>Select lower amperage. Use smaller electrode.</td>
</tr>
<tr>
<td></td>
<td>Increase and/or maintain steady travel speed.</td>
</tr>
</tbody>
</table>

## 12.20 Troubleshooting – Waviness Of Bead

**Waviness Of Bead** – weld metal that is not parallel and does not cover joint formed by base metal.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsteady hand.</td>
<td>Use two hands. Practice technique.</td>
</tr>
</tbody>
</table>

## 12.21 Troubleshooting – Distortion

**Distortion** – contraction of weld metal during welding that forces base metal to move.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive heat input.</td>
<td>Use restraint (clamp) to hold base metal in position.</td>
</tr>
<tr>
<td></td>
<td>Make tack welds along joint before starting welding operation.</td>
</tr>
<tr>
<td></td>
<td>Select lower amperage for electrode.</td>
</tr>
<tr>
<td></td>
<td>Increase travel speed.</td>
</tr>
<tr>
<td></td>
<td>Weld in small segments and allow cooling between welds.</td>
</tr>
</tbody>
</table>
13. MIG Welding (GMAW) Guidelines

13.1 Typical MIG Process Connections

⚠️ Weld current can damage electronic parts in vehicles. Disconnect both battery cables before welding on a vehicle. Place work clamp as close to the weld as possible.
13.2 Typical MIG Process Control Settings

**Note** These settings are guidelines only. Material and wire type, joint design, fitup, position, shielding gas, etc. affect settings. Test welds to be sure they comply to specifications.

Material thickness determines weld parameters.

1/8 or 0.125 in

![Material thickness diagram]

**Convert Material Thickness to Amperage (A)**

\[ \text{.001 in} = 1 \text{ ampere} \]

\[ \text{.125 in} = 125 \text{ A} \]

**Select Wire Size**

<table>
<thead>
<tr>
<th>Wire Size</th>
<th>Amperage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>.030 in</td>
<td>40 – 145 A</td>
</tr>
<tr>
<td>.035 in</td>
<td>50 – 180 A</td>
</tr>
<tr>
<td>.045 in</td>
<td>75 – 250 A</td>
</tr>
</tbody>
</table>

**Select Wire Speed**

<table>
<thead>
<tr>
<th>Wire Size</th>
<th>Recommendation</th>
<th>Wire Speed (Approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.030 in</td>
<td>2 in per ampere</td>
<td>2 x 125 A = 250 ipm</td>
</tr>
<tr>
<td>.035 in</td>
<td>1.6 in per ampere</td>
<td>1.6 x 125 A = 200 ipm</td>
</tr>
<tr>
<td>.045 in</td>
<td>1 in per ampere</td>
<td>1 x 125 A = 125 ipm</td>
</tr>
</tbody>
</table>

**Select Voltage**

- Low voltage: wire stubs into work
- High voltage: arc is unstable (spatter)
- Set voltage midway between high/low voltage.

**Wire speed (amperage) controls weld penetration (wire speed = burn-off rate)**

Voltage controls height and width of weld bead.
13.3 Holding And Positioning Welding Gun

Note: Welding wire is energized when gun trigger is pressed. Before lowering helmet and pressing trigger, be sure wire is no more than 1/2 in (13 mm) past end of nozzle, and tip of wire is positioned correctly on seam.

1. Hold Gun and Control Gun Trigger
2. Workpiece
3. Work Clamp
4. Electrode Extension (Stickout) 1/4 to 1/2 in (6 to 13 mm)
5. Cradle Gun and Rest Hand on Workpiece

---

**GROOVE WELDS**

End View Of Work Angle

Side View Of Gun Angle

**FILLET WELDS**

End View Of Work Angle

Side View Of Gun Angle
Weld bead shape depends on gun angle, direction of travel, electrode extension (stickout), travel speed, thickness of base metal, wire feed speed (weld current), and voltage.
13.5 Gun Movement During Welding

Note Normally, a single stringer bead is satisfactory for most narrow groove weld joints; however, for wide groove weld joints or bridging across gaps, a weave bead or multiple stringer beads works better.

1. Stringer Bead – Steady Movement Along Seam
2. Weave Bead – Side To Side Movement Along Seam
3. Weave Patterns
   Use weave patterns to cover a wide area in one pass of the electrode.

13.6 Poor Weld Bead Characteristics

1. Large Spatter Deposits
2. Rough, Uneven Bead
3. Slight Crater During Welding
4. Bad Overlap
5. Poor Penetration

13.7 Good Weld Bead Characteristics

Fine Spatter
Uniform Bead
Moderate Crater During Welding
   Weld a new bead or layer for each \( \frac{1}{8} \) in (3.2 mm) thickness in metals being welded.
   No Overlap
   Good Penetration into Base Metal
### 13.8 Troubleshooting – Excessive Spatter

Excessive Spatter – scattering of molten metal particles that cool to solid form near weld bead.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire feed speed too high.</td>
<td>Select lower wire feed speed.</td>
</tr>
<tr>
<td>Voltage too high.</td>
<td>Select lower voltage range.</td>
</tr>
<tr>
<td>Electrode extension (stickout) too long.</td>
<td>Use shorter electrode extension (stickout).</td>
</tr>
<tr>
<td>Workpiece dirty.</td>
<td>Remove all grease, oil, moisture, rust, paint, undercoating, and dirt from work surface before welding.</td>
</tr>
<tr>
<td>Insufficient shielding gas at welding arc.</td>
<td>Increase flow of shielding gas at regulator/flowmeter and/or prevent drafts near welding arc.</td>
</tr>
<tr>
<td>Dirty welding wire.</td>
<td>Use clean, dry welding wire.</td>
</tr>
<tr>
<td></td>
<td>Eliminate pickup of oil or lubricant on welding wire from feeder or liner.</td>
</tr>
</tbody>
</table>

### 13.9 Troubleshooting – Porosity

Porosity – small cavities or holes resulting from gas pockets in weld metal.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient shielding gas at welding arc.</td>
<td>Increase flow of shielding gas at regulator/flowmeter and/or prevent drafts near welding arc.</td>
</tr>
<tr>
<td></td>
<td>Remove spatter from gun nozzle.</td>
</tr>
<tr>
<td></td>
<td>Check gas hoses for leaks.</td>
</tr>
<tr>
<td></td>
<td>Place nozzle 1/4 to 1/2 in (6-13 mm) from workpiece.</td>
</tr>
<tr>
<td></td>
<td>Hold gun near bead at end of weld until molten metal solidifies.</td>
</tr>
<tr>
<td>Wrong gas.</td>
<td>Use welding grade shielding gas; change to different gas.</td>
</tr>
<tr>
<td>Dirty welding wire.</td>
<td>Use clean, dry welding wire.</td>
</tr>
<tr>
<td></td>
<td>Eliminate pick up of oil or lubricant on welding wire from feeder or liner.</td>
</tr>
<tr>
<td>Workpiece dirty.</td>
<td>Remove all grease, oil, moisture, rust, paint, coatings, and dirt from work surface before welding.</td>
</tr>
<tr>
<td></td>
<td>Use a more highly deoxidizing welding wire (contact supplier).</td>
</tr>
<tr>
<td>Welding wire extends too far out of nozzle.</td>
<td>Be sure welding wire extends not more than 1/2 in (13 mm) beyond nozzle.</td>
</tr>
</tbody>
</table>
13.10 Troubleshooting – Excessive Penetration

Excessive Penetration – weld metal melting through base metal and hanging underneath weld.

**Possible Causes**
- Excessive heat input.
- Improper weld technique.
- Insufficient heat input.

**Corrective Actions**
- Select lower voltage range and reduce wire feed speed.
- Maintain normal gun angle of 0 to 15 degrees to achieve maximum penetration.
- Select higher wire feed speed and/or select higher voltage range.
- Place stringer bead in proper location(s) at joint during welding.
- Adjust work angle or widen groove to access bottom during welding.

13.11 Troubleshooting – Lack Of Penetration

Lack Of Penetration – shallow fusion between weld metal and base metal.

**Possible Causes**
- Improper joint preparation.
- Improper weld technique.
- Insufficient heat input.

**Corrective Actions**
- Material too thick. Joint preparation and design must provide access to bottom of groove while maintaining proper welding wire extension and arc characteristics.
- Maintain normal gun angle of 0 to 15 degrees to achieve maximum penetration.
- Select higher voltage range and/or adjust wire feed speed.
- Place stringer bead in proper location(s) at joint during welding.
- Adjust work angle or widen groove to access bottom during welding.
- Momentarily hold arc on groove side walls when using weaving technique.
- Use correct gun angle of 0 to 15 degrees.

13.12 Troubleshooting – Incomplete Fusion

Incomplete Fusion – failure of weld metal to fuse completely with base metal or a preceding weld bead.

**Possible Causes**
- Workpiece dirty.
- Insufficient heat input.
- Improper welding technique.

**Corrective Actions**
- Remove all grease, oil, moisture, rust, paint, undercoating, and dirt from work surface before welding.
- Select higher voltage range and/or adjust wire feed speed.
- Place stringer bead in proper location(s) at joint during welding.
- Adjust work angle or widen groove to access bottom during welding.
- Momentarily hold arc on groove side walls when using weaving technique.
- Keep arc on leading edge of weld puddle.
- Use correct gun angle of 0 to 15 degrees.
## 13.13 Troubleshooting – Burn-Through

Burn-Through – weld metal melting completely through base metal resulting in holes where no metal remains.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive heat input.</td>
<td>Select lower voltage range and reduce wire feed speed.</td>
</tr>
<tr>
<td></td>
<td>Increase and/or maintain steady travel speed.</td>
</tr>
</tbody>
</table>

## 13.14 Troubleshooting – Waviness Of Bead

Waviness Of Bead – weld metal that is not parallel and does not cover joint formed by base metal.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding wire extends too far out of nozzle.</td>
<td>Be sure welding wire extends not more than 1/2 in (13 mm) beyond nozzle.</td>
</tr>
<tr>
<td>Unsteady hand.</td>
<td>Support hand on solid surface or use two hands.</td>
</tr>
</tbody>
</table>

## 13.15 Troubleshooting – Distortion

Distortion – contraction of weld metal during welding that forces base metal to move.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive heat input.</td>
<td>Use restraint (clamp) to hold base metal in position.</td>
</tr>
<tr>
<td></td>
<td>Make tack welds along joint before starting welding operation.</td>
</tr>
<tr>
<td></td>
<td>Select lower voltage range and/or reduce wire feed speed.</td>
</tr>
<tr>
<td></td>
<td>Increase travel speed.</td>
</tr>
<tr>
<td></td>
<td>Weld in small segments and allow cooling between welds.</td>
</tr>
</tbody>
</table>
13.16 Common MIG Shielding Gases

This is a general chart for common gases and where they are used. Many different combinations (mixtures) of shielding gases have been developed over the years. The most commonly used shielding gases are listed in the following table.

<table>
<thead>
<tr>
<th>Gas</th>
<th>Application</th>
<th>Spray Arc Steel</th>
<th>Short Circuiting Steel</th>
<th>Spray Arc Stainless Steel</th>
<th>Short Circuiting Stainless Steel</th>
<th>Spray Arc Aluminum</th>
<th>Short Circuiting Aluminum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon + 1% O₂</td>
<td>Flat &amp; Horizontal⁵ Fillet</td>
<td>Flat &amp; Horizontal⁵ Fillet</td>
<td></td>
<td></td>
<td></td>
<td>All Positions⁵</td>
<td>All Positions</td>
</tr>
<tr>
<td>Argon + 2% O₂</td>
<td>Flat &amp; Horizontal⁵ Fillet</td>
<td>Flat &amp; Horizontal⁵ Fillet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon + 5% O₂</td>
<td>Flat &amp; Horizontal⁵ Fillet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon + 8% CO₂</td>
<td>Flat &amp; Horizontal⁵ Fillet</td>
<td>Flat &amp; Horizontal⁵ Fillet</td>
<td></td>
<td></td>
<td>All Positions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon + 25% CO₂</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td></td>
<td>All Positions⁴</td>
<td></td>
<td>All Positions⁴</td>
</tr>
<tr>
<td>Argon + 50% CO₂</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td></td>
<td></td>
<td>All Positions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO₂</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td></td>
<td></td>
<td>All Positions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td></td>
<td></td>
<td>All Positions</td>
<td></td>
<td>All Positions²</td>
</tr>
<tr>
<td>Argon + Helium</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td></td>
<td></td>
<td>All Positions</td>
<td></td>
<td>All Positions²</td>
</tr>
<tr>
<td>Tri-Mix⁴</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td>Flat &amp; Horizontal¹ Fillet</td>
<td></td>
<td></td>
<td>All Positions</td>
<td></td>
<td>All Positions</td>
</tr>
</tbody>
</table>

1  Globular Transfer  
2  Heavy Thicknesses  
3  Single Pass Welding Only  
4  90% HE + 7-1/2% AR + 2-1/2% CO₂  
5  Also for GMAW-P, All Positions
14. Parts List

14.1 Main Assembly (Onan Engine)
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Dia Mks.</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1 . . .</td>
<td>181 881</td>
<td>. . . . .</td>
<td>Grommet, neck filler</td>
</tr>
<tr>
<td>.2 . . .</td>
<td>147 601</td>
<td>. . . . .</td>
<td>Cap, tank screw-on w/vent</td>
</tr>
<tr>
<td>.3 . . .</td>
<td>108 487</td>
<td>. . . . .</td>
<td>Label, warning: falling equipment</td>
</tr>
<tr>
<td>.4 . . .</td>
<td>183 433</td>
<td>. . . . .</td>
<td>Pipe, exhaust</td>
</tr>
<tr>
<td>.5 . . .</td>
<td>+183 221</td>
<td>. . . . .</td>
<td>Cover, top (Onan)</td>
</tr>
<tr>
<td>.5 . . .</td>
<td>+183 354</td>
<td>. . . . .</td>
<td>Cover, top (Kohler)</td>
</tr>
<tr>
<td>.5 . . .</td>
<td>+183 355</td>
<td>. . . . .</td>
<td>Cover, top (Kohler)</td>
</tr>
<tr>
<td>.6 . . .</td>
<td>182 365</td>
<td>. . . . .</td>
<td>Panel, rear upper</td>
</tr>
<tr>
<td>.6 . . .</td>
<td>+185 351</td>
<td>. . . . .</td>
<td>Panel, rear upper stainless</td>
</tr>
<tr>
<td>.7 . . .</td>
<td>183 626</td>
<td>. . . . .</td>
<td>Baffle, engine air (Onan)</td>
</tr>
<tr>
<td>.8 . . .</td>
<td>159 914</td>
<td>. . . . .</td>
<td>Upright, base</td>
</tr>
<tr>
<td>.9 . . .</td>
<td>121 652</td>
<td>. . . . .</td>
<td>Filter Kit, fuel w/clamps</td>
</tr>
<tr>
<td>10 . . R2</td>
<td>184 278</td>
<td>. . . . .</td>
<td>Resistor, WW fxd 225W 5 ohm</td>
</tr>
<tr>
<td>11 . .</td>
<td>159 914</td>
<td>. . . . .</td>
<td>Upright, base</td>
</tr>
<tr>
<td>12 . .</td>
<td>164 928</td>
<td>. . . . .</td>
<td>Seal, barrel</td>
</tr>
<tr>
<td>13 . .</td>
<td>183 166</td>
<td>. . . . .</td>
<td>Panel, rear lower</td>
</tr>
<tr>
<td>14 . .</td>
<td>165 715</td>
<td>. . . . .</td>
<td>Valve, oil drain 3/8-18NPTF (included w/engine)</td>
</tr>
<tr>
<td>14 . .</td>
<td>165 925</td>
<td>. . . . .</td>
<td>Gauge, fuel</td>
</tr>
<tr>
<td>14 . .</td>
<td>165 623</td>
<td>. . . . .</td>
<td>Filter Kit, fuel w/clamps</td>
</tr>
<tr>
<td>15 . .</td>
<td>173 098</td>
<td>. . . . .</td>
<td>Label, engine maintenance (Kohler)</td>
</tr>
<tr>
<td>16 . .</td>
<td>183 314</td>
<td>. . . . .</td>
<td>Clamp, muffler</td>
</tr>
<tr>
<td>17 . .</td>
<td>+182 895</td>
<td>. . . . .</td>
<td>Engine, gas elec start (Onan)</td>
</tr>
<tr>
<td>18 . .</td>
<td>183 434</td>
<td>. . . . .</td>
<td>Muffler, exhaust engine</td>
</tr>
<tr>
<td>19 . .</td>
<td>065 313</td>
<td>. . . . .</td>
<td>Muffler Gasket</td>
</tr>
<tr>
<td>20 . .</td>
<td>059 926</td>
<td>. . . . .</td>
<td>Pin, spring CS .093 x 1.000</td>
</tr>
<tr>
<td>21 . . TS1</td>
<td>165 810</td>
<td>. . . . .</td>
<td>Solenoid, 14VDC .53A</td>
</tr>
<tr>
<td>22 . .</td>
<td>165 522</td>
<td>. . . . .</td>
<td>Bracket, mtg solenoid</td>
</tr>
<tr>
<td>23 . .</td>
<td>137 046</td>
<td>. . . . .</td>
<td>Tune-Up &amp; Filter Kit (Onan)</td>
</tr>
<tr>
<td>24 . .</td>
<td>065 211</td>
<td>. . . . .</td>
<td>Oil Filter</td>
</tr>
<tr>
<td>25 . .</td>
<td>121 652</td>
<td>. . . . .</td>
<td>Filter/Clamps, fuel</td>
</tr>
<tr>
<td>26 . .</td>
<td>064 617</td>
<td>. . . . .</td>
<td>Element, air cleaner</td>
</tr>
<tr>
<td>27 . .</td>
<td>065 709</td>
<td>. . . . .</td>
<td>Spark Plug</td>
</tr>
<tr>
<td>28 . .</td>
<td>+183 169</td>
<td>. . . . .</td>
<td>Engine, gas elec start (Kohler)</td>
</tr>
<tr>
<td>29 . .</td>
<td>183 435</td>
<td>. . . . .</td>
<td>Muffler</td>
</tr>
<tr>
<td>30 . .</td>
<td>165 271</td>
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<td>Valve, oil drain 3/8-18NPTF</td>
</tr>
<tr>
<td>30 . . TS1</td>
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<td>Solenoid, (see engine parts list)</td>
<td></td>
</tr>
<tr>
<td>31 . .</td>
<td>183 435</td>
<td>. . . . .</td>
<td>Muffler</td>
</tr>
<tr>
<td>32 . .</td>
<td>183 314</td>
<td>. . . . .</td>
<td>Clamp, muffler</td>
</tr>
<tr>
<td>33 . .</td>
<td>183 626</td>
<td>. . . . .</td>
<td>Baffle, engine air (Onan)</td>
</tr>
<tr>
<td>34 . .</td>
<td>121 652</td>
<td>. . . . .</td>
<td>Filter Kit, fuel w/clamps</td>
</tr>
<tr>
<td>35 . .</td>
<td>182 928</td>
<td>. . . . .</td>
<td>Solenoid, (see engine parts list)</td>
</tr>
<tr>
<td>36 . .</td>
<td>173 098</td>
<td>. . . . .</td>
<td>Label, engine maintenance (Kohler)</td>
</tr>
<tr>
<td>37 . .</td>
<td>173 734</td>
<td>. . . . .</td>
<td>Link, jumper</td>
</tr>
<tr>
<td>38 . .</td>
<td>065 211</td>
<td>. . . . .</td>
<td>Oil Filter</td>
</tr>
<tr>
<td>39 . .</td>
<td>121 652</td>
<td>. . . . .</td>
<td>Filter/Clamps, fuel</td>
</tr>
<tr>
<td>40 . .</td>
<td>064 617</td>
<td>. . . . .</td>
<td>Element, air cleaner</td>
</tr>
<tr>
<td>41 . .</td>
<td>065 709</td>
<td>. . . . .</td>
<td>Spark Plug</td>
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<td>063 959</td>
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<td>Resistor, WW fxd 225W 5 ohm</td>
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<tr>
<td>43 . .</td>
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<td>Clamp, muffler</td>
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</tr>
<tr>
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<td>121 652</td>
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<td>Filter Kit, fuel w/clamps</td>
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<tr>
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<td>065 313</td>
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<td>Muffler Gasket</td>
</tr>
<tr>
<td>48 . .</td>
<td>059 926</td>
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<td>Pin, spring CS .093 x 1.000</td>
</tr>
<tr>
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<td>Solenoid, 14VDC .53A</td>
</tr>
<tr>
<td>50 . .</td>
<td>165 522</td>
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<td>Bracket, mtg solenoid</td>
</tr>
<tr>
<td>51 . .</td>
<td>137 046</td>
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<td>Tune-Up &amp; Filter Kit (Onan)</td>
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<tr>
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<td>Oil Filter</td>
</tr>
<tr>
<td>53 . .</td>
<td>121 652</td>
<td>. . . . .</td>
<td>Filter/Clamps, fuel</td>
</tr>
<tr>
<td>54 . .</td>
<td>064 617</td>
<td>. . . . .</td>
<td>Element, air cleaner</td>
</tr>
<tr>
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<td>065 709</td>
<td>. . . . .</td>
<td>Spark Plug</td>
</tr>
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<td>. . . . .</td>
<td>Muffler</td>
</tr>
<tr>
<td>57 . .</td>
<td>183 314</td>
<td>. . . . .</td>
<td>Clamp, muffler</td>
</tr>
<tr>
<td>58 . .</td>
<td>183 626</td>
<td>. . . . .</td>
<td>Baffle, engine air (Onan)</td>
</tr>
<tr>
<td>59 . .</td>
<td>121 652</td>
<td>. . . . .</td>
<td>Filter Kit, fuel w/clamps</td>
</tr>
<tr>
<td>60 . .</td>
<td>065 313</td>
<td>. . . . .</td>
<td>Muffler Gasket</td>
</tr>
<tr>
<td>61 . .</td>
<td>059 926</td>
<td>. . . . .</td>
<td>Pin, spring CS .093 x 1.000</td>
</tr>
<tr>
<td>62 . .</td>
<td>165 810</td>
<td>. . . . .</td>
<td>Solenoid, 14VDC .53A</td>
</tr>
<tr>
<td>63 . .</td>
<td>165 522</td>
<td>. . . . .</td>
<td>Bracket, mtg solenoid</td>
</tr>
<tr>
<td>64 . .</td>
<td>137 046</td>
<td>. . . . .</td>
<td>Tune-Up &amp; Filter Kit (Onan)</td>
</tr>
</tbody>
</table>

Model and serial number required when ordering parts from your local distributor.
14.2 Panel, Front w/Components (Fig 14-1 Item 43)

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Dia Mkgs.</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S1 184</td>
<td>754</td>
<td>Switch, polarity</td>
</tr>
<tr>
<td>2</td>
<td>S1 183</td>
<td>171</td>
<td>Panel, front</td>
</tr>
<tr>
<td>3</td>
<td>S3 183</td>
<td>148</td>
<td>Switch, selector</td>
</tr>
<tr>
<td>4</td>
<td>R1 117</td>
<td>243</td>
<td>Rheostat, WW 100W 10 ohm</td>
</tr>
<tr>
<td>5</td>
<td>PC1 184</td>
<td>731</td>
<td>Module, pull to idle</td>
</tr>
<tr>
<td>6</td>
<td>S2 176</td>
<td>606</td>
<td>Switch, ignition</td>
</tr>
<tr>
<td>7</td>
<td>RC2,3 119</td>
<td>657</td>
<td>Receptacle, str dx grd 2P3W 15A 125V</td>
</tr>
<tr>
<td>8</td>
<td>CB1,2 119</td>
<td>501</td>
<td>Circuit Breaker, 40A</td>
</tr>
<tr>
<td>9</td>
<td>CB3,4 093</td>
<td>996</td>
<td>Circuit Breaker, 20A</td>
</tr>
<tr>
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<td>HM 145</td>
<td>247</td>
<td>Meter, hour</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>195</td>
<td>Nut, .375-27 nyl</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>954</td>
<td>Receptacle, 50A</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>956</td>
<td>Handle, switch</td>
</tr>
<tr>
<td>14</td>
<td>R3,VR1 046</td>
<td>819</td>
<td>Suppressor</td>
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<td>15</td>
<td>Work, Elect 099</td>
<td>255</td>
<td>Terminal, pwr output</td>
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<tr>
<td>16</td>
<td></td>
<td>083 030</td>
<td>Stud, brs .250-20 x 1,750</td>
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<td>010 915</td>
<td>Washer, flat .250 ID brs</td>
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<td>601 836</td>
<td>Nut, 250-20 brs</td>
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<td>19</td>
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<td>159 921</td>
<td>Bezel</td>
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<td>20</td>
<td></td>
<td>147 195</td>
<td>Nut, .375-27 nyl</td>
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<td>21</td>
<td>RC1 182</td>
<td>954</td>
<td>Receptacle, 50A</td>
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<td>Bezel</td>
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<tr>
<td>23</td>
<td></td>
<td>097 924</td>
<td>Knob, pointer</td>
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Model and serial number required when ordering parts from your local distributor.
### 14.3 Generator (Fig 14-1 Item 23)

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Part No.</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>013 367</td>
<td>Label, warning moving parts</td>
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<tr>
<td>2</td>
<td>165 818</td>
<td>Label, warning engine fuel (Onan)</td>
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<tr>
<td>3</td>
<td>+183 178</td>
<td>Stator, generator</td>
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<tr>
<td>4</td>
<td>159 909</td>
<td>Rotor, generator</td>
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<tr>
<td>5</td>
<td>053 390</td>
<td>Bearing, ball rdl sgl row 1.370 x 2.830 x .6</td>
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<tr>
<td>6</td>
<td>160 566</td>
<td>Fan, rotor</td>
</tr>
<tr>
<td>7</td>
<td>160 567</td>
<td>Adapter, engine (Onan)</td>
</tr>
<tr>
<td>7</td>
<td>172 683</td>
<td>Adapter, engine (Kohler)</td>
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<tr>
<td>8</td>
<td>142 156</td>
<td>Screw, 375-16 x 1.750hexhd</td>
</tr>
<tr>
<td>9</td>
<td>160 573</td>
<td>Stud, stl .375-16 x 17.125</td>
</tr>
<tr>
<td>10</td>
<td>125 548</td>
<td>Holder, brush elect</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>005 614</td>
<td>Holder, brush</td>
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<tr>
<td>12</td>
<td>*126 984</td>
<td>Brush w/Spring</td>
</tr>
<tr>
<td>13</td>
<td>161 306</td>
<td>Cap, brushholder</td>
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<tr>
<td>14</td>
<td>047 879</td>
<td>Bar, retaining brushholder</td>
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<td>010 910</td>
<td>Washer, flat .406 ID stl</td>
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<td>010 909</td>
<td>Nut, .375-16 stl</td>
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<td>17</td>
<td>160 943</td>
<td>Endbell</td>
</tr>
<tr>
<td>18</td>
<td>143 220</td>
<td>O-Ring, 2.859 ID x .139CS</td>
</tr>
</tbody>
</table>

*When ordering a component originally displaying a precautionary label, the label should also be ordered.

Model and serial number required when ordering parts from your local distributor.
**WARRANTY**

**Effective February 7, 1996**

(Equipment with a serial number preface of “KD” or newer)

This limited warranty supersedes all previous Miller warranties and is exclusive with no other guarantees or warranties expressed or implied.

LIMITED WARRANTY – Subject to the terms and conditions below, Miller Electric Mfg. Co., Appleton, Wisconsin, warrants to its original retail purchaser that new Miller equipment sold after the effective date of this limited warranty is free of defects in material and workmanship at the time it is shipped by Miller. **THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS.**

Within the warranty periods listed below, Miller will repair or replace any warranted parts or components that fail due to such defects in material or workmanship. Miller must be notified in writing within thirty (30) days of such defect or failure, at which time Miller will provide instructions on the warranty claim procedures to be followed.

Miller shall honor warranty claims on warranted equipment listed below in the event of such a failure within the warranty time periods. All warranty time periods start on the date that the equipment was delivered to the original retail purchaser, or one year after the equipment is sent to a North American distributor or eighteen months after the equipment is sent to an International distributor.

1. **5 Years Parts – 3 Years Labor**
   - Original main power rectifiers
   - Inverters (input and output rectifiers only)
   - Transformer/Rectifier Power Sources
   - Plasma Arc Cutting Power Sources
   - Semi-Automatic and Automatic Wire Feeders
   - Inverter Power Supplies
   - Intellitig
   - Robots (1 year labor)
2. **3 Years — Parts and Labor**
   - Engine Driven Welding Generators (NOTE: Engines are warranted separately by the engine manufacturer.)
   - Air Compressors
3. **2 Years — Parts and Labor**
   - Motor Driven Guns
   - Process Controllers
   - IHPS Power Sources
   - Water Coolant Systems
   - HF Units
   - Grids
   - Spot Welders
   - Load Banks
   - SDX Transformers
   - Miller Cyclomatic Equipment
   - Running Gear/Trailers
   - Plasma Cutting Torches (except APT, ZIPCUT & PLAZCUT Models)
   - Tecumseh Engines
   - Deutz Engines (outside North America)
   - Field Options (NOTE: Field options are covered under True Blue® warranty, if any.)
4. **1 Year — Parts and Labor**
   - APT, ZIPCUT & PLAZCUT Model Plasma Cutting Torches
   - Remote Controls
   - Accessory Kits
   - Replacement Parts

Miller’s True Blue® Limited Warranty shall not apply to:

1. Items furnished by Miller, but manufactured by others, such as engines or trade accessories. These items are covered by the manufacturer’s warranty, if any.
2. Consumable components; such as contact tips, cutting nozzles, contactors and relays or parts that fail due to normal wear.
3. Equipment that has been modified by any party other than Miller, or equipment that has been improperly installed, improperly operated or misused based upon industry standards, or equipment which has not had reasonable and necessary maintenance, or equipment which has been used for operation outside of the specifications for the equipment.

MILLER PRODUCTS ARE INTENDED FOR PURCHASE AND USE BY COMMERCIAL/INDUSTRIAL USERS AND PERSONS TRAINED AND EXPERIENCED IN THE USE AND MAINTENANCE OF WELDING EQUIPMENT.

In the event of a warranty claim covered by this warranty, the exclusive remedies shall be, at Miller’s option: (1) repair; or (2) replacement; or, where authorized in writing by Miller in appropriate cases, (3) the reasonable cost of repair or replacement at an authorized Miller service station; or (4) payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the goods at customer’s risk and expense. Miller’s option of repair or replacement will be F.O.B., Factory at Appleton, Wisconsin, or F.O.B. at a Miller authorized service facility as determined by Miller. Therefore no compensation or reimbursement for transportation costs of any kind will be allowed.

TO THE EXTENT PERMITTED BY LAW, THE REMEDIES PROVIDED HEREIN ARE THE SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL MILLER BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING LOSS OF PROFIT), WHETHER BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY.

ANY EXPRESS WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTEE OR REPRESENTATION AS TO PERFORMANCE, AND ANY REMEDY FOR BREACH OF CONTRACT TORT OR ANY OTHER LEGAL THEORY WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION, OPERATION OF LAW, CUSTOM OF TRADE OR COURSE OF DEALING, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE, WITH RESPECT TO ANY AND ALL EQUIPMENT FURNISHED BY MILLER IS EXCLUDED AND DISCLAIMED BY MILLER.

Some states in the U.S.A. do not allow limitations of how long an implied warranty lasts, or the exclusion of incidental, indirect, special or consequential damages, so the above limitation or exclusion may not apply to you. This warranty provides specific legal rights, and other rights may be available, but may vary from state to state.

In Canada, legislation in some provinces provides for certain additional warranties or remedies other than as stated herein, and to the extent that they may not be waived, the limitations and exclusions set out above may not apply. This Limited Warranty provides specific legal rights, and other rights may be available, but may vary from province to province.

Warranty Questions?

Call 1-800-4-A-MILLER for your local Miller distributor.

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## Owner’s Record

Please complete and retain with your personal records.

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Serial/Style Number</th>
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<table>
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<tr>
<th>Purchase Date</th>
<th>(Date which equipment was delivered to original customer.)</th>
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<table>
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<tr>
<th>Distributor</th>
<th>Address</th>
<th>City</th>
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<tbody>
<tr>
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## Resources Available

Always provide Model Name and Serial/Style Number.

**Contact your Distributor for:**

- Welding Supplies and Consumables
- Options and Accessories
- Personal Safety Equipment
- Service and Repair
- Replacement Parts
- Training (Schools, Videos, Books)
- Owner’s Manuals
- Technical Manuals (Servicing Information and Parts)
- Circuit Diagrams
- Welding Process Handbooks

**Contact the Delivering Carrier for:**

File a claim for loss or damage during shipment.

For assistance in filing or settling claims, contact your distributor and/or equipment manufacturer’s Transportation Department.