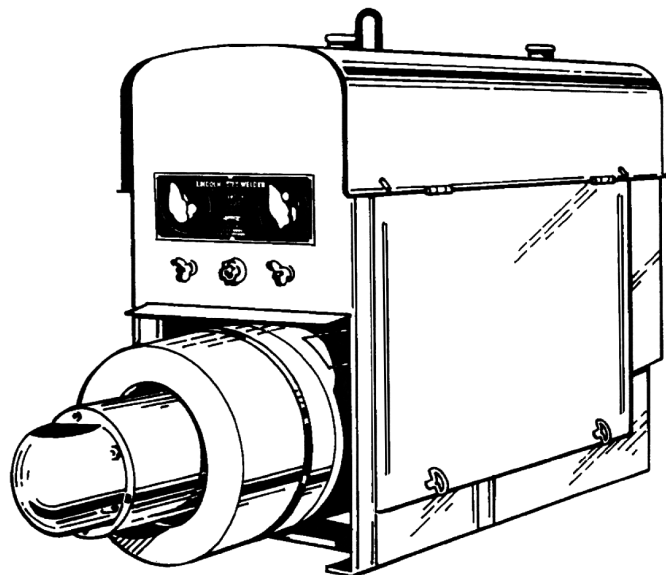




## SA-200<sup>®</sup>

For use with machines having Code Numbers: **7276; 7302; 7307; 7693; 7699; 7789; 8017; 8023; 8244; 8245; 8348; 8583; 8638; 8676; 8677; 8790; 8791; 8915; 8916; 9052; 9053; 9324; 9325; 9442; 9443; 9527; 9530; 3417; 3418; 3554; 3555; 4113; 4149; 4150; 4744; 4745; 4815; 4816; 4843; 4998; 4999; 5065; 5107; 5108; 5141; 5336; 5337; 5376; 5495; 5496; 5500; 5537; 5568; 5604; 5642; 5660; 5696; 5840; 5841; 5957; 6072; 6073; 6132; 6339; 6340; 6345; 6552; 6632; 6633; 6634; 6779; 6791; 6792; 6934; 7044; 7074; 7078; 7167; 7168; 7213; 7214; 7242, K-6090 215; 244; 317; 370; 371; 445; 459; 527; 671; 681; 960; 974; 1122; 1123; 1223; 1228; 1421; 1422; 1678; 1679; 1827; 1828; 1846; 1847; 1903; 1904; 2163; 2164; 2292; 2293; 2364; 2365; 2866; 2867; 2954; 2955; 3311; 3312**

# SERVICE MANUAL



## ⚠ WARNING

### ⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The Above For Diesel Engines

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

The Above For Gasoline Engines

**ARC WELDING can be hazardous. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.**

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

**BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.**



### FOR ENGINE powered equipment.

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.



1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.



1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

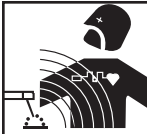


1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.



1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



### ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.



### ELECTRIC SHOCK can kill.

3.a. The electrode and work (or ground) circuits are electrically “hot” when the welder is on. Do not touch these “hot” parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

**In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:**

- Semiautomatic DC Constant Voltage (Wire) Welder.
- DC Manual (Stick) Welder.
- AC Welder with Reduced Voltage Control.

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

3.k. If using the welder as a power source for mechanized welding, the above precautions also apply for the automatic electrode, electrode reel, welding head, nozzle or semiautomatic welding gun.



### ARC RAYS can burn.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87.1 standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.



### FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

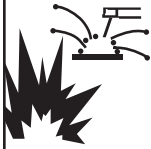
5.b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.e. Read and understand the manufacturer’s instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer’s safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.



## WELDING and CUTTING SPARKS can cause fire or explosion.

- 6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.
- 6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.
- 6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- 6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).
- 6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- 6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- 6.h. Also see item 1.c.
- 6.i. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, Ma 02269-9101.
- 6.j. Do not use a welding power source for pipe thawing.



## CYLINDER may explode if damaged.

- 7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.
- 7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- 7.c. Cylinders should be located:
  - Away from areas where they may be struck or subjected to physical damage.
  - A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- 7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.
- 7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- 7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- 7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.



## FOR ELECTRICALLY powered equipment.

- 8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
- 8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.
- 8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Refer to <http://www.lincolnelectric.com/safety> for additional safety information.

## PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté spécifiques qui paraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

### Sûreté Pour Soudage A L'Arc

1. Protégez-vous contre la secousse électrique:
  - a. Les circuits à l'électrode et à la pièce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vêtements mouillés. Porter des gants secs et sans trous pour isoler les mains.
  - b. Faire très attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher métallique ou des grilles métalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
  - c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état de fonctionnement.
  - d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
  - e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
  - f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces précautions pour le porte-électrode s'appliquent aussi au pistolet de soudage.
2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas où on reçoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.
3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:
  - a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
  - b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
  - c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.
4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.
5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans latéraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.
7. Quand on ne soude pas, poser la pince à un endroit isolé de la masse. Un court-circuit accidentel peut provoquer un échauffement et un risque d'incendie.
8. S'assurer que la masse est connectée le plus près possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaînes de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'échauffement des chaînes et des câbles jusqu'à ce qu'ils se rompent.
9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particulièrement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumées toxiques.
10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistologie. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgène (gas fortement toxique) ou autres produits irritants.
11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

## PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le châssis du poste conformément au code de l'électricité et aux recommandations du fabricant. Le dispositif de montage ou la pièce à souder doit être branché à une bonne mise à la terre.
2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.
3. Avant de faire des travaux à l'intérieur de poste, la débrancher à l'interrupteur à la boîte de fusibles.
4. Garder tous les couvercles et dispositifs de sûreté à leur place.



			
<b>WARNING</b>	<ul style="list-style-type: none"> <li>Do not touch electrically live parts or electrode with skin or wet clothing.</li> <li>Insulate yourself from work and ground.</li> </ul>	<ul style="list-style-type: none"> <li>Keep flammable materials away.</li> </ul>	<ul style="list-style-type: none"> <li>Wear eye, ear and body protection.</li> </ul>
Spanish <b>AVISO DE PRECAUCION</b>	<ul style="list-style-type: none"> <li>No toque las partes o los electrodos bajo carga con la piel o ropa mojada.</li> <li>Aíselese del trabajo y de la tierra.</li> </ul>	<ul style="list-style-type: none"> <li>Mantenga el material combustible fuera del área de trabajo.</li> </ul>	<ul style="list-style-type: none"> <li>Protéjase los ojos, los oídos y el cuerpo.</li> </ul>
French <b>ATTENTION</b>	<ul style="list-style-type: none"> <li>Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension.</li> <li>Isolez-vous du travail et de la terre.</li> </ul>	<ul style="list-style-type: none"> <li>Gardez à l'écart de tout matériel inflammable.</li> </ul>	<ul style="list-style-type: none"> <li>Protégez vos yeux, vos oreilles et votre corps.</li> </ul>
German <b>WARNUNG</b>	<ul style="list-style-type: none"> <li>Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung!</li> <li>Isolieren Sie sich von den Elektroden und dem Erdboden!</li> </ul>	<ul style="list-style-type: none"> <li>Entfernen Sie brennbares Material!</li> </ul>	<ul style="list-style-type: none"> <li>Tragen Sie Augen-, Ohren- und Körperschutz!</li> </ul>
Portuguese <b>ATENÇÃO</b>	<ul style="list-style-type: none"> <li>Não toque partes elétricas e electrodos com a pele ou roupa molhada.</li> <li>Isole-se da peça e terra.</li> </ul>	<ul style="list-style-type: none"> <li>Mantenha inflamáveis bem guardados.</li> </ul>	<ul style="list-style-type: none"> <li>Use proteção para a vista, ouvido e corpo.</li> </ul>
Japanese <b>注意事項</b>	<ul style="list-style-type: none"> <li>● 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。</li> <li>● 施工物やアースから身体が絶縁されている様にして下さい。</li> </ul>	<ul style="list-style-type: none"> <li>● 燃えやすいものの側での溶接作業は絶対にしてはなりません。</li> </ul>	<ul style="list-style-type: none"> <li>● 目、耳及び身体に保護具をして下さい。</li> </ul>
Chinese <b>警告</b>	<ul style="list-style-type: none"> <li>● 皮肤或湿衣物切勿接触带电部件及焊条。</li> <li>● 使你自已与地面和工件绝缘。</li> </ul>	<ul style="list-style-type: none"> <li>● 把一切易燃物品移离工作场所。</li> </ul>	<ul style="list-style-type: none"> <li>● 佩戴眼、耳及身体劳动保护用具。</li> </ul>
Korean <b>위험</b>	<ul style="list-style-type: none"> <li>● 전도체나 용접봉을 젖은 형갑 또는 피부로 절대 접촉치 마십시오.</li> <li>● 모재와 접지를 접촉치 마십시오.</li> </ul>	<ul style="list-style-type: none"> <li>● 인화성 물질을 접근 시키지 마십시오.</li> </ul>	<ul style="list-style-type: none"> <li>● 눈, 귀와 몸에 보호장구를 착용하십시오.</li> </ul>
Arabic <b>تحذير</b>	<ul style="list-style-type: none"> <li>● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الألكترود بجند الجسم أو بالملايس المبللة بالماء.</li> <li>● ضع عازلا على جسمك خلال العمل.</li> </ul>	<ul style="list-style-type: none"> <li>● ضع المواد القابلة للاشتعال في مكان بعيد.</li> </ul>	<ul style="list-style-type: none"> <li>● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.</li> </ul>

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTION FOR THIS EQUIPMENT AND THE CONSUMABLES TO BE USED AND FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.

SE RECOMIENDA LEER Y ENTENDER LAS INSTRUCCIONES DEL FABRICANTE PARA EL USO DE ESTE EQUIPO Y LOS CONSUMIBLES QUE VA A UTILIZAR, SIGA LAS MEDIDAS DE SEGURIDAD DE SU SUPERVISOR.

LISEZ ET COMPRENEZ LES INSTRUCTIONS DU FABRICANT EN CE QUI REGARDE CET EQUIPMENT ET LES PRODUITS A ETRE EMPLOYES ET SUIVEZ LES PROCEDURES DE SECURITE DE VOTRE EMPLOYEUR.

LESEN SIE UND BEFOLGEN SIE DIE BETRIEBSANLEITUNG DER ANLAGE UND DEN ELEKTRODENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

			
<ul style="list-style-type: none"> <li>Keep your head out of fumes.</li> <li>Use ventilation or exhaust to remove fumes from breathing zone.</li> </ul>	<ul style="list-style-type: none"> <li>Turn power off before servicing.</li> </ul>	<ul style="list-style-type: none"> <li>Do not operate with panel open or guards off.</li> </ul>	<b>WARNING</b>
<ul style="list-style-type: none"> <li>Los humos fuera de la zona de respiración.</li> <li>Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.</li> </ul>	<ul style="list-style-type: none"> <li>Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.</li> </ul>	<ul style="list-style-type: none"> <li>No operar con panel abierto o guardas quitadas.</li> </ul>	Spanish <b>AVISO DE PRECAUCION</b>
<ul style="list-style-type: none"> <li>Gardez la tête à l'écart des fumées.</li> <li>Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.</li> </ul>	<ul style="list-style-type: none"> <li>Débranchez le courant avant l'entretien.</li> </ul>	<ul style="list-style-type: none"> <li>N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.</li> </ul>	French <b>ATTENTION</b>
<ul style="list-style-type: none"> <li>Vermeiden Sie das Einatmen von Schweißrauch!</li> <li>Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!</li> </ul>	<ul style="list-style-type: none"> <li>Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)</li> </ul>	<ul style="list-style-type: none"> <li>Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!</li> </ul>	German <b>WARNUNG</b>
<ul style="list-style-type: none"> <li>Mantenha seu rosto da fumaça.</li> <li>Use ventilação e exaustão para remover fumo da zona respiratória.</li> </ul>	<ul style="list-style-type: none"> <li>Não opere com as tampas removidas.</li> <li>Desligue a corrente antes de fazer serviço.</li> <li>Não toque as partes elétricas nuas.</li> </ul>	<ul style="list-style-type: none"> <li>Mantenha-se afastado das partes moventes.</li> <li>Não opere com os painéis abertos ou guardas removidas.</li> </ul>	Portuguese <b>ATENÇÃO</b>
<ul style="list-style-type: none"> <li>● ヒュームから頭を離すようにして下さい。</li> <li>● 換気や排煙に十分留意して下さい。</li> </ul>	<ul style="list-style-type: none"> <li>● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切ってください。</li> </ul>	<ul style="list-style-type: none"> <li>● パネルやカバーを取り外したままで機械操作をしないで下さい。</li> </ul>	Japanese <b>注意事項</b>
<ul style="list-style-type: none"> <li>● 頭部遠離煙霧。</li> <li>● 在呼吸區使用通風或排風器除煙。</li> </ul>	<ul style="list-style-type: none"> <li>● 維修前切斷電源。</li> </ul>	<ul style="list-style-type: none"> <li>● 儀表板打開或沒有安全罩時不準作業。</li> </ul>	Chinese <b>警告</b>
<ul style="list-style-type: none"> <li>● 얼굴로부터 용접가스를 멀리하십시오.</li> <li>● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시오.</li> </ul>	<ul style="list-style-type: none"> <li>● 보수전에 전원을 차단하십시오.</li> </ul>	<ul style="list-style-type: none"> <li>● 관널이 열린 상태로 작동치 마십시오.</li> </ul>	Korean <b>위험</b>
<ul style="list-style-type: none"> <li>● ابعء رأسك بعيداً عن الدخان.</li> <li>● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها.</li> </ul>	<ul style="list-style-type: none"> <li>● اقطع التيار الكهربائي قبل القيام بأية صيانة.</li> </ul>	<ul style="list-style-type: none"> <li>● لا تشغيل هذا الجهاز اذا كانت الاغطية الحديدية الواقية ليست عليه.</li> </ul>	Arabic <b>تحذير</b>

**LEIA E COMPREENDA AS INSTRUÇÕES DO FABRICANTE PARA ESTE EQUIPAMENTO E AS PARTES DE USO, E SIGA AS PRÁTICAS DE SEGURANÇA DO EMPREGADOR.**

使う機械や溶材のメーカーの指示書をよく読み、まず理解して下さい。そして貴社の安全規定に従って下さい。

請詳細閱讀並理解製造廠提供的說明以及應該使用的銀捍材料，並請遵守貴方的有閣勞動保護規定。

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقرأ بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.

SA-200

**LINCOLN**  
ELECTRIC

# I - MASTER TABLE OF CONTENTS FOR ALL SECTIONS - I

RETURN TO MAIN INDEX

Page

<b>Safety</b> .....	i-vi
<hr/>	
<b>Installation, Operation, Accessories, Maintenance</b>	
<b>Shield-Arc SA-200 Welder with Lincoln Model L-200 Engine, Type S-6090</b>	
Codes 215 - 3312 .....	See IM-114-C
<b>Shield-Arc SA-200 Welder with Continental 4-Cylinder Gasoline Engine,</b>	
<b>Type S-6090 or S6090-SM Codes Below 3400</b> .....	See IM-142-F
<b>Shield-Arc SA-200 Welder with Continental F162 or F163 Engine, Type S-6090,</b>	
<b>Codes 3400 to 7275</b> .....	See IM-208-A
<b>Shield-Arc SA-200 Welder with Continental F163 Engine, Type S-6090-SM Codes 7276</b>	
<b>to 8017, &amp; Type S-6090-SB Codes 8023 &amp; up</b> .....	See IM-276-B
<b>Zenith Carburetor Types: S-7538, S-8110 &amp; M7033</b> .....	See IM-214
<b>Marvel-Schebler Carburetor Used with Continental F-162 Engine Type: S-9790</b> .....	See IM-215
<b>Zenith Carburetor Types: S-8082, S-8318</b> .....	See IM-225
<b>Gasoline Engine Adjustment: Timing, Carburetor, Governor &amp; Idler Codes 3312-7242</b> .....	See IM-179-G
<b>R-57 Engine Idler Instructions</b> .....	See IM-179-G.1
<b>Lincoln Engine Idlers Types: L-2299 &amp; L-2299-D</b> .....	See IM-117-B
<b>Gasoline Engine Adjustment: Timing, Carburetor, Governor &amp; Electronic Idler</b>	
<b>Codes Above 7275</b> .....	See IM-277-A
<b>Adjustment &amp; Trouble-Shooting for Shield-Arc SA-200 Welder with Lincoln Model L-200</b>	
<b>Engine, Type S-6090 Codes 215 - 3312</b> .....	See IM-127-B
<b>Theory of Operation</b> .....	Section E
<b>Troubleshooting and Repair</b> .....	Section F
<b>Electrical Diagrams</b> .....	Section G



**Theory of Operation** .....E-1

General Description ..... E-2

Battery, Starter, Engine Alternator and Oil Switch Circuit ..... E-2

Engine, Main Generator Armature and Frame and DC Exciter ..... E-3

Excitation (Flashing) ..... E-3

Main Shunt, Interpole and Series Coils ..... E-3

Current Range Selector ..... E-4

Fine Current Adjustment ..... E-4

Engine Idler Circuit ..... E-4

DC Generator Machines ..... E-5

\* This theory addresses later production machines.

**FIGURE E.1 BLOCK LOGIC DIAGRAM**

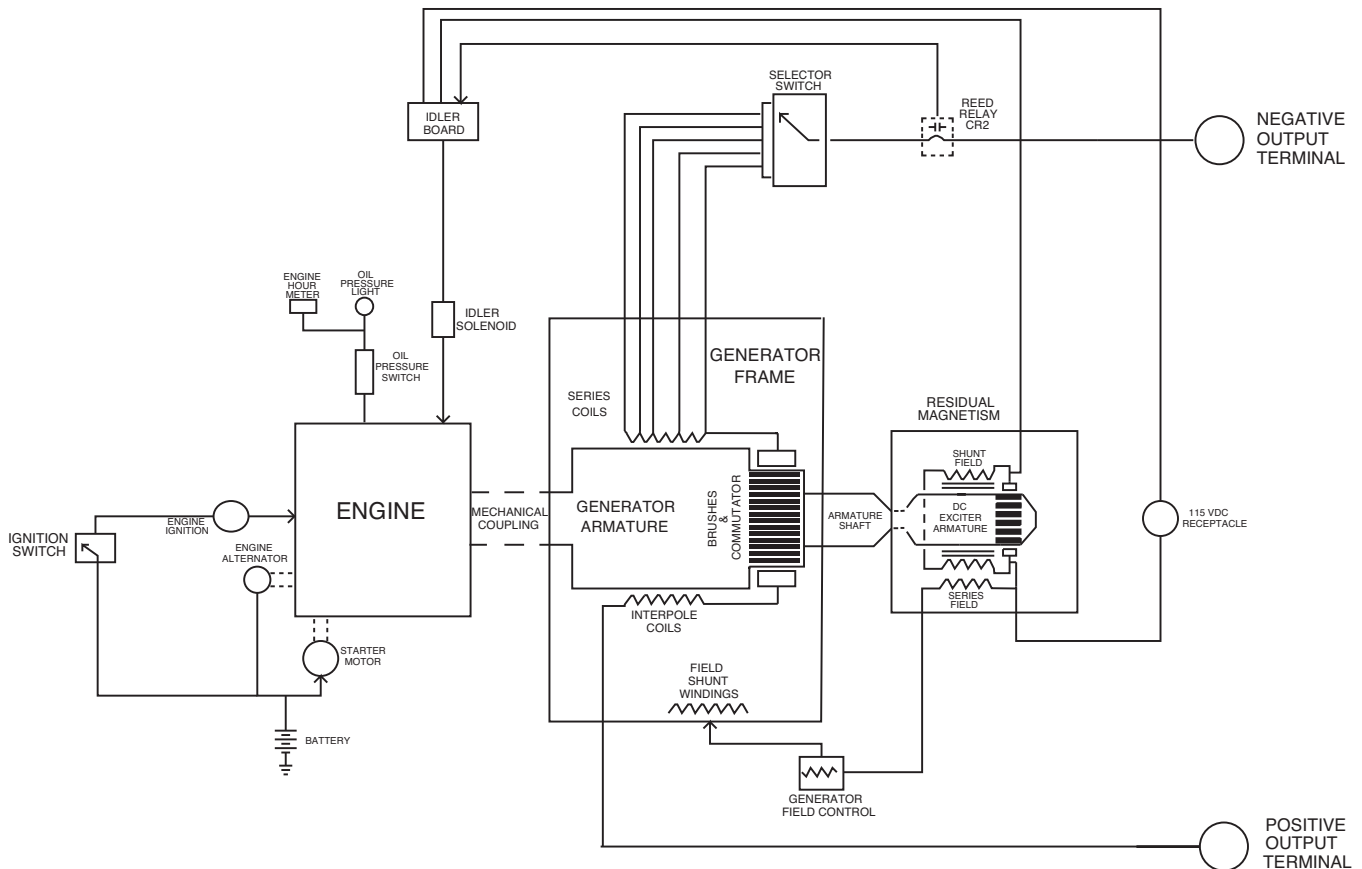
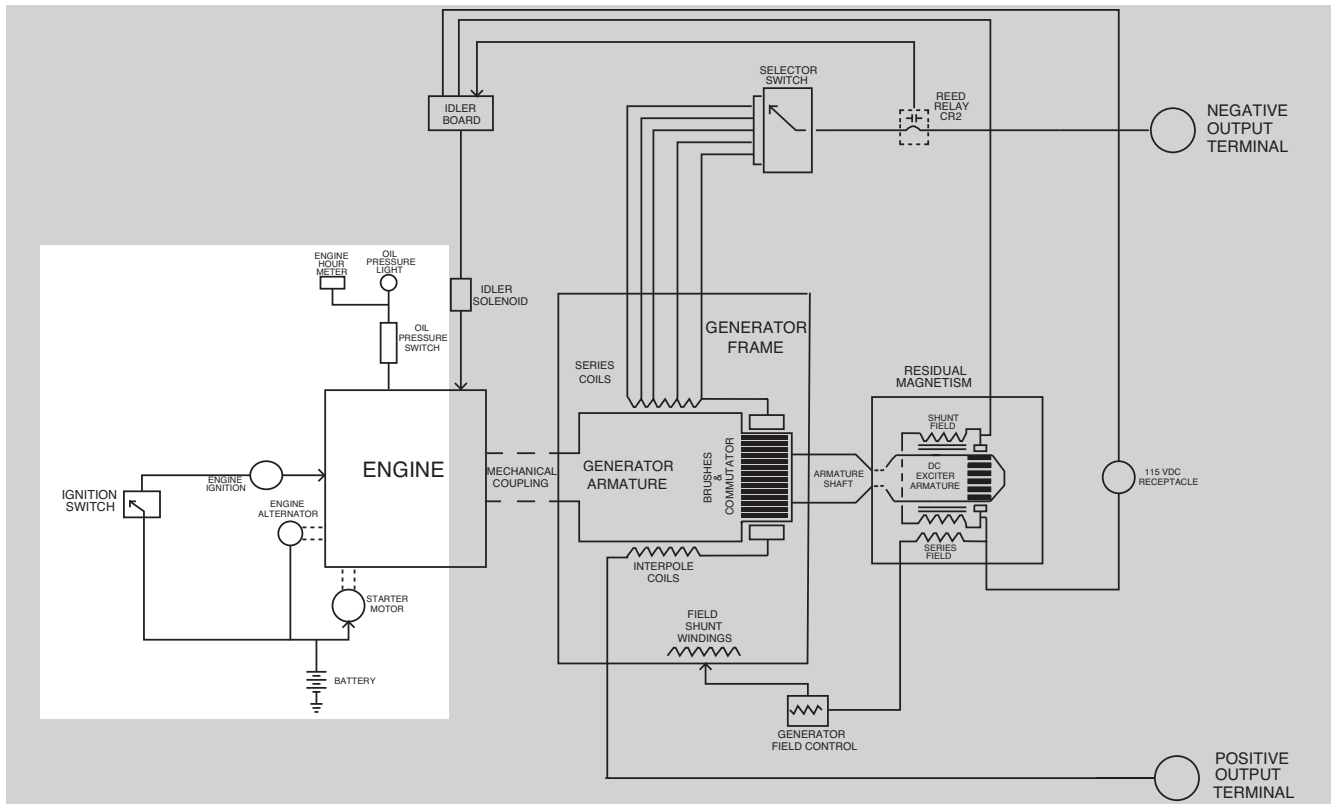


FIGURE E.2 - BATTERY, STARTER, ENGINE ALTERNATOR AND OIL SWITCH CIRCUIT



## GENERAL DESCRIPTION

The SA-200 is a heavy duty, engine driven, DC arc welding power source capable of providing constant current output for stick welding or DC TIG welding. Also, a total of 1,000 watts or, 1750 watts (on later models) of auxiliary power is available at the 115VDC receptacle.

## BATTERY, STARTER, ENGINE ALTERNATOR AND OIL SWITCH CIRCUIT

The 12VDC battery powers the starter motor through the ignition switch and engine ignition. The engine alternator supplies "charging" current for the battery circuit. If the oil pressure switch does not close, due to low oil pressure or inadequate oil supply, the oil pressure light will not glow, the hour meter will not operate and the engine alternator will not function. (Not all SA-200's)

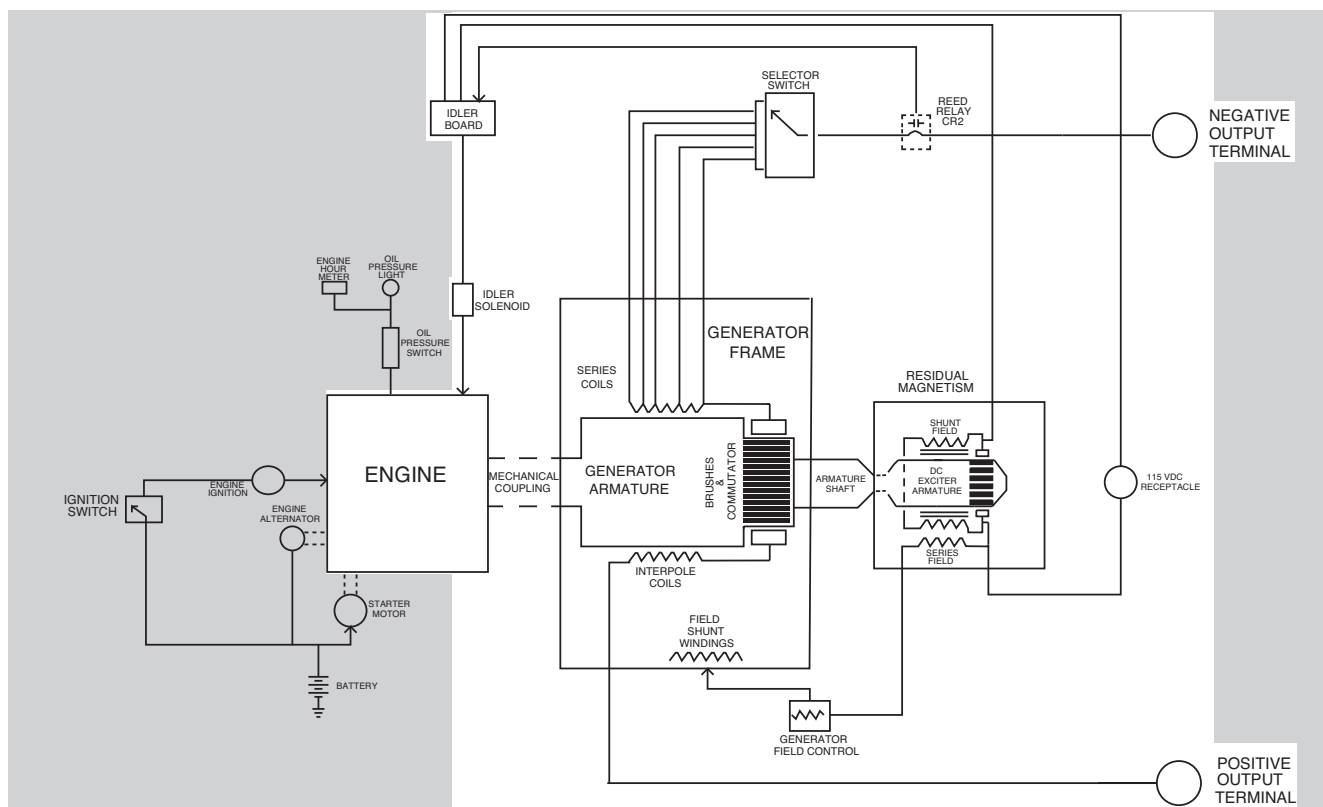
Early machines used a crank start and magneto ignition. Field installed conversions to electric start used an engine Generator to charge the battery and a positive ground. See related code numbers and wiring diagrams for correct Wiring Diagrams.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

SA-200

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FIGURE E.3 - ENGINE, MAIN GENERATOR ARMATURE AND FRAME AND DC EXCITER



## ENGINE, MAIN GENERATOR ARMATURE AND FRAME AND DC EXCITER EXCITATION (FLASHING)

The main generator armature and the exciter armature are mechanically coupled to the engine. When the engine is started and running, the residual magnetism that is stored in the exciter pole pieces is induced upon the exciter armature. This causes the exciter to "build-up" and produce a DC output voltage. This DC voltage is applied, via the field rheostat control, to the main generator shunt field coils. The exciter output is also connected to the 115VDC receptacle.

## MAIN SHUNT, INTERPOLE AND SERIES COILS

The generator armature rotates within the magnetic field created by the shunt field windings. A DC voltage is induced in the armature and is transferred, through the armature commutator and brushes, to the series and interpole coils. The interpole coils, which are connected in series with the positive output terminal, are located so as to counteract any magnetic influences that could cause mechanical distortion in the rotating armature. The series coils are designed to oppose or "buck" the DC voltage that is generated in the armature.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

SA-200

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## ENGINE, MAIN GENERATOR ARMATURE AND FRAME AND DC EXCITER (CONTINUED)

### CURRENT RANGE SELECTOR

The selector switch acts as a coarse current adjustment by allowing varying amounts of series windings to be included in the welding current path. The series coils and selector switch are connected in series with the negative output terminal.

### FINE CURRENT ADJUSTMENT

The field rheostat control functions as a fine output current adjustment by controlling the current through the shunt windings, thus controlling the amount of magnetism created in the shunt field windings. Open circuit weld voltage can also be controlled by the field rheostat control.

Earliest machines used engine speed for fine current control.

### ENGINE IDLER CIRCUIT

The idler solenoid is mechanically connected to the engine governor linkage. When welding current is being drawn, the reed switch CR2 is closed. This signals the idler PC board to release (deactivate) the idler solenoid, which then lets the machine go to a high speed condition. Also, when auxiliary power (115VDC) is being used, the current is passed through a reed switch coil located on the idler PC board, which signals the PC board to release the idler solenoid.

When welding ceases or the auxiliary load is removed, a preset time delay of about 15 seconds starts. After approximately 15 seconds, the idler PC board activates the idler solenoid, and the machine will return to a low idle speed condition.

Some early machines used a "Vacuum" idler to adjust engine speed. Engine vacuum is applied to a bellows to pull the engine to low speed. The vacuum bellows has a small coil that is connected across the series coils of the main D.C. generator. When welding current is drawn through the series coils the solenoid coil is energized and pulls a small valve in the idler, releasing the vacuum and allowing the engine to go to high idle.

Return to Section TOC  
Return to Master TOC

Return to Section TOC  
Return to Master TOC

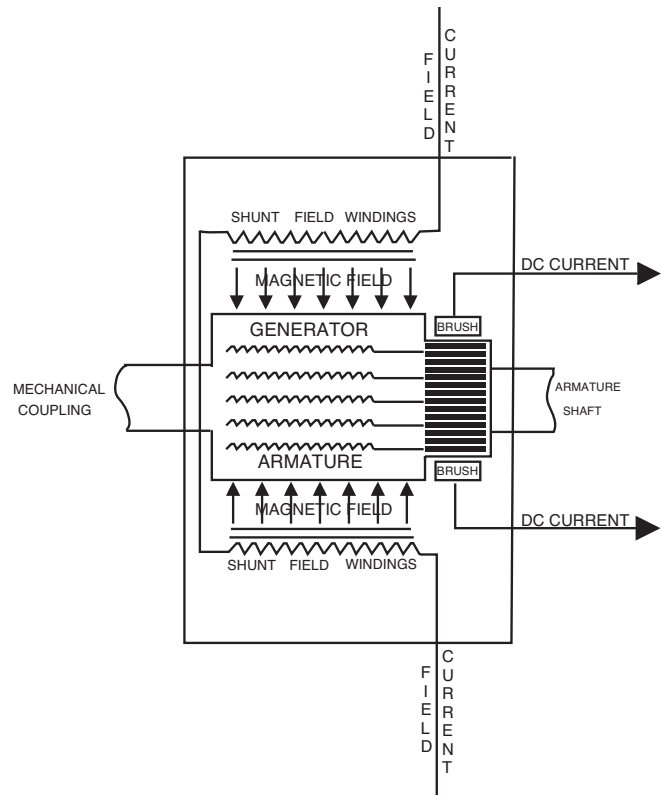
Return to Section TOC  
Return to Master TOC

Return to Section TOC  
Return to Master TOC

## DC GENERATOR MACHINES

The armature winding of a DC generator is located on the rotating member. Current is conducted from it by means of carbon brushes. The field winding is located in the stator, which is stationary and excited by direct current.

The armature coil sides are placed at opposite points on the rotating shaft with the conductors parallel to the shaft. The armature assembly is normally turned at a constant speed by a source of mechanical power connected to the shaft. When the armature rotates through the magnetic field produced by the stationary field winding, it induces a coil voltage in the armature winding. The voltage induced in an individual armature coil is an alternating (AC) voltage, which must be rectified. In a conventional DC generator machine, rectification is provided mechanically by means of a commutator. A commutator is a cylinder formed of copper segments insulated from each other and mounted on, but insulated from, the rotating shaft. Stationary carbon brushes held against the commutator surface connect the armature windings to external terminals. The commutator provides full-wave rectification, transforming the voltage waveform between brushes and making available a DC voltage to the external circuit.



Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC



Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

**Troubleshooting and Repair** .....F-1

    How to Use Troubleshooting Guide ..... F-2

    PC Board Troubleshooting Procedures ..... F-3

    Troubleshooting Guide ..... F-4/F-11

    DC Exciter Test ..... F-13

    Idle Solenoid Test ..... F-19

    Main Generator Shunt Field Winding Test ..... F-27

    Flashing The Fields ..... F-33

    Rack Adjustment Procedure ..... F-37

    Waveform Diagrams ..... F-42/F-44

    DC Exciter Armature And Field Coils Removal And Replacement ..... F-45

    Main Generator Frame Removal And Replacement ..... F-49

    Main Generator Armature Removal And Replacement ..... F-61

    Retest and Repair ..... F-63

## HOW TO USE TROUBLESHOOTING GUIDE

**⚠ WARNING**

Service and Repair should only be performed by Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

**Step 1. LOCATE PROBLEM (SYMPTOM).**

Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into the following categories: output problems, function problems, and welding problems.

**Step 2. PERFORM EXTERNAL TESTS.**

The second column labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)" lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

**Step 3. RECOMMENDED COURSE OF ACTION**

The last column labeled "Recommended Course of Action" lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

All of the referenced test procedures referred to in the Troubleshooting Guide are described in detail at the end of this chapter. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the specified test points, components, terminal strips, etc. can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

## PC BOARD TROUBLESHOOTING PROCEDURES

**WARNING**

**ELECTRIC SHOCK  
can kill.**

- Have an electrician install and service this equipment. Turn the input power OFF at the fuse box before working on equipment. Do not touch electrically hot parts.

**CAUTION**

Sometimes machine failures appear to be due to PC board failures. These problems can sometimes be traced to poor electrical connections. To avoid problems when troubleshooting and replacing PC boards, please use the following procedure:

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board to assure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock. Read the warning inside the static resistant bag and perform the following procedures:

**PC board can be damaged by static electricity.**

- Remove your body's static charge before opening the static-shielding bag. Wear an anti-static wrist strap. For safety, use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame.

- If you don't have a wrist strap, touch an un-painted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.

- Tools which come in contact with the PC board must be either conductive, anti-static or static-dissipative.

- Remove the PC board from the static-shielding bag and place it directly into the equipment. Don't set the PC board on or near paper, plastic or cloth which could have a static charge. If the PC board can't be installed immediately, put it back in the static-shielding bag.

- If the PC board uses protective shorting jumpers, don't remove them until installation is complete.

- If you return a PC board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.

4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

**NOTE:** It is desirable to have a spare (known good) PC board available for PC board troubleshooting.

**NOTE:** Allow the machine to heat up so that all electrical components can reach their operating temperature.

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.

- a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks, and terminal strips.

- b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.

6. Always indicate that this procedure was followed when warranty reports are to be submitted.

**NOTE:** Following this procedure and writing on the warranty report, "INSTALLED AND SWITCHED PC BOARDS TO VERIFY PROBLEM," will help avoid denial of legitimate PC board warranty claims.

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>The engine starts and runs at correct speed, but there is very low to no welder output voltage. There is no DC auxiliary output voltage.</p>	<ol style="list-style-type: none"> <li>1. Check for loose or missing brushes in the DC exciter.</li> <li>2. The exciter may need "flashing." See <i>Flashing the Fields</i> in this section.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check for loose or broken wires between the exciter brushes and the DC receptacle and the fine current control field rheostat. See the Wiring Diagram. (Not all machines)</li> <li>2. Perform the <i>DC Exciter Test</i>.</li> </ol>
<p>The engine starts and runs at the correct speed but there is very low to no welder output. The DC auxiliary output voltage is normal.</p>	<ol style="list-style-type: none"> <li>1. Check the welding cables for loose or faulty connections.</li> <li>2. Check for loose or missing brushes in the welding generator.</li> <li>3. Check for open circuit voltage at weld studs, check heavy current carrying leads for loose or corroded connections.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the fine current control field rheostat for resistance and proper operation. Normal resistance is 64 ohms. Check associated wires for loose or faulty connections. See the Wiring Diagram.</li> <li>2. Perform the <i>Main Generator Shunt Field Winding Test</i>.</li> <li>3. Check the continuity of the interpole coils. They should show continuity from the positive brush holders to the positive output terminal and should NOT be grounded to the generator frame.</li> <li>4. Check the continuity of the series coils. They should show continuity from the negative brush holders, through the current selector switch, to the negative output terminal and should NOT be grounded to the generator frame.</li> <li>5. The main armature may be faulty. Check for grounds and/or shorts.</li> <li>6. Check for proper brush rack position. Perform <i>Rack Adjustment Test</i>.</li> </ol>

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>The welding output varies abnormally. The auxiliary output remains constant. The engine is operating correctly.</p>	<ol style="list-style-type: none"> <li>1. Check for loose or faulty welding cables.</li> <li>2. This may be a normal condition. The machine will normally lose some output as the components are heated.</li> <li>3. Check for loose, worn, dirty or poorly seated main DC generator brushes.</li> <li>4. The main armature commutator may need cleaning.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the fine current control field rheostat for resistance and proper operation. Normal resistance is 64 ohms. Check associated wires for loose or faulty connections. See the Wiring Diagram.</li> <li>2. Perform the <b>Main Generator Shunt Field Winding Test</b>.</li> <li>3. Check the current range selector switch and contacts for proper operation.</li> <li>4. While the machine is loaded, check the interpole and series coils for signs of "arcing." This condition would indicate shorted turns in the "arcing" coil.</li> <li>5. The main armature may be faulty. Check for grounds.</li> </ol>
<p>The engine starts and runs at the correct speed, but there is no DC auxiliary output voltage at the 115VDC receptacle (Not all machines). The welding generator is functioning correctly.</p>	<ol style="list-style-type: none"> <li>1. Check the DC receptacle and plug for loose or faulty connections. (Not all machines).</li> <li>2. Check the 15 Amp fuse. (Not all machines)</li> </ol>	<ol style="list-style-type: none"> <li>1. Check for loose or faulty connections or wires at the 120 VDC receptacle and associated circuitry. (Not all machines). See Wiring Diagram.</li> </ol>

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC

Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>The actual welding current is much less than is indicated on the dials.</p>	<ol style="list-style-type: none"> <li>1. Check the welding cables for loose or faulty connections.</li> <li>2. The welding cables may be excessively long or coiled.</li> <li>3. Check the main DC generator brushes for good commutation and alignment. Contact the Lincoln Electric Service Dept. 1-888-935-3877.</li> </ol>	<ol style="list-style-type: none"> <li>1. The engine RPM may be low. If necessary perform an adjustment.</li> <li>2. Perform the <b>DC Exciter Test</b>.</li> <li>3. Check the fine current control field rheostat for resistance and proper operation. Normal resistance is 64 ohms. Check associated wires for loose or faulty connections. See the Wiring Diagram.</li> <li>4. Check the current range selector switch and contacts for proper operation.</li> <li>5. Perform the <b>Main Generator Shunt Field Winding Test</b>.</li> <li>6. The main armature may be faulty. Check for grounds.</li> <li>7. Check brush rack. Perform <b>Rack Adjustment Test</b>.</li> </ol>
<p>The actual welding current is much greater than is indicated on the dials.</p>	<ol style="list-style-type: none"> <li>1. Check the main DC generator brushes for good commutation and alignment. Contact the Lincoln Electric Service Dept. 1-888-935-3877.</li> </ol>	<ol style="list-style-type: none"> <li>1. The engine operating speed may be too high. If necessary perform an adjustment.</li> <li>2. While the machine is loaded, check the series coils for signs of "arcing." This condition could point to shorted turns in the series coils.</li> <li>3. Perform the <b>DC Exciter Test</b>.</li> <li>4. Check brush rack position. Perform <b>Brush Rack Adjustment Test</b>.</li> <li>5. Test Series coils for a short.</li> </ol>

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC

Return to Master TOC



Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>FUNCTION PROBLEMS</b>		
<p>The engine will not return to low idle when the welding and auxiliary loads are removed. (Not all machines were equipped with auto idle)</p> <p>R51 - idler code 445-2867 @ fbs exciter</p> <p>R57 - 3417 - 7242 codes</p> <p>Electronic 7276 - 9530 codes</p> <p><b>(Above code 7275 only)</b></p>	<ol style="list-style-type: none"> <li>1. Make sure the idler control switch is set to the "Auto" position.</li> <li>2. Make sure both welding and auxiliary loads are removed.</li> <li>3. Check for mechanical restrictions in the idler and throttle linkage. Contact the Lincoln Electric Service Dept. 1-888-935-3877.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the idler control switch and associated leads for loose or faulty connections. See Wiring Diagram.</li> <li>2. Perform the <b><i>Idler Solenoid Test</i></b>.</li> <li>3. Check for loose or faulty connections at the idler PC board.</li> <li>4. Contact the Lincoln Electric Service Dept. 1-888-935-3877.</li> </ol>

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC

Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>FUNCTION PROBLEMS</b>		
<p>The engine will NOT go to high speed when a load is applied to the welding output terminals. The engine does go to high speed when a load is applied to the DC auxiliary power receptacle. When the engine is operating in the high RPM condition, both welding output and DC auxiliary are normal.</p> <p>R51 - Codes 445 - 2867</p> <p>R57 - Codes 3417 - 7242</p> <p>Do not go to high idle @ aux. load.</p> <p><b>(Above code 7242 only)</b></p>	<ol style="list-style-type: none"> <li>1. Check welding cables for loose or faulty connections.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the idler control switch and associated leads for loose or faulty connections. See the Wiring Diagram.</li> <li>2. Perform the <b>Idler Solenoid Test</b>.</li> <li>3. Check for loose or faulty connections at the idler PC board.</li> <li>4. Contact the Lincoln Electric Service Dept. 1-888-935-3877.</li> <li>5. Perform the appropriate Idler Test.</li> </ol>
<p>Engine is sluggish to go to high speed - or will not go to high speed.</p>	<ol style="list-style-type: none"> <li>1. Verify idler (if equipped) is operating properly.</li> <li>2. Engine Governor may not be operating correctly.</li> <li>3. Engine throttle may need adjustment.</li> </ol>	<ol style="list-style-type: none"> <li>1. <b>See IM-127</b> code 445-8312. <b>IM-179</b> code 3354 - 7225, <b>IM-277</b> code 7225 and up for proper engine adjustment procedure.</li> </ol>

### ⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

SA-200



Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>FUNCTION PROBLEMS</b>		
<ol style="list-style-type: none"> <li>1. The machine will not achieve low range on each tap.</li> <li>2. There is minimum control on each tap.</li> </ol>	<ol style="list-style-type: none"> <li>1. Rheostat may be open or shorted.</li> <li>2. Shunt field coils may be shorted.</li> <li>3. Brush rack may be out of position.</li> <li>4. Series coils may be shorted.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check rehostat function.</li> <li>2. Perform <i>Main Generator Shunt Field Winding Test</i>.</li> <li>3. Check Rack Position.</li> <li>4. Check Series coils for shorts.</li> </ol>

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC

Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>FUNCTION PROBLEMS</b>		
<p>The engine will NOT go to high idle speed when a load is applied to the DC auxiliary receptacle. The engine does go to high speed when a load is applied to the welding output terminals. When the engine is operating in the high RPM condition, both welding output and DC auxiliary are normal.</p> <p>Does not apply to:</p> <p>R51 - codes 445 - 2867 &amp;</p> <p>R57 - code 3417 - 7242</p> <p>Above code 7276 only.</p>	<ol style="list-style-type: none"> <li>1. Check the auxiliary power plug and associated leads for loose or faulty connections.</li> <li>2. The load may be too small. The load must be above 150 watts.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the idler control switch and associated leads for loose or faulty connections. See the Wiring Diagram.</li> <li>2. Perform the <b>Idler Solenoid Test</b>.</li> <li>3. Check for loose or faulty connections at the idler PC board.</li> <li>4. The idler PC board may need replacing. Contact the Lincoln Electric Service Dept. 1-888-935-3877.</li> </ol>
<p>The engine "cranks" but will not start.</p>	<ol style="list-style-type: none"> <li>1. Make sure the ignition switch is in the ON position.</li> <li>2. Check for adequate fuel supply.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the ignition switch for proper operation. Check the associated leads for loose or faulty connections. See the Wiring Diagram.</li> <li>2. Contact the Lincoln Electric Service Dept. 1-888-935-3877.</li> <li>3. <b>See IM-127-B</b> 445-3312. <b>See IM-277-A</b> for codes 7275 &amp; above = <b>IM-179</b> 3754 - 7275 <b>See IM-129</b>.</li> </ol>

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC

Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>WELDING PROBLEMS</b>		
The engine “cranks” AND starts, but runs only about 30-60 seconds and shuts down.	<ol style="list-style-type: none"> <li>1. Check engine oil level.</li> <li>2. Make sure the engine is not overheating.</li> <li>3. Make sure the engine alternator is operating properly.</li> </ol>	<ol style="list-style-type: none"> <li>1. The oil pressure switch may be faulty.</li> <li>2. The temperature switch may be faulty.</li> <li>3. The alternator may be faulty.</li> <li>4. The Idler/Engine Protection Board may be faulty. Contact the Lincoln Electric Service Dept. 1-888-935-3877.</li> </ol>
The welding arc is loud and spatters excessively.	<ol style="list-style-type: none"> <li>1. The current setting may be too high for the electrode and process.</li> <li>2. The polarity may be wrong for the electrode and process.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the engine speed. If necessary, adjust.</li> <li>2. Check the main DC generator brushes for good commutation and alignment. Contact the Lincoln Electric Service Dept. 1-888-935-3877.</li> </ol>
The welding arc frequently “pops out”.	<ol style="list-style-type: none"> <li>1. The fine current control field rheostat may be set too low for the process and electrode.</li> <li>2. Check the welding cables for loose or faulty connections.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the engine speed. If necessary, adjust.</li> <li>2. The current range selector switch may be faulty. Check for proper operation and contact.</li> <li>3. Check the DC generator brushes for good commutation and alignment. Contact the Lincoln Electric Service Dept. 1-888-935-3877.</li> </ol>

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC

Return to Master TOC

Return to Section TOC  
Return to Section TOC  
Return to Section TOC  
Return to Section TOC  
Return to Master TOC  
Return to Master TOC  
Return to Master TOC  
Return to Master TOC



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**DC EXCITER TEST****⚠ WARNING**

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

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**TEST DESCRIPTION**

This test will help determine whether or not the DC Exciter is operating correctly. If operation is not correct, the test will also determine what component(s) may be faulty.

**MATERIALS NEEDED**

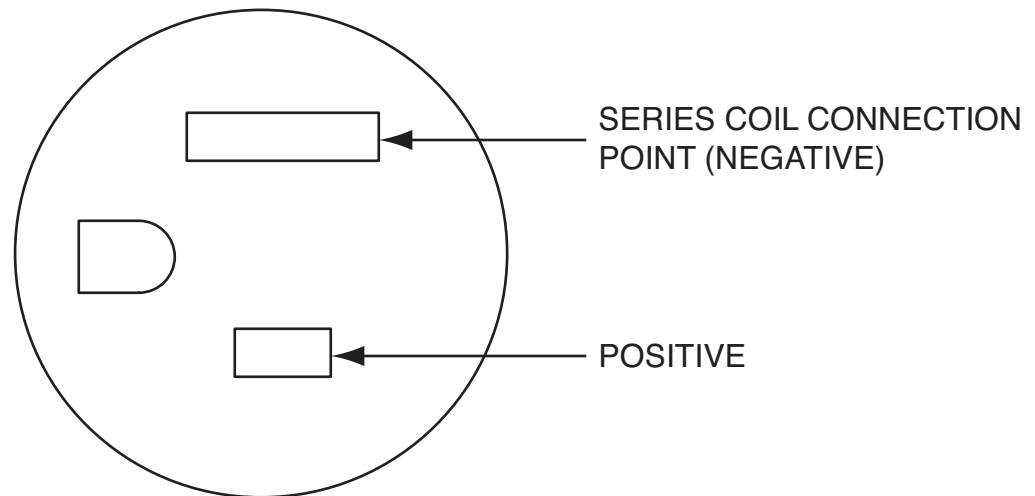
- 3/8" Wrench
- Volt/Ohmmeter (Multimeter)
- Wiring Diagram

SA-200



## DC EXCITER TEST (continued)

FIGURE F.1 – 120VDC RECEPTACLE



## PROCEDURE

1. Turn off the engine and remove all external loads to the welder terminals and auxiliary receptacle.
2. Start the engine and put the idler switch in the HIGH idle position.

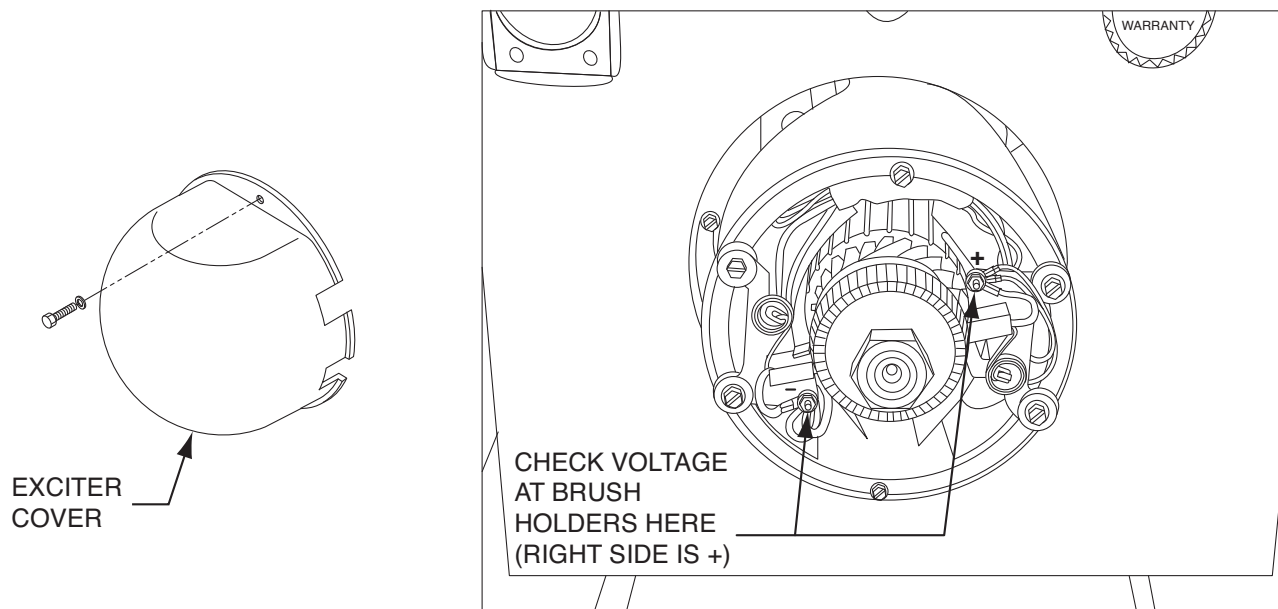
**WARNING****MOVING PARTS can injure.**

- Remove guards only when necessary to perform service, and replace them when the service requiring their removal is complete.
  - Keep hands, hair, clothing and tools away from V-belts, gears, fans, and all other moving parts when starting, operating, or repairing equipment.
  - If fan guards are missing from a machine, obtain replacements from a Lincoln Distributor. (See Parts List.) Always use greatest care when working near moving parts.
3. Using the volt/ohmmeter, carefully check the DC voltage at the 120V receptacle. (Observe proper polarity. The large slot of the receptacle is negative. See Figure F.1.) Normal voltage is 125 - 135VDC, no load, with the engine at the high idle speed of 1600 RPM. If the voltage is normal, the DC exciter is functioning correctly. If the voltage is low or not present, proceed to the next step.

SA-200

## DC EXCITER TEST (continued)

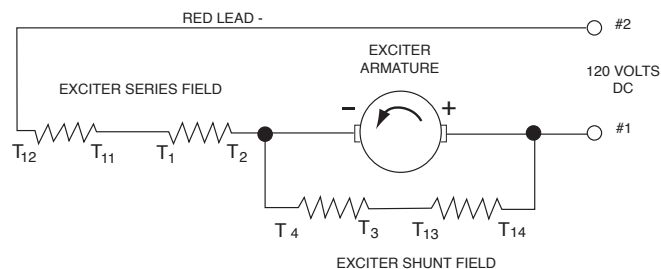
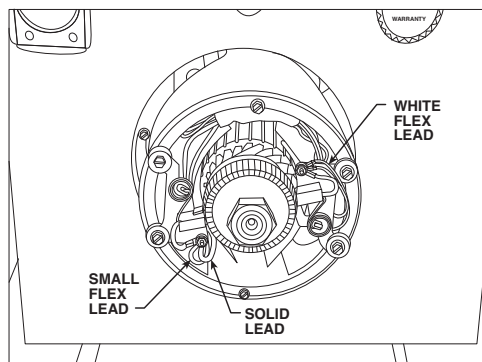
FIGURE F.2 – EXCITER COVER REMOVAL



4. Turn off the engine. Using the 3/8" nutdriver, remove the exciter cover. See Figure F.2.
5. Start the engine. Using the volt/ohmmeter, carefully check the DC voltage at the brush holders. See Figure F.2. The right side brush holder is positive polarity. Normal DC voltage is 125 - 135VDC with the engine at the high idle speed of 1600 RPM.
6. If the DC voltage is normal at the brush holders, the DC exciter armature and shunt coils are OK.
  - a. If the voltage is low or not present, proceed with the shunt coil and series coil resistance tests.
  - b. If the correct DC voltage is present at the brush holders but not at the 120VDC receptacle, the series coil or associated leads may be faulty. See the Wiring Diagram. Proceed with the shunt coil and series coil resistance tests.

## DC EXCITER TEST (continued)

FIGURE F.3 – BRUSH HOLDER LEADS

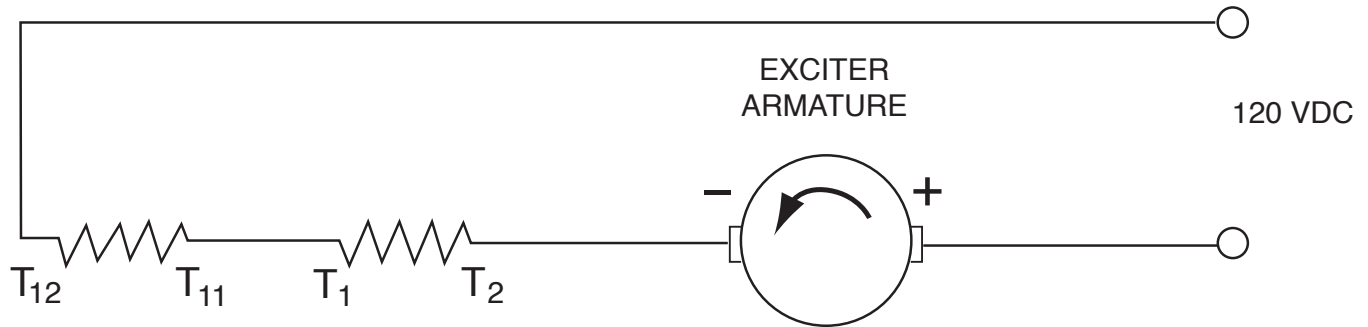


## SHUNT COIL AND SERIES COIL RESISTANCE TESTS

7. Turn the engine OFF.
  8. Using the 3/8" nutdriver, disconnect the two leads from the left side brush holder. See Figure F.3. Separate the two leads. One will be a larger "solid" lead (series coil). The other will be a smaller flex lead (shunt coil).
  9. Using the 3/8" nutdriver, remove the two flex leads from the right side brush holder.
- NOTE:** Two coils make up a set (L8707), and each coil consists of two coils wound together; an Exciter Shunt Field Coil and an Exciter Series Coil.
10. The coil leads should be disconnected from the positive and negative brush holder and also the bolted connection within the exciter bracket that connects T12 to the RED lead.
  11. Using the Ohmmeter, measure the Exciter Series Coils from the T12 and T2 (heavy stiff magnet wire) and the Exciter Shunt Field Coils from T4 and T14 (fine stranded wire) to a good frame ground. The resistance should be very high (500k Ohms or higher). This indicates that the coils are not grounded. If the resistance reading is less than 500k Ohms, this indicates a grounded condition and replacement should be considered.
  12. Using the Ohmmeter, measure Exciter Series Field Coils from connection T12 to connection T2. The resistance should be .276 to .296 Ohms. Measure with the Ohmmeter the Exciter Shunt Field Coils between T4 and T14, The resistance should be 127.0 to 133.0 Ohms. If resistance is very low, the coils are shorted. If coils are warmer or colder than 25 degrees Celsius, the resistance will be considerably higher or lower. If coil resistances vary significantly, REPLACEMENT MAY BE NECESSARY.
  13. If the shunt and series coils are good, and the exciter is not operating properly, the exciter armature may be faulty. Replace the exciter armature.
  14. After the test and repairs are completed, install the exciter cover using the 3/8" nutdriver.

## DC EXCITER TEST (continued)

FIGURE F.4 – STANDARD (SERIES) 1KW EXCITER



### STANDARD (SERIES) 1KW EXCITER TEST - Code 445, 671, 960, 1122 & above

1. There are two exciter coils, in series, in the FBS exciter. One on each side of the barrel.
2. Each coil will measure 5 Ohms (T1-T2) and (T11-T12).
3. Total resistance of 10 Ohms can be measured from T2-T12.
4. Lift the left exciter brush (NEGATIVE), and find the bolted connection at the T12 to black exciter lead.
5. Disconnect the bolted T12 connection, and measure between the T12 lead and the negative brush holder (T2). The resistance should be 10 Ohms.
6. Check between T12 and a good ground point, resistance should be a minimum of 500 K Ohms.

SA-200

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Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

## IDLER SOLENOID TEST

**⚠ WARNING**

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

**TEST DESCRIPTION**

This test will determine whether or not the Idler Solenoid can function when it is energized with 12VDC.

**MATERIALS NEEDED**

External 12VDC Supply  
Wiring Diagram  
Volt/ohmmeter (Multimeter)

Electronic Idler Codes - 7276 - 9530.

For older Idler Circuits and devices - See *IM-117-B*, *IM-277-A*, or *IM-179-G*.

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

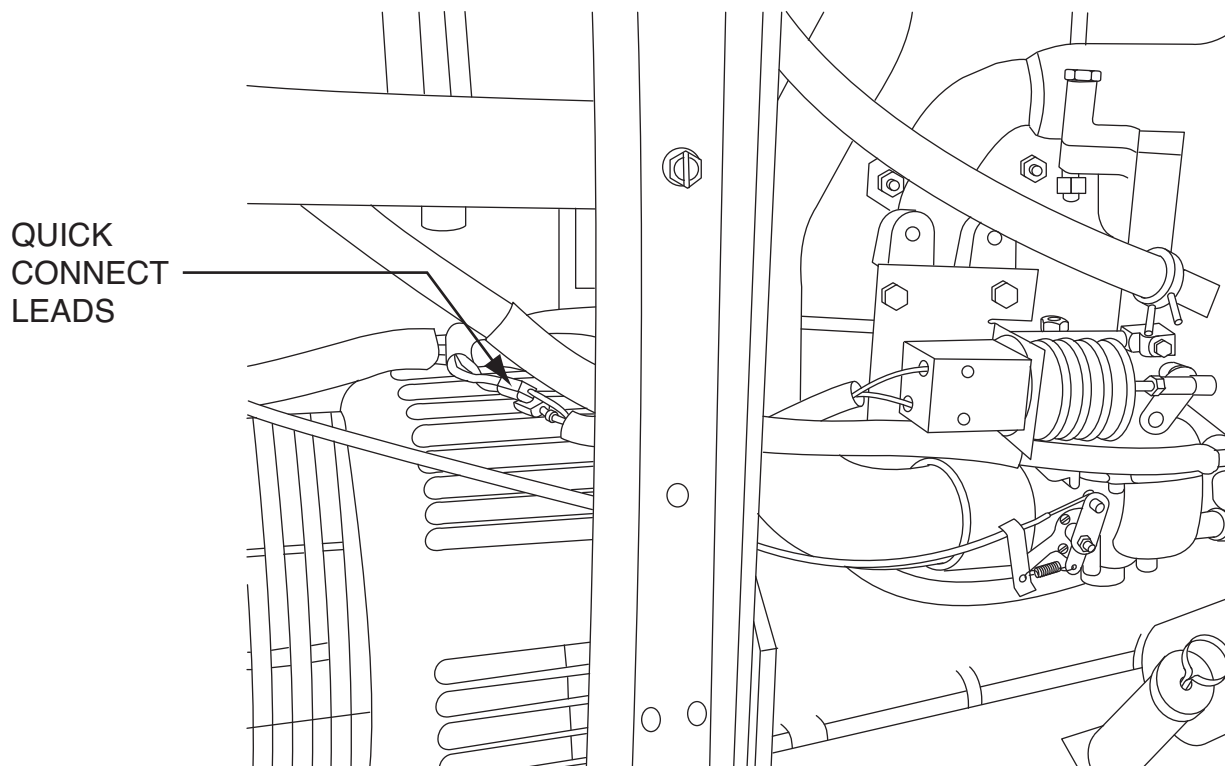
SA-200

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## IDLER SOLENOID TEST (continued)

FIGURE F.5 – IDLER SOLENOID CONNECTIONS



## PROCEDURE

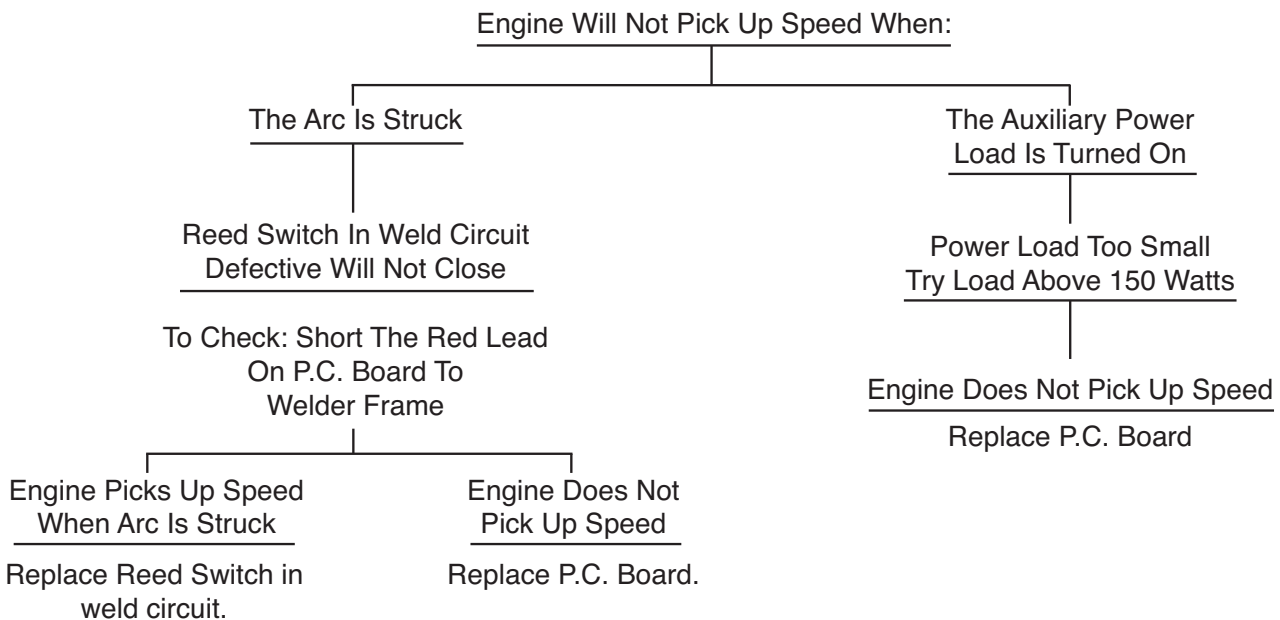
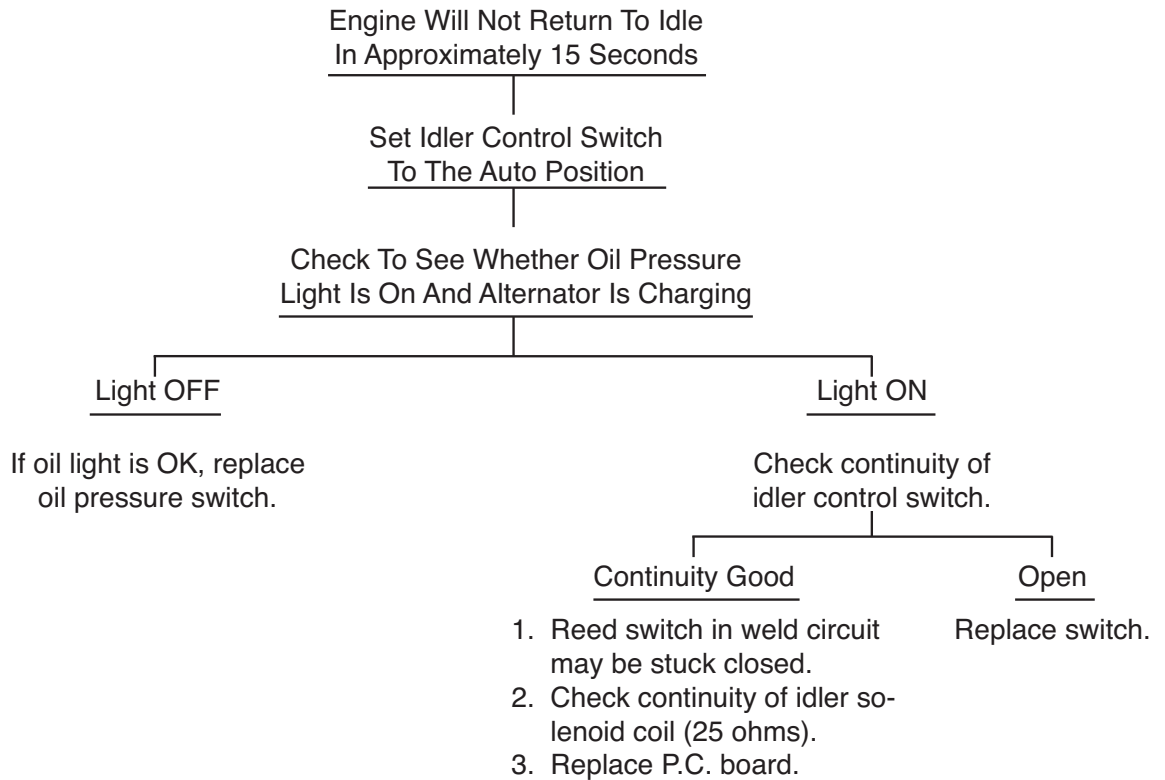
1. Turn the engine OFF.
2. Unlatch and secure the right side door.
3. Locate the idler solenoid and the two leads with quick connects. See Figure F.5.
4. Disconnect the two solenoid leads at the quick connection splices.
5. Using the external power supply, apply 12VDC to the idler solenoid leads. The solenoid should activate.
6. The solenoid should deactivate when the 12VDC is removed.
7. If the solenoid does not operate properly, check for a mechanical restriction in the linkage or for a missing spring.
8. If the linkage is intact and the solenoid does not operate correctly when 12VDC is applied, the idler solenoid may be faulty. Replace the idler solenoid.

**NOTE:** Normal solenoid coil resistance is approximately 9 ohms.

9. After the test and repairs are completed, close and latch the right side door.

**IDLER SOLENOID TEST (continued)**

**FIGURE F.6 – IDLER SOLENOID FLOWCHART CODE: 7276 & ABOVE**



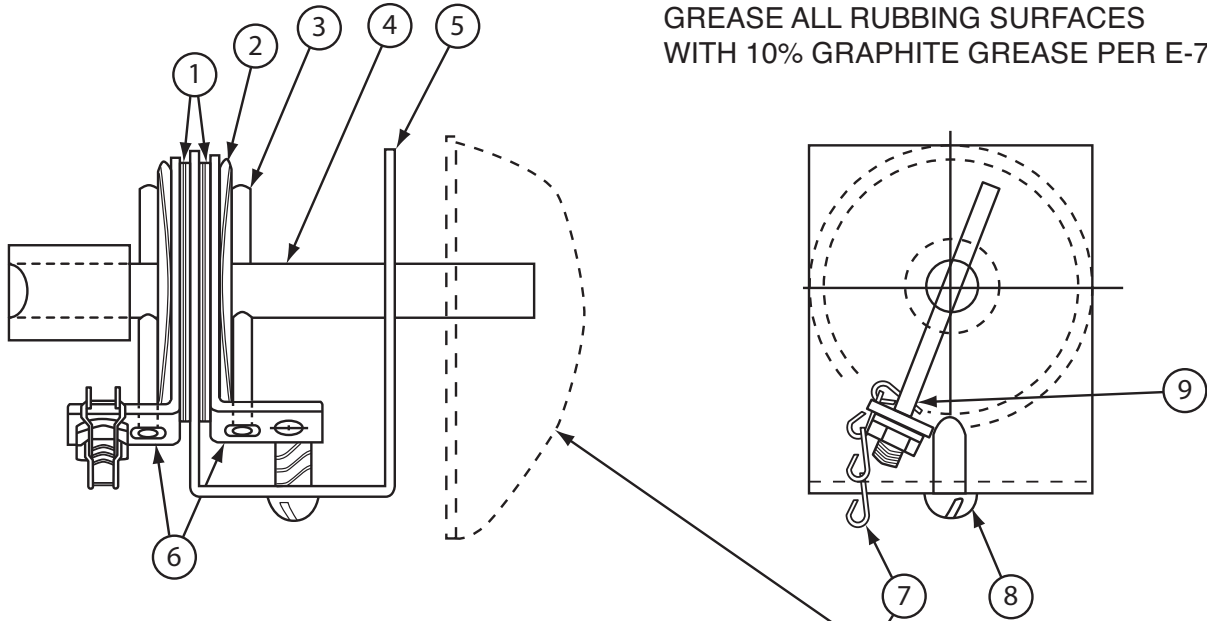
Return to Section TOC

Return to Master TOC

**IDLER SOLENOID TEST (continued)**

**FIGURE F.7 – MANUAL SPEED CONTROL CODES 215-1122 STD. FBS EXCITER ONLY**

GREASE ALL RUBBING SURFACES WITH 10% GRAPHITE GREASE PER E-708



ASSEMBLY S-7291 (WITHOUT HANDLE S-8158)

ASSEMBLY No. S-7291-1 ASSEMBLED WITH S-8158 HANDLE FOR REPLACEMENT ORDERS ONLY

CHAIN MUST BE PLACED WITH LINKS TURNED UP AS SHOWN

ITEM	DESCRIPTION	QTY.
1	T-8431	2
2	T-8095	2
3	1/8 X 1 3/4 TYPE #3 GROOV-PIN	2
4	T-8432	1
5	S-7292	1

ITEM	DESCRIPTION	QTY.
6	T-8430	2
7	T-8667	52"
8	S-8025-10	1
9	#10-24 X 3/8 R.H. MACH. SCR. NUT & LOCKWASHER	1

CODE 215-1

Return to Section TOC

Return to Master TOC



## IDLER SOLENOID TEST (continued)

R57 Vacuum Code 3417 - 7242

R-51 Bellows Code 445-3312 @ FDW oversize exciter only.

### TROUBLE SHOOTING AND MAINTENANCE – R51 AND R57 IDLERS

The idler has been carefully set and calibrated at the factory and should require a minimum of maintenance. When the idler “does not work” it either (1) does not slow the engine down after welding has stopped or (2) it does not permit the engine to pick up speed when the arc is struck.

There are two simple checks and adjustments that can easily be made and which will take care of practically all idlers that fail to operate. Be sure these checks are made and follow these instructions before tampering with the internal parts of the idler.

1. If the idler does not reduce engine speed about 10 seconds after the welding has stopped:

Loosen the sealing nut on the petcock (*item 11, Figure F.9*). Turn the adjusting screw counter-clockwise to speed up the operation of idler until the time delay is about 10 seconds. Do not try and reduce the time delay to less than 8 seconds as this may prevent the engine from coming up to full speed when the arc is struck. Retighten the sealing nut while holding the adjusting screw at the desired setting. When tightening the sealing nut be sure that it is just snug. This should enable you to make future adjustments without loosening the sealing nut.

2. If the engine fails to pick up speed when the arc is struck:

The engine may be idling too slowly to provide the minimum required solenoid voltage. All Lincoln water cooled gas engine driven welders equipped with R51 and R57 idlers should idle at 1000 RPM.

Adjust idle speed if necessary with idle speed adjusting screw on carburetor.

If either of the above mentioned adjustments do not correct the difficulty, then the following procedures can serve as a guide in finding the source of trouble.

Trouble: Idler does not slow down engine

1. Adjust petcock per above instructions.
2. If the petcock is open but the idler still does not slow down the engine, then there is a leak in the vacuum system which prevents the vacuum from being applied to the diaphragm.

Sources of leaks are as follows:

- a. Broken or cracked vacuum line or fittings.
- b. Leaky diaphragm (*item 2, Figure F.9*).
- c. Needle valve (*item 6, Figure F.9*) is not sealing. This can be caused by one of the following troubles:
  1. Dirt is preventing valve from sealing.
  2. The core and cap assembly (*item 8, Figure F.9*) is not pushing the needle valve closed. This will occur if the core spring (*item 9, Figure F.9*) is missing or if the residual magnetism in the solenoid is holding the core and cap assembly down. The residual magnetism will hold the core and cap assembly down if the spacer (*item 12, Figure F.9*) is missing. Late model idlers have a piece of plastic permanently inserted in the solenoid to act as a spacer while older idlers have a removable bronze disc. If there is a question as to whether there is a spacer in the solenoid a bronze disc, Part No. T-10172 can be added with no bad affect.

Trouble: Engine does not pick up speed when arc is struck

1. Check engine idle speed per above instructions.
2. Check to see if solenoid is pulling in when arc is struck. This can be done by lifting the rubber seal (*item 10, Figure F.9*) and seeing if the core and cap assembly moves down when the arc is struck.
  - a. If the solenoid is pulling in:
    - (1) Needle valve may be sticking closed. This will occur if there is not the proper spring (*item 7, Figure F.9*) in the valve.
  - b. If the solenoid is not pulling in:

Check the voltage across the solenoid coil when the arc is struck:

- (1) If there is no voltage or insufficient voltage then there is an open in the connections or the connections were improperly made.



Return to Section TOC  
Return to Section TOC  
Return to Section TOC  
Return to Section TOC  
Return to Master TOC  
Return to Master TOC  
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Return to Master TOC



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**MAIN GENERATOR SHUNT FIELD WINDING TEST****⚠ WARNING**

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

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**TEST DESCRIPTION**

This test will help determine whether or not the Main Shunt Field Coils are shorted, open, or grounded.

**MATERIALS NEEDED**

Volt/Ohmmeter (Multimeter)  
Wiring Diagram

Return to Section TOC

Return to Master TOC

Return to Section TOC

Return to Master TOC

Return to Section TOC

Return to Master TOC

Return to Section TOC

Return to Master TOC

SA-200





## MAIN GENERATOR SHUNT FIELD WINDING TEST (continued)

### PROCEDURE

1. Locate the blue and brown leads emerging from the welder lead block at the top of the main generating housing (On SA200 Short hood code 445-3312, the blue lead is connected to R51).
2. Open the Shunt lead to the SERIES EXCITER connection.
3. Ohm between the Shunt lead and the Shunt field at the mercury switch on the idler.
4. The resistance should be 42 Ohms, and a MINIMUM of 500,000 Ohms from one lead to ground.

On Vacuum Idler and Electronic Idler models above code 3312-

The BLUE lead is connected to the FINE CURRENT CONTROL RHEOSTAT, the Brown lead is connected to one side of the 115 VDC receptacle.

(On Electronic Idler models the BROWN and BLACK lead are bolted together; this connection should be unbolted).

Lift the rheostat wiper and place an insulator between the brush and the winding Ohm between the BLUE and BROWN leads.

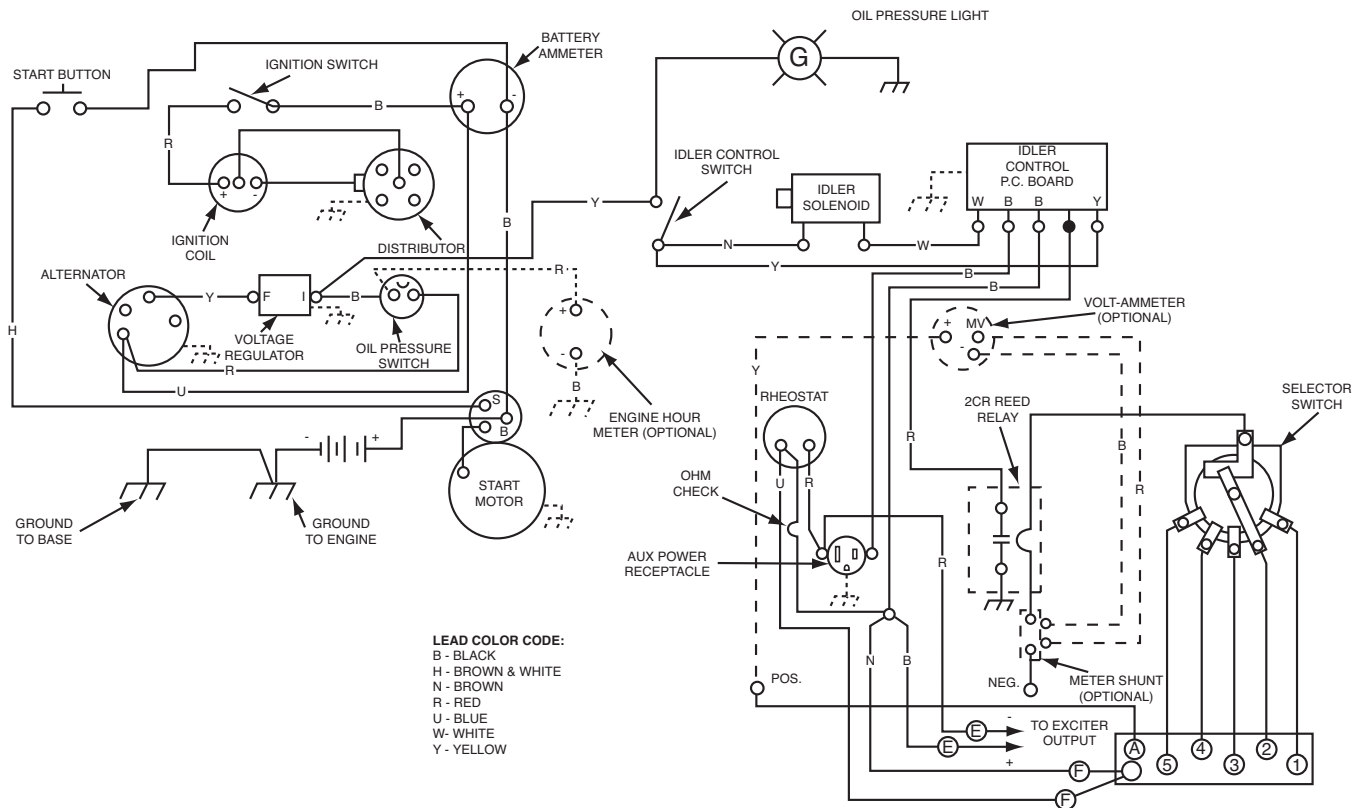
The resistance value @ 75 degrees F should be approximately 42 Ohms. Now Ohm between either lead and a good chassis ground.

The resistance value should be greater than 500,000 Ohms.

See diagrams on next pages.

MAIN GENERATOR SHUNT FIELD WINDING TEST (continued)

FIGURE F.10 – BATTERY IGNITION WIRING DIAGRAM



A.N.S.I. ELECTRICAL SYMBOLS PER E-1537

MAINTENANCE INSTRUCTIONS

Observe operating and maintenance instructions in engine manual. Blow out welders and controls with air hose at least once every two months - once every week in dirty locations.

Brushes should be replaced before the pigtails are within .12" of the commutator or before the limit of spring travel is reached.

Replace with the same kind of brushes as were originally furnished. Sand in brushes according to instructions in the instruction manuals. Commutators may be cleaned with fine sandpaper while the machine running to remove and grease or dirt that has accumulated. **DO NOT USE EMERY CLOTH.**

Ball bearings should not be greased more than once a year under normal service. Most bearing failures are caused by allowing dirt to be forced into the bearing with the grease, or use of improper kind of grease. **DO NOT OVERPACK WITH GREASE.**

Keep ground and electrode connections tight.

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

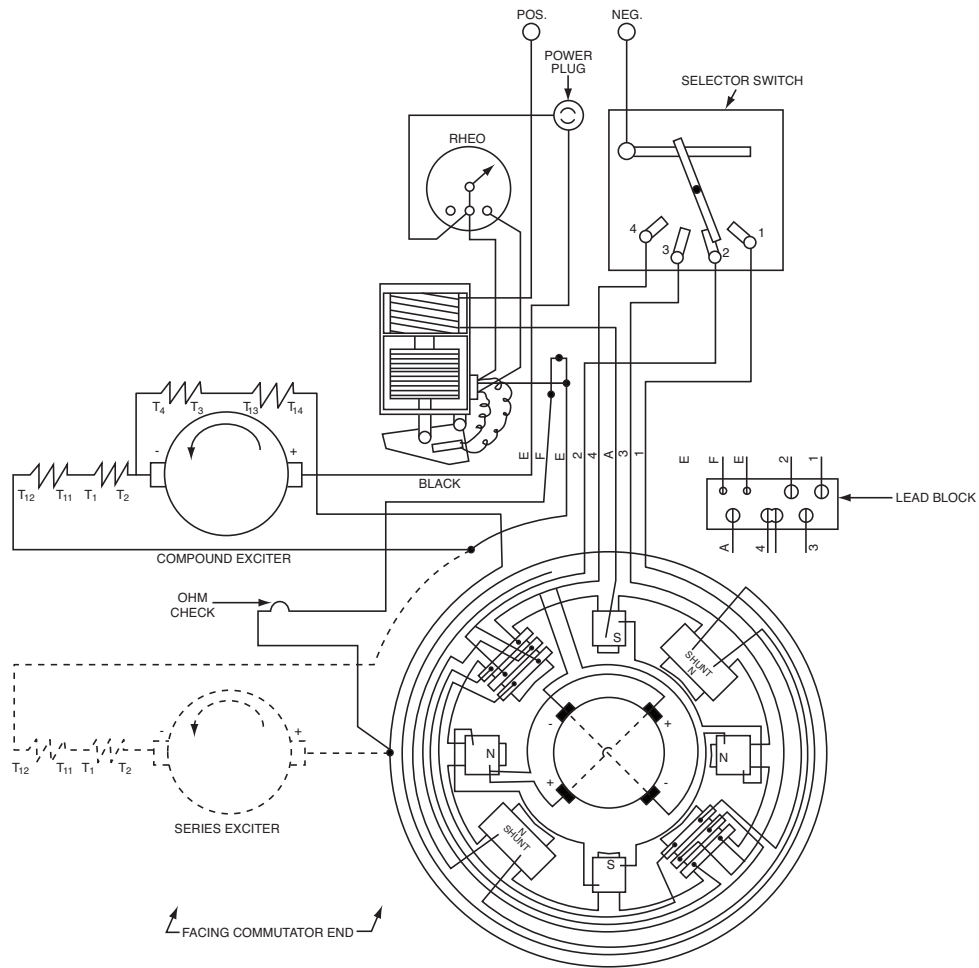
Return to Master TOC

Return to Master TOC

Return to Master TOC

MAIN GENERATOR SHUNT FIELD WINDING TEST (continued)

FIGURE F.11 – ENGINE DRIVEN - TYPE 6090 CODE 445 - 3312



**GOVERNOR CONTROL**

When governor control is used, leads “E” and “F” are brought out of generator through lead block and spliced together as shown by dotted lines.

**RHEOSTAT CONTROL**

When rheostat control is used, compound exciter and rheostat are wired as shown by solid lines. Leads “E” and “F” are connected to the engine regulator.

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC



Return to Section TOC      Return to Section TOC      Return to Section TOC      Return to Section TOC  
Return to Master TOC      Return to Master TOC      Return to Master TOC      Return to Master TOC



## FLASHING THE FIELDS

**⚠ WARNING**

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

**TEST DESCRIPTION**

This procedure will magnetize the Exciter Pole pieces. The Exciter can then “build-up” when the engine is started.

**MATERIALS NEEDED**

- 12-Volt Battery
- Two Jumper Wires With Alligator Clips On Each End
- Wiring Diagram
- 3/8” Nutdriver

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

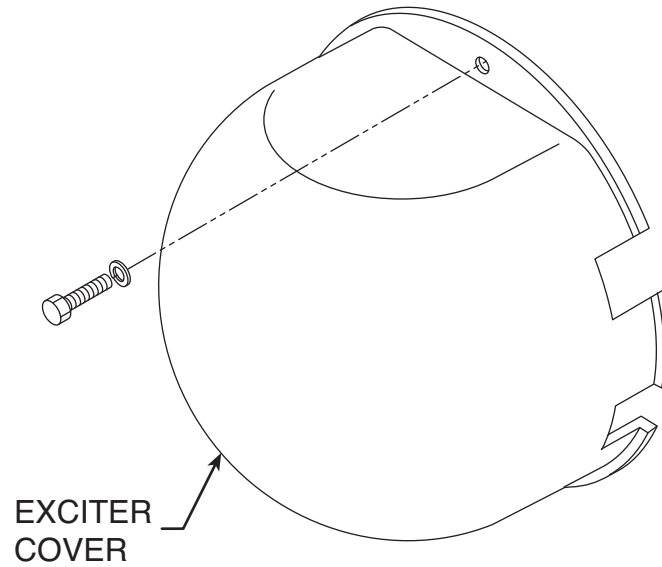
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SA-200



## FLASHING THE FIELDS (continued)

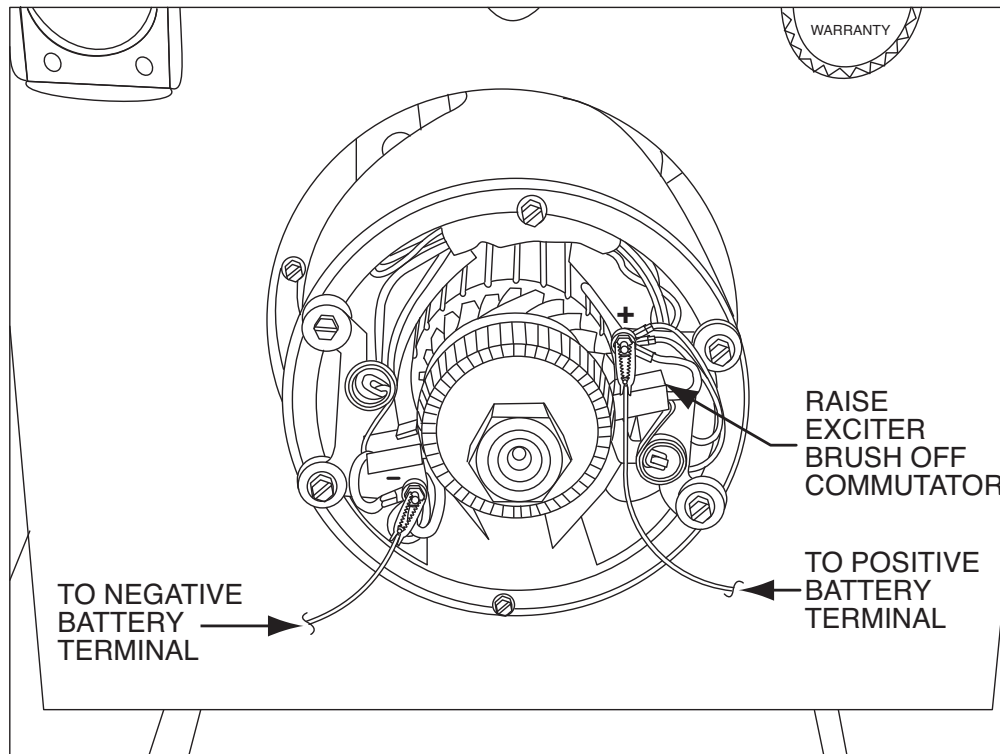
FIGURE F.13 – EXCITER COVER REMOVAL

**PROCEDURE**

1. Turn the engine OFF.
2. Using a 3/8" Nutdriver, remove the exciter cover. See Figure F.13.

## FLASHING THE FIELDS (continued)

FIGURE F.14 – BRUSH HOLDER / BATTERY JUMPER CONNECTIONS



3. Raise one exciter brush off the armature commutator.
4. Using the jumper leads and the 12VDC battery, first attach the clip of one lead to the POSITIVE terminal of the battery. Attach the other end of this same lead to the right side brush holder. See Figure F.14.
5. Carefully attach one clip of the other lead to the NEGATIVE terminal of the battery. Attach the other end of the same lead to the left side brush holder for approximately five seconds. Pull the lead away quickly to minimize arcing. See Figure F.14.
6. Remove both leads from the brush holders and the battery.
7. Install the brush removed in step 3.
8. Install the exciter cover using the 3/8" nutdriver.
9. Start the engine. The exciter should produce DC output voltage.

SA-200



Return to Section TOC

Return to Section TOC

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**RACK ADJUSTMENT PROCEDURE****⚠ WARNING**

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

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**TEST DESCRIPTION**

This procedure will aid the technician in the adjustment of the Rack.

**MATERIALS NEEDED**

Flat Screwdriver  
7/16" Wrench  
Carbon Stone

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

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Return to Master TOC

SA-200



## RACK ADJUSTMENT PROCEDURE (continued)

### PROCEDURE

1. Connect the SA 200 to a load bank, make sure the engine is adjusted to specifications and the machine is hot.
2. Set the machine for MAXIMUM TAP, Maximum Rheostat.
3. Set grid load for 300 Amps, adjust the rack position to achieve 33-39 Volts at 1440-1500 RPM.

#### WARNING



#### **ELECTRIC SHOCK** can kill.

- Do not operate with panels open.
- Disconnect **NEGATIVE (-)** Battery lead before servicing.
- Do not touch electrically live parts.

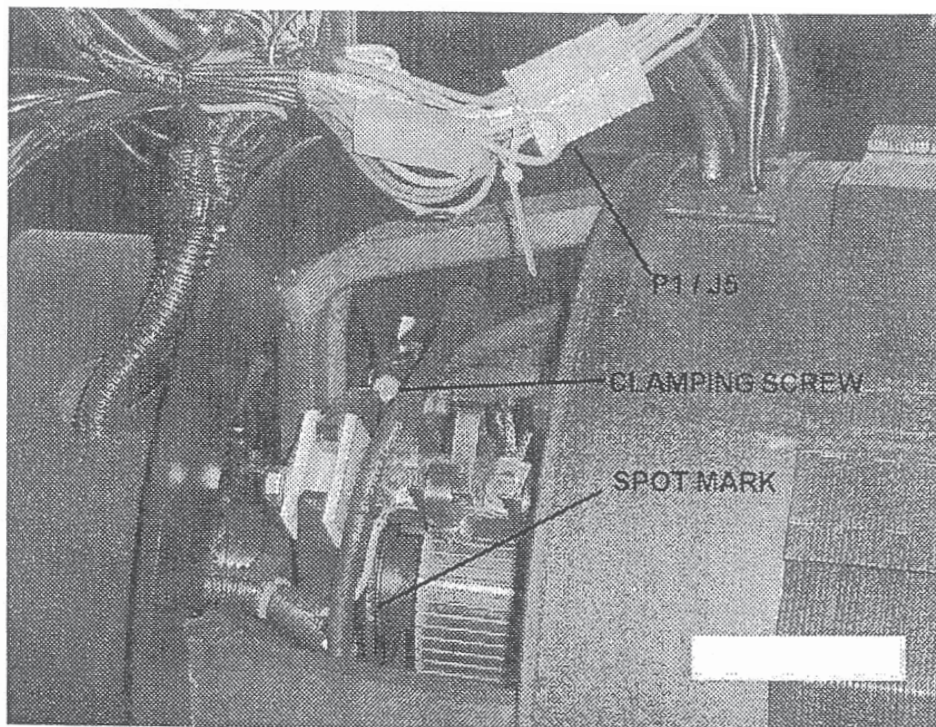
#### WARNING



#### **MOVING PARTS** can injure.

- Keep guards in place.
- Keep away from moving parts.
- Only qualified personnel should install, use or service this equipment.

FIGURE F.15 – RACK



### INSTRUCTIONS FOR ROTATING THE ROCKER (“RACK”)

**FOR: CLASSIC 300 D&G, CLASSIC II, SA-250, & SA 200 (Before adjusting the rocker, the machine must be set to factory spec. E3383)**

1. With machine not running, remove the generator cover (“Wraparound”) by removing the two 1/4-20 RH screws.
2. Disconnect jumper plug “P1” from receptacle “J5”. (Ignore on SA-200).
3. Locate the rocker “spot mark”. This mark is a 1/8” dia. drill mark that is placed on the rocker where it clamps to the bearing hub on the right side of the machine. (Looking at the nameplate).
4. Loosen the 1/4-20 HH rocker clamping screw approximately one turn. (Clamp screw is located on the right side at the top of the rocker.)
5. Gently rotate the rocker up or down 1/2 diameter of the “spot mark” depending on desired weld characteristics.

*Against Rotation* – will give a “HOTTER ARC”  
(More Fluid)

*With Rotation* – will give a “COLDER ARC”  
(Better Stacking)

6. Re-tighten the rocker clamp screw to 70-75 inch lbs.

**NOTE:** Rocker must be fully seated against the bearing hub shoulder.

7. Start the machine. Using a 120-150 grit carbon stone, re-seat the generator brushes by moving the stone back and forth over the commutator for approximately 1-2 min.

**CAUTION:** Do not allow the stone to rub against the armature coils while the machine is running.

8. Turn the machine off. Using compressed air, blow out the carbon dust from generator and armature area. (Turning the engine over with the starter will help in the process.)
9. Replace generator cover and reconnect jumper plug “P1 to J5”. (Ignore on SA-200).

**IT IS RECOMMENDED THAT AFTER ADJUSTING THE ROCKER, THE MACHINE BE RUN FOR 30-45 MINUTES AT HIGH IDLE / NO LOAD TO ALLOW THE BRUSHES TO COMPLETE THE SEATING PROCESS FOLLOWED BY A TEST WELD TO ENSURE THAT THE DESIRED WELD CHARACTERISTICS WERE ACHIEVED.**

SA-200



RACK ADJUSTMENT PROCEDURE (continued)

FIGURE F.16 – TEST AND INSPECTION

WELDER	MAX. IDLE				MIN. IDLE			MAX. 300 AMPS		200 AMPS		150 AMPS	100 AMPS	MIN. SHORT		ENGINE IDLE RPM	EXCITER		
	D.C. VOLTS	EXC. VOLTS	FIELD AMPS	RPM	D.C. VOLTS	EXC. VOLTS	FIELD AMPS	VOLTS	RPM	VOLTS	RPM	VOLTS	VOLTS	VOLTS	AMPS		AMPS	VOLTS	FIELD AMPS
SA200 F162 FJW 4 TAP	$\frac{83}{89}$	$\frac{125}{133}$	$\frac{2.35}{2.65}$	$\frac{1490}{1510}$	$\frac{44}{54}$	$\frac{126}{134}$	$\frac{1.05}{1.30}$	$\frac{39}{45}$	$\frac{1300}{1400}$	$\frac{33}{39}$	$\frac{1390}{1490}$	$\frac{21}{27}$	$\frac{1}{5}$	$\frac{105}{120}$	$\frac{950}{1050}$	10	$\frac{123}{131}$	$\frac{.63}{.70}$	
F163 OR C175 L200 FJW-FDW 5 TAP CODE 7699 & LOWER	$\frac{87}{93}$	$\frac{121}{129}$	$\frac{2.35}{2.65}$	$\frac{1540}{1560}$	$\frac{47}{57}$	$\frac{121}{129}$	$\frac{1.00}{1.25}$	$\frac{35}{41}$	$\frac{1440}{1500}$	$\frac{37}{43}$	$\frac{1475}{1535}$	$\frac{36}{42}$	$\frac{37}{43}$	$\frac{1}{5}$	$\frac{105}{120}$	$\frac{1000}{1050}$	10	$\frac{122}{130}$	$\frac{FDW-5E}{.63/.70}$ $\frac{FDW-5K}{.78/.85}$
WELDER	MAX. IDLE				MIN. IDLE			MAX. TAP 300 AMPS		SHORT OUTPUTS				ENGINE IDLE RPM	POWER PLUG EXCITER LOAD				
	O.C. VOLTS	EXC. VOLTS	FIELD AMPS	RPM	O.C. VOLTS	EXC. VOLTS	FIELD AMPS	VOLTS	RPM	200 TAP AMPS	150 TAP AMPS	100 TAP AMPS	MIN. AMPS		AMPS	VOLTS	FIELD AMPS		
L200 F163 ABOVE CODE 7700 SA-200	$\frac{88}{95}$	$\frac{123}{132}$	$\frac{2.35}{2.65}$	$\frac{1540}{1560}$	$\frac{47}{57}$	$\frac{124}{133}$	$\frac{1.00}{1.25}$	$\frac{33}{39}$	$\frac{1440}{1500}$		$\frac{325}{385}$	$\frac{245}{285}$	$\frac{165}{195}$	$\frac{110}{130}$	$\frac{1000}{1050}$	15	$\frac{115^*}{125}$	$\frac{.79^\Delta}{.87}$	
SA250 D3.152 DIESEL	$\frac{94}{100}$	$\frac{121}{130}$	$\frac{2.3}{2.6}$	$\frac{1790}{1810}$	$\frac{47}{57}$	$\frac{122}{130}$	$\frac{.95}{1.20}$	$\frac{43}{49}$	$\frac{1700}{1770}$		$\frac{340}{410}$	$\frac{255}{310}$	$\frac{175}{220}$	$\frac{115}{130}$	$\frac{1325}{1375}$	15	$\frac{125^{**}}{134}$	$\frac{.85}{.94}$	

\* Taken at receptacle after removing generator field ammeter from the circuit (black exciter lead connected directly to right hand exciter brush holder.)

\*\* Taken across exciter brush holders.

Δ Field amps limit for units other than SA-200:  $\frac{.85}{.94}$

**Long Test:**

If additional voltage for quick heating of fields is not available, run machine at max. control settings and no load until field current and open circuit voltage stops decreasing. This will take one hour or more. Then at this time short circuit the output terminals at max control settings for 30 seconds. Then proceed with rest of testing.

**NOTE:** If the welder under test does not fall within the above limits, and in the opinion & experience of the test and the Inspection Department the welder is still passable, a test sheet shall be made out and submitted to the Engineering Department for approval. If the Engineering Department approves the test, the welder may be passed. The serial number of the machine is to appear on the test sheet and the sheet will be filled in the Engineering Department.

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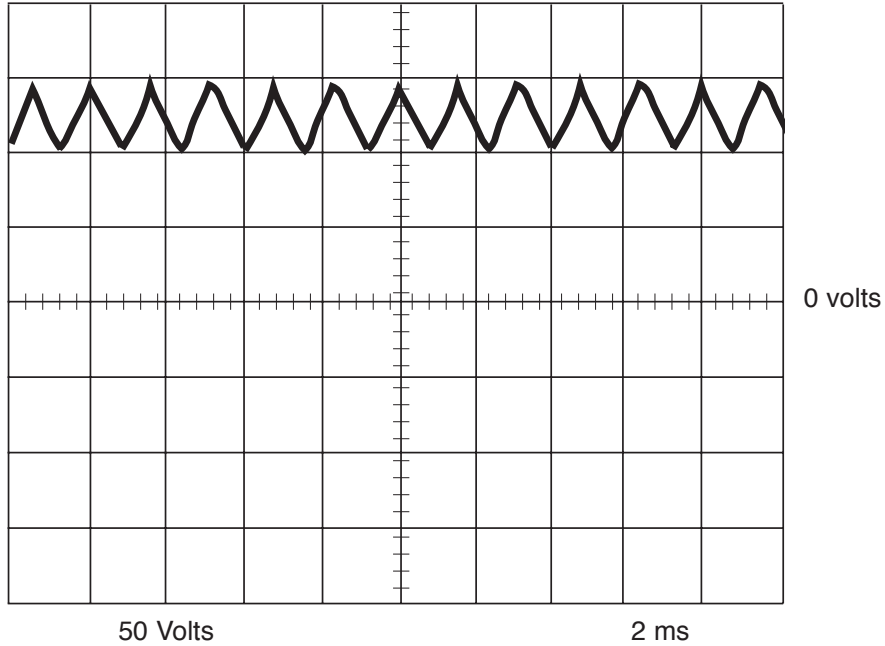
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**NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (115VDC SUPPLY)**

**HIGH IDLE – NO LOAD – FINE CURRENT CONTROL RHEOSTAT AT MAXIMUM**



This is the typical auxiliary output voltage generated from a properly operating machine. Note that each vertical division represents 50 volts and that each horizontal division represents 2 milliseconds in time.

Note: Scope probes connected at machine 115VDC receptacle.

**SCOPE SETTINGS**

Volts/Div .....	50V/Div.
Horizontal Sweep .....	2 ms/Div.
Coupling .....	DC
Trigger .....	Internal

SA-200

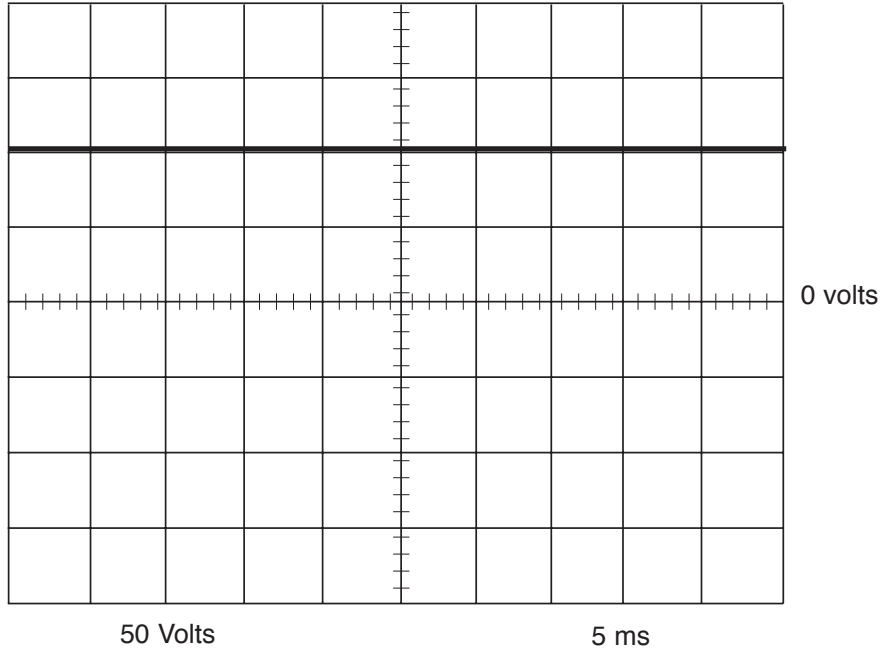


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**NORMAL OPEN CIRCUIT DC WELD VOLTAGE WAVEFORM**

**HIGH IDLE – NO LOAD – FINE CURRENT CONTROL RHEOSTAT AND SELECTOR SWITCH AT MAXIMUM**



This is the typical DC welding output voltage generated from a properly operating machine. Note that each vertical division represents 50 volts and that each horizontal division represents 5 milliseconds in time.

Note: Scope probes connected at machine output terminals.

**SCOPE SETTINGS**

Volts/Div .....	50V/Div.
Horizontal Sweep .....	5 ms/Div.
Coupling .....	DC
Trigger .....	Internal

SA-200



Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

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Return to Master TOC

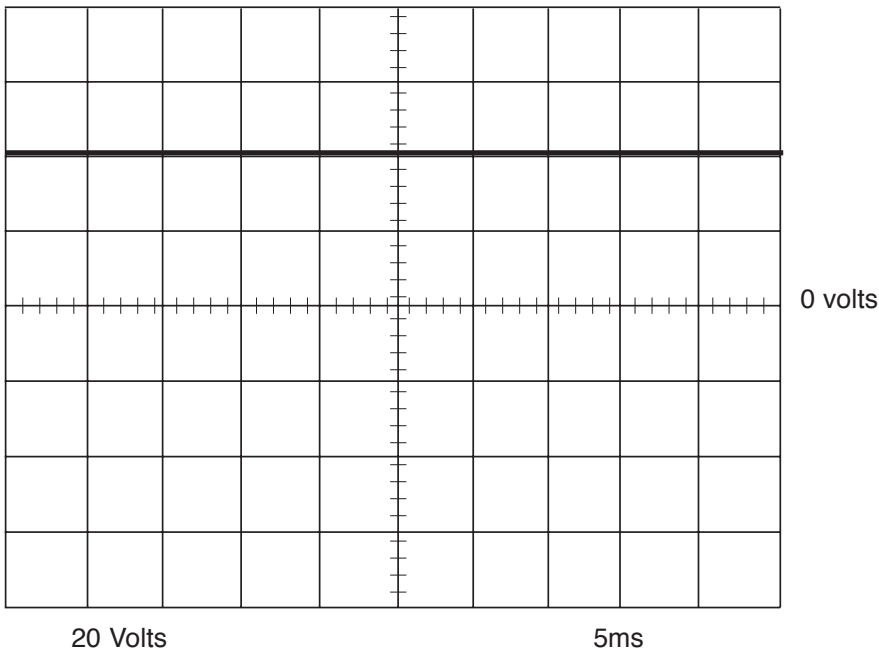
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# TROUBLESHOOTING AND REPAIR

## TYPICAL DC WELD VOLTAGE WAVEFORM

### MACHINE LOADED – SELECTOR SWITCH AT MAXIMUM



### MACHINE LOADED TO 200 AMPS AT 40VDC

This is the typical DC welding output voltage generated from a properly operating machine. Note that each vertical division represents 20 volts and that each horizontal division represents 5 milliseconds in time. The machine was loaded with a resistance grid bank.

Note: Scope probes connected at machine output terminals.

### SCOPE SETTINGS

Volts/Div .....	20V/Div.
Horizontal Sweep .....	5 ms/Div.
Coupling .....	DC
Trigger .....	Internal

Return to Section TOC  
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## DC EXCITER ARMATURE AND FIELD COILS REMOVAL AND REPLACEMENT PROCEDURE

### WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

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### TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Exciter Armature and Field Coils. This procedure is for later production models. Many of the procedures will apply to older models.

### MATERIALS NEEDED

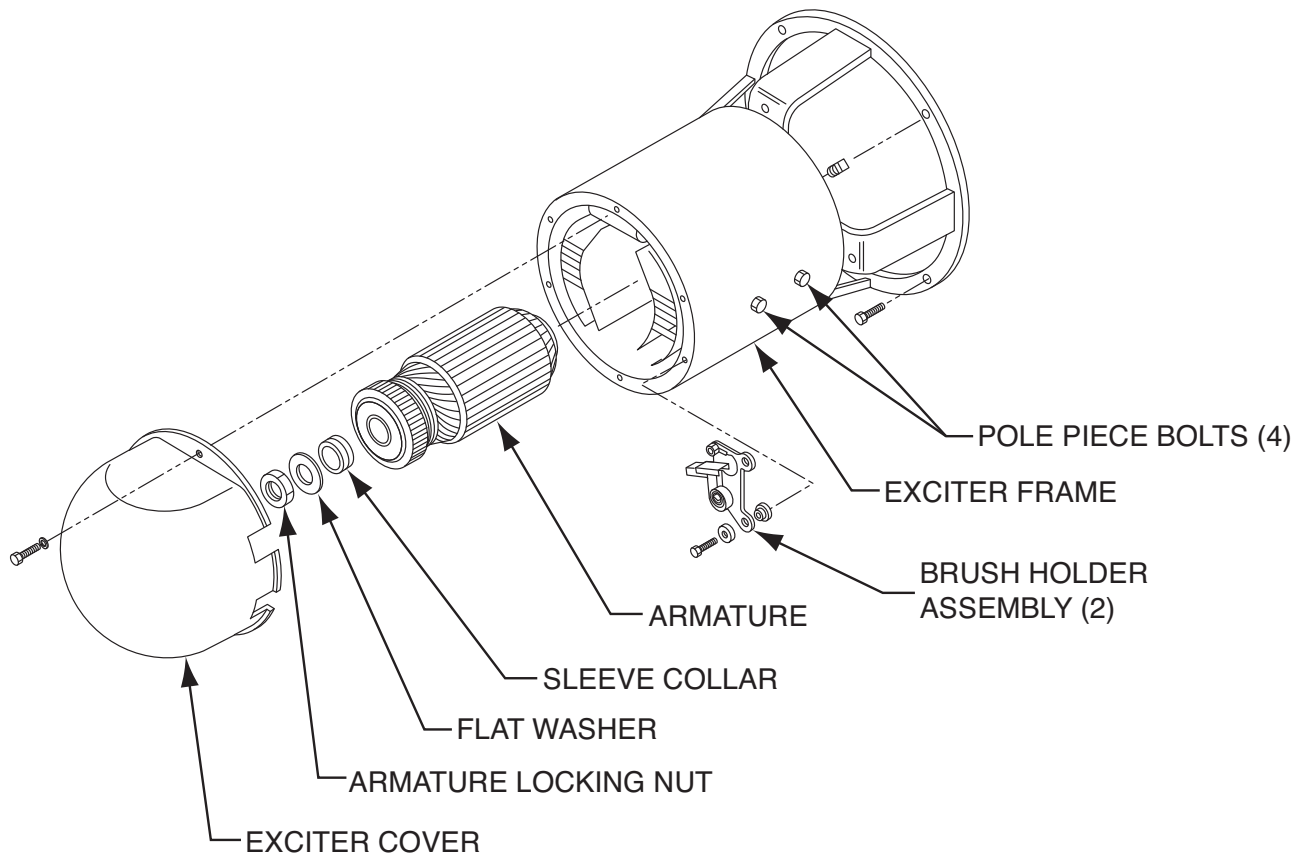
- 3/8" Wrench
- 1/2" Wrench
- 1-5/8" Socket Wrench
- Wiring Diagram

SA-200



## DC EXCITER ARMATURE AND FIELD COILS REMOVAL AND REPLACEMENT (continued)

FIGURE F.17 – EXCITER COVER REMOVAL



### PROCEDURE

#### DC Exciter Armature Removal Procedure

1. Turn the engine OFF.
2. Using the 3/8" nutdriver, remove the exciter cover. See Figure F.17.
3. Using the 3/8" wrench, remove the two brush holder assemblies. Note insulator placement for reassembly.
4. Bend the flat washer away from the armature locking nut.
5. Using the 1-5/8" socket wrench, remove the armature locking nut, washer, and sleeve collar.
6. Carefully remove the armature by sliding it from the shaft.

**NOTE:** The sleeve collar may have to be removed with a gear puller. Be careful not to damage the armature commutator.

#### Reassembly:

7. Upon reassembly, the armature locking nut should be torqued to 170 ft.-lbs. Install a new sleeve collar if necessary (Part number T5345). Bend the flat washer against the locking nut.
8. Install the brush holder assemblies. Note insulator placement.
9. Check the armature air gap. Minimum gap should be .025".
10. Install the exciter cover.

SA-200

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## DC EXCITER ARMATURE AND FIELD COILS REMOVAL AND REPLACEMENT (continued)

### Field Coils Removal Procedure

1. Perform the **DC Exciter Armature Removal Procedure**.
2. Using the 3/8" wrench, remove the leads from the brush holder. Note lead placement for reassembly.
3. Using the 1/2" wrench, remove the four bolts (two on each side) holding the pole pieces to the exciter frame. **See Figure F.17.**
4. Label and remove the tape and splices from the black and red leads that go to the idler board and 115VDC receptacle. See the Wiring Diagram.
5. Carefully slide the coils and pole pieces from the exciter frame.
6. Remove the coils from the pole pieces.

### Reassembly:

7. Assemble the new coils to their respective pole pieces.
8. Assemble the coil and pole pieces to the exciter frame with four bolts.
9. Make the necessary lead connections to the idler board and 115VDC receptacle. Wrap the splices with tape.
10. Assemble the armature and brushes. See the **DC Exciter Armature Removal Procedure**.

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT PROCEDURE

### WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

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### TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Main DC Generator Frame. This procedure is for later production models. Many of the procedures will apply to older models.

### MATERIALS NEEDED

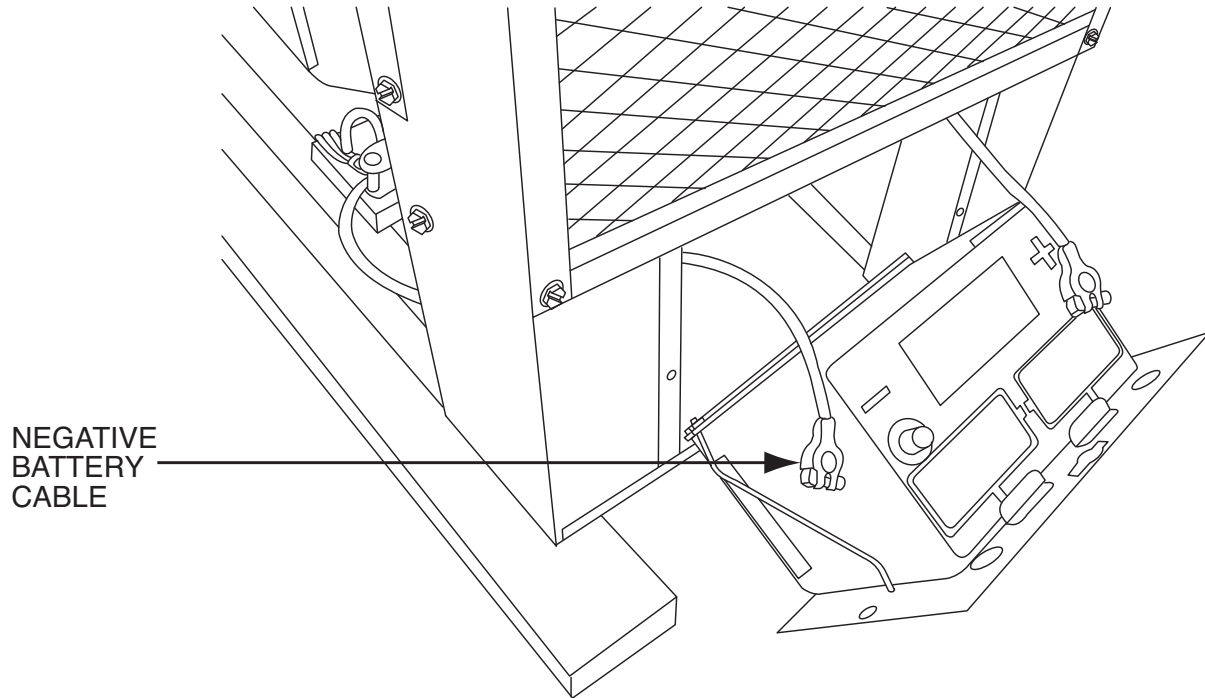
- Rope Sling
- Wood Or Steel Blocks
- Pry Bars
- 9/16" Wrench
- 1/2" Wrench
- 7/16" Wrench
- 3/4" Wrench
- Slot Head Screwdriver
- Wiring Diagram

SA-200



## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT (continued)

### FIGURE F.18 – BATTERY PANEL REMOVAL



### PROCEDURE

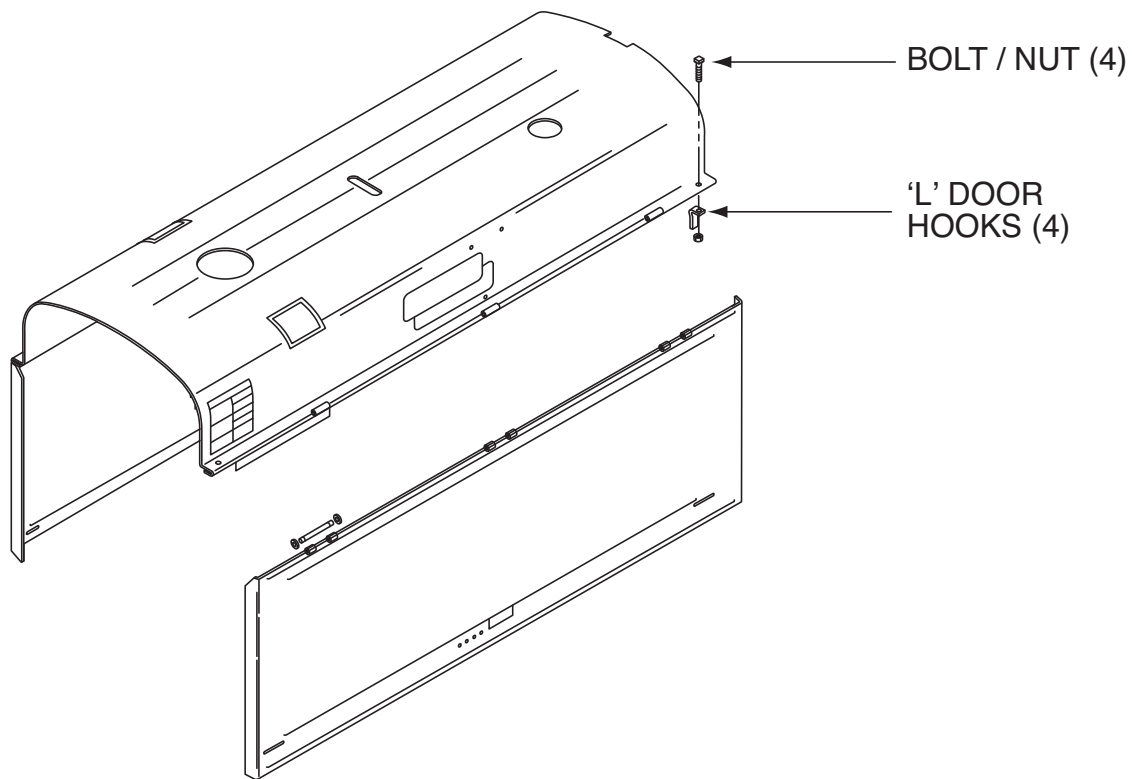
1. Turn the engine OFF.
2. Using the 7/16" wrench, remove the two bolts and washers and partially slide out the battery mounting panel. See Figure F.18.
3. Using the 1/2" wrench, remove the negative battery cable.

SA-200

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## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT (continued)

FIGURE F.19 – TOP AND DOORS ASSEMBLY DETAILS

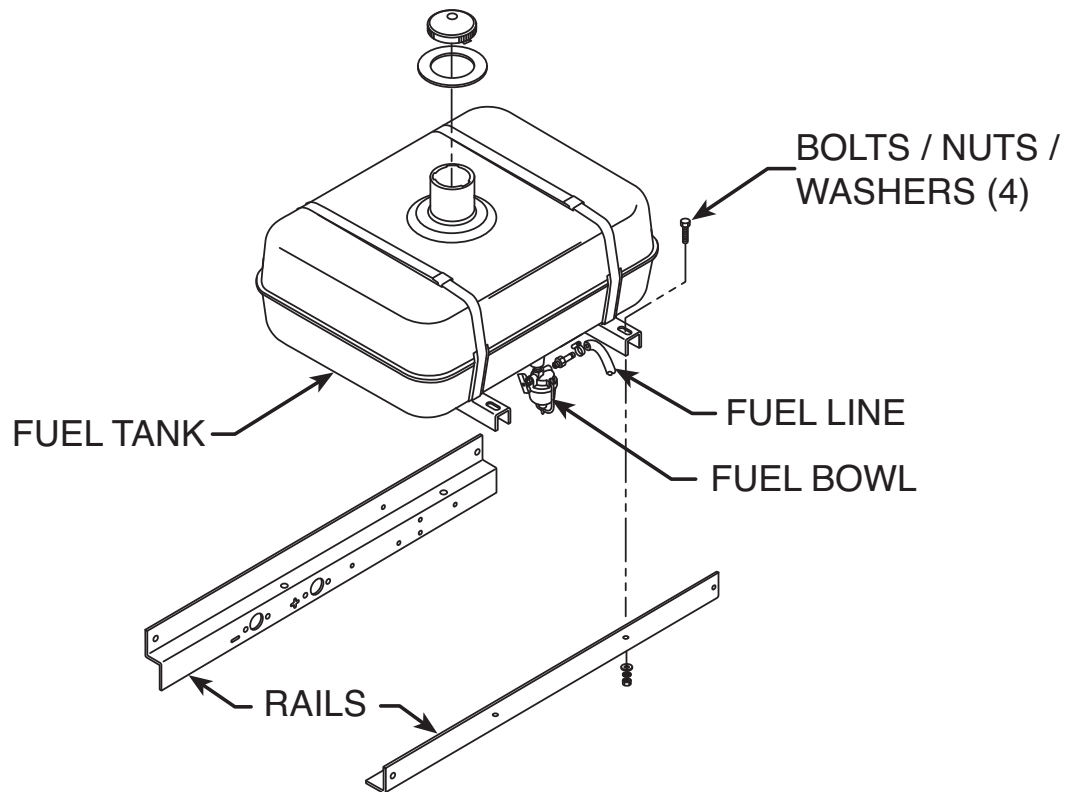


4. Using the 1/2" wrench, remove the four nuts and bolts holding the case top and doors assembly to the welder frame. Remove the rubber gasket from the top. Carefully lift up and remove the top and doors assembly. Carefully remove the "L" shaped door hooks. See Figure F.19.



## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT (continued)

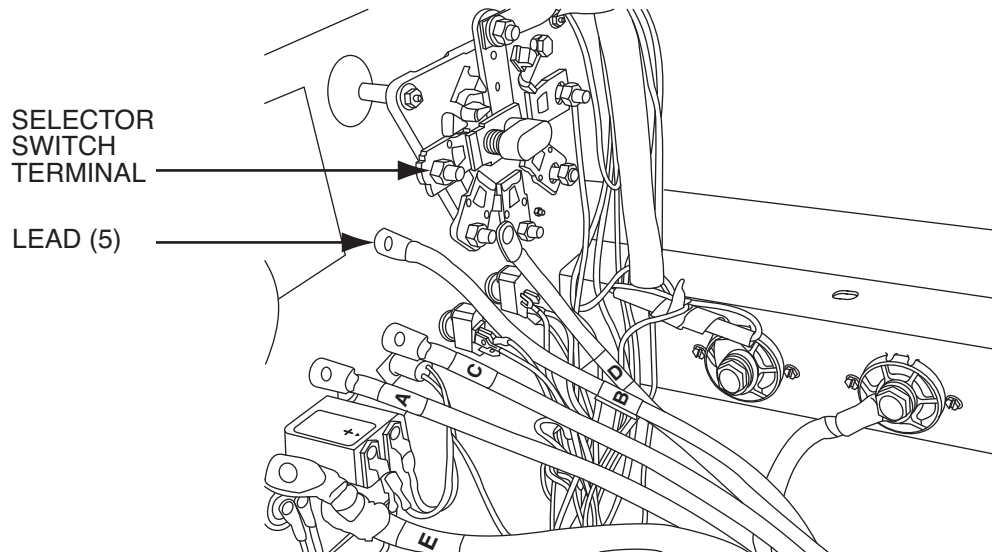
FIGURE F.20 – FUEL TANK MOUNTING DETAILS



5. Perform the ***DC Exciter Armature Removal Procedure***.
6. Turn off the fuel supply at the fuel bowl and remove the fuel line. Plug the line to avoid spillage.
7. Using the 9/16" wrench, remove the four nuts, bolts, and washers holding the fuel tank assembly to the rails. See Figure F.20.
8. Carefully remove the fuel tank and set it aside in a safe area.

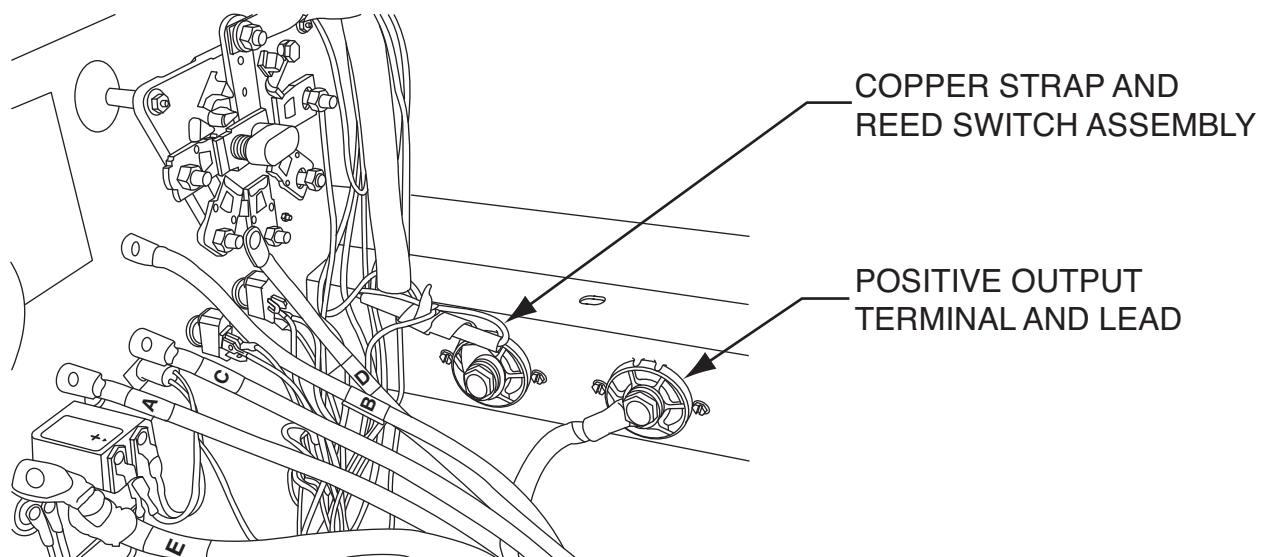
## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT (continued)

### FIGURE F.21 – SELECTOR SWITCH LEAD REMOVAL



- Using the 1/2" wrench, remove the five heavy flex leads from the selector switch terminals. Label the leads for reassembly. See Figure F.21.

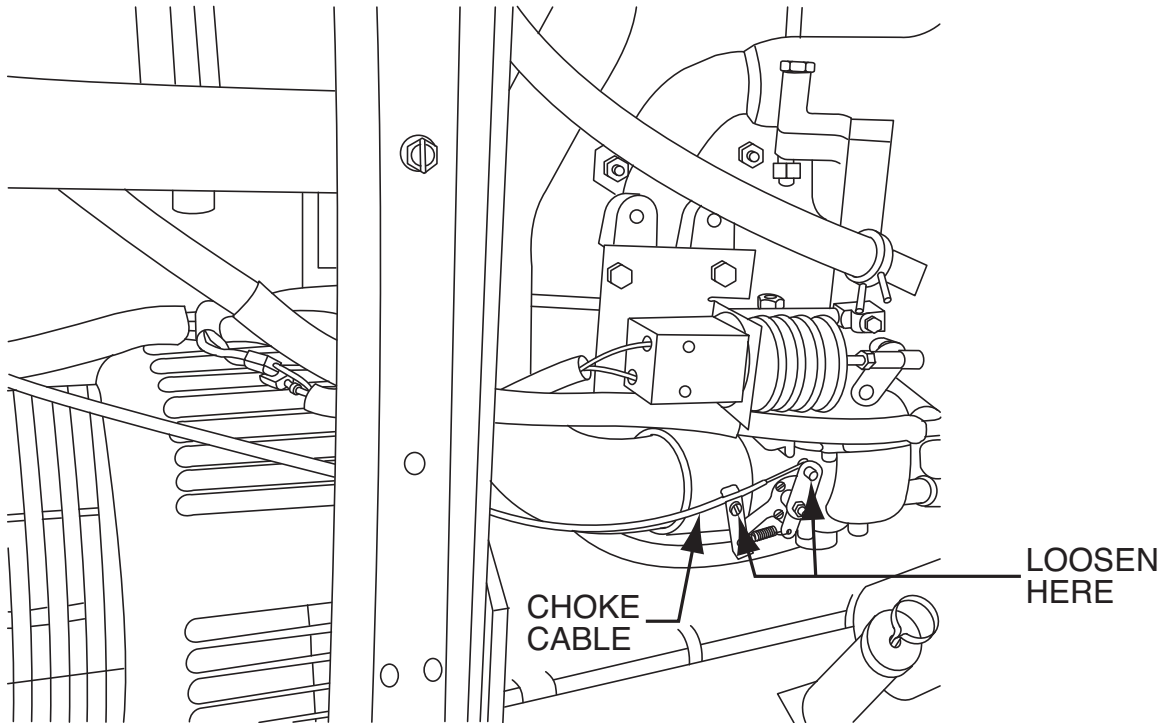
### FIGURE F.22 – OUTPUT TERMINAL LEAD REMOVAL



- Using the 3/4" wrench, remove the copper strap lead and reed switch assembly from the negative output terminal. See Figure F.22.
- Using the 3/4" wrench, remove the heavy lead from the positive output terminal. See Figure F.22.

## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT (continued)

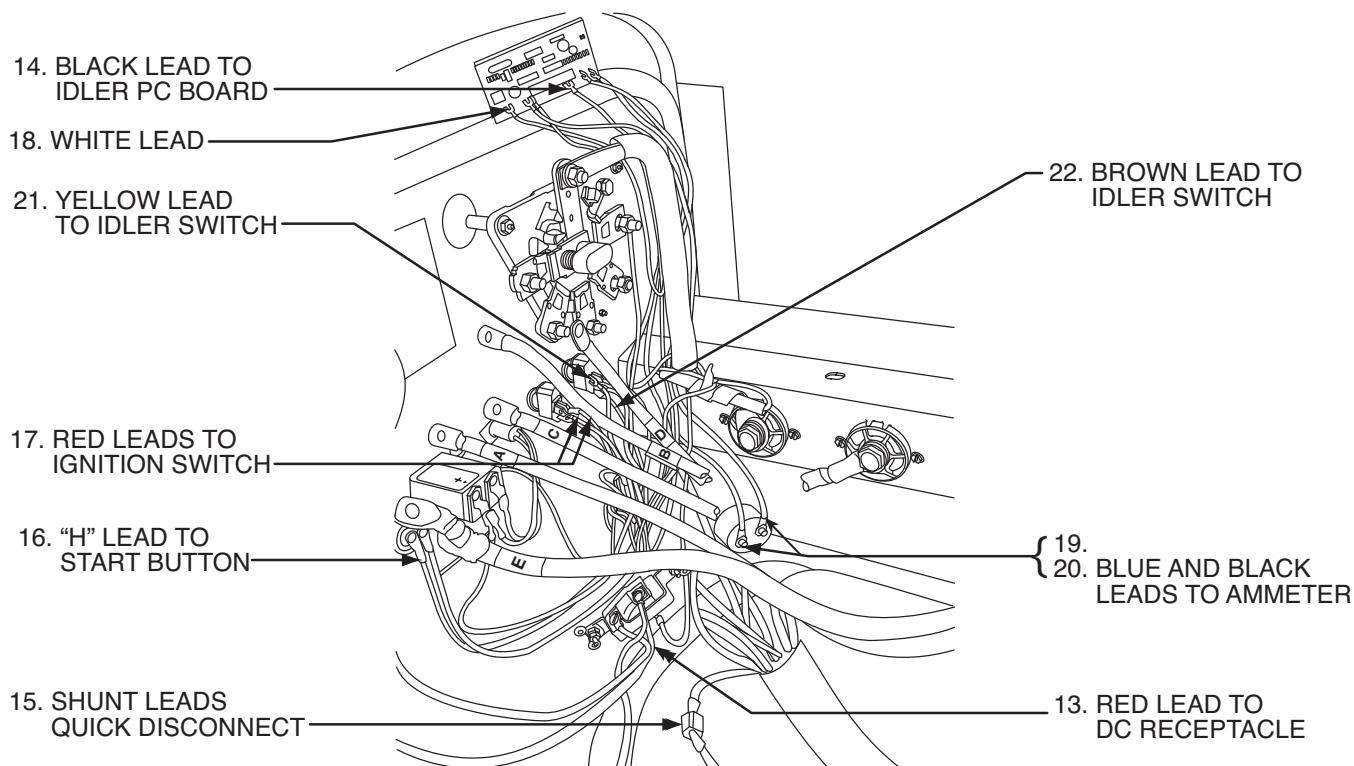
### FIGURE F.23 – CHOKE CONTROL CABLE REMOVAL



- Using the slot head screw driver, remove the choke control cable from the engine carburetor assembly. Mark cable replacement for reassembly. See Figure F.23.

## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT (continued)

### FIGURE F.24 – FRONT PANEL WIRING CONNECTIONS

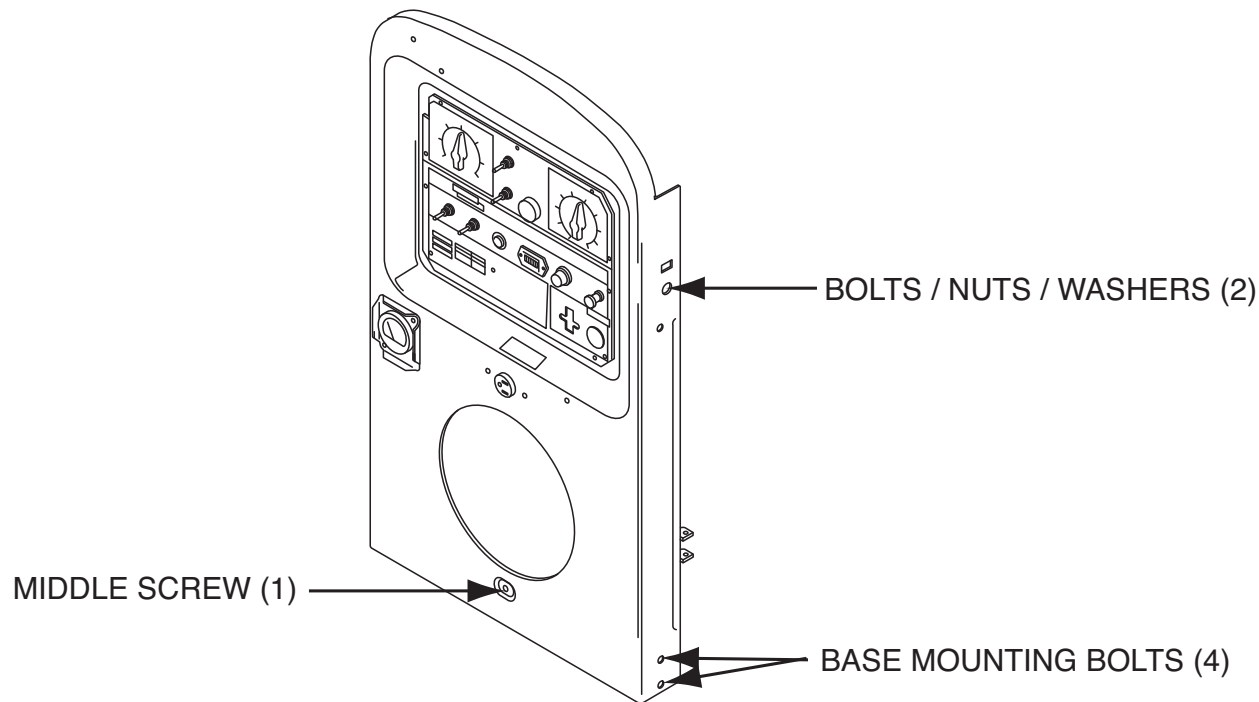


13. Using the slot head screw driver, remove the red lead connecting the 115VDC receptacle to the DC exciter. See Figure F.24 and the Wiring Diagram. Cut any necessary cable ties.
14. Remove the black lead connecting the idler PC board to the DC exciter. See Figure F.24 and the Wiring Diagram. Cut any necessary cable ties.
15. Disconnect the blue and brown main shunt leads from their quick disconnect splices. See the Wiring Diagram.
16. Disconnect the "H" lead from the START button switch. See Figure F.24 and the Wiring Diagram.
17. Remove the two red leads from the ignition switch. Label for reassembly. See Figure F.24 and the Wiring Diagram.

18. Remove the white lead from the idler PC board. See Figure F.24 and the Wiring Diagram.
19. Using the 3/8" nutdriver, remove the blue lead from the ammeter. Label for reassembly. See Figure F.24 and the Wiring Diagram.
20. Using the 3/8" nutdriver, remove the black lead from the ammeter. Label for reassembly. See Figure F.24 and the Wiring Diagram.
21. Label and remove the yellow lead from the idler switch. The yellow lead connects the idler switch to the oil pressure switch. See Figure F.24 and the Wiring Diagram.
22. Label and remove the brown lead from the idler switch. The brown lead connects the idler switch to the idler solenoid. See Figure F.24 and the Wiring Diagram.

## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT (continued)

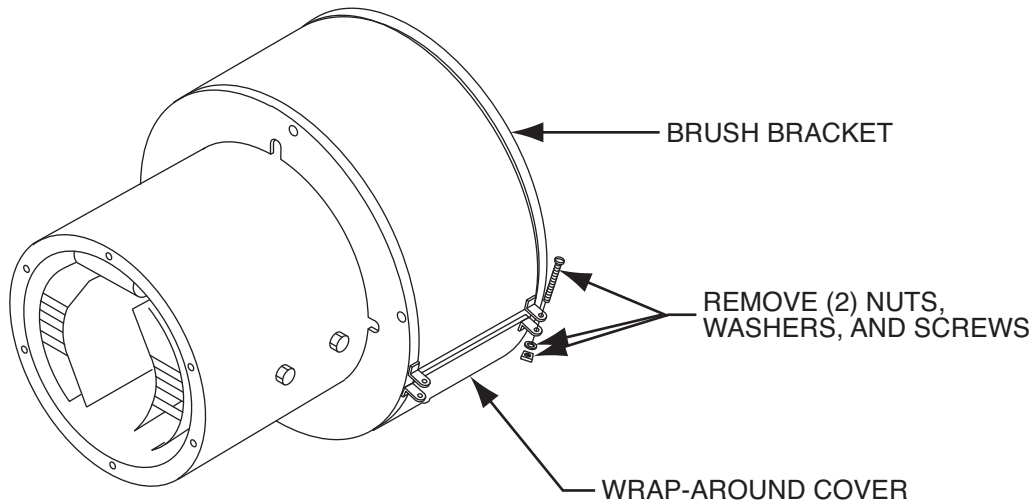
FIGURE F.25 – FRONT PANEL FASTENER REMOVAL



23. Using the 1/2" wrench, remove the two bolts, nuts, and washers that hold the front panel assembly to the horizontal rails. (There is one on each side.) See Figure F.25.
24. Using the 9/16" wrench, remove the four bolts, nuts, and washers from the bottom of the front panel assembly. These four bolts mount the front to the base. (There are two on each side.) See Figure F.25.
25. Using the 3/8" nutdriver, remove the screw from the lower middle of the front panel. See Figure F.25.
26. Carefully remove the front panel assembly.

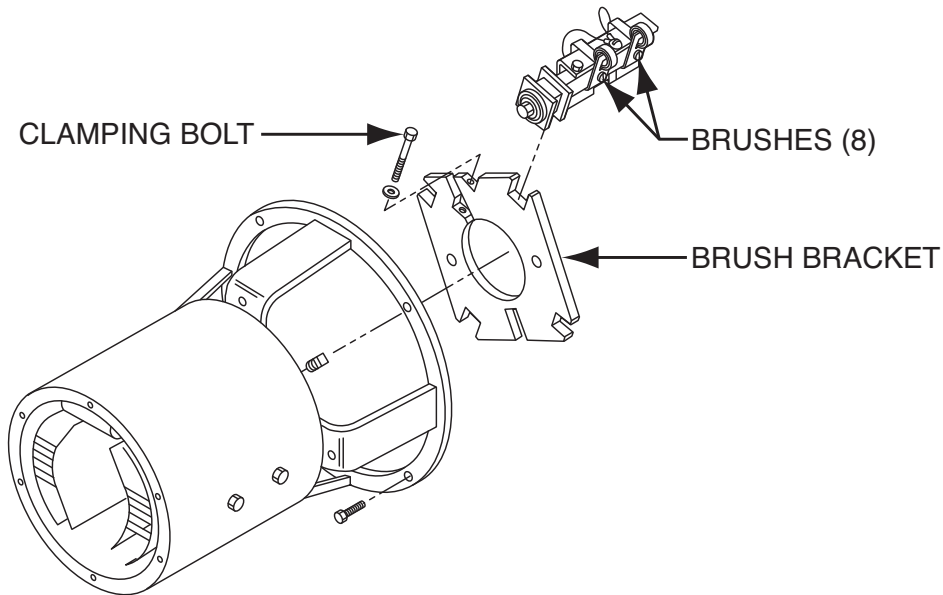
## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT (continued)

### FIGURE F.26 – BRUSH BRACKET WRAP-AROUND COVER



27. Using the slot head screw driver, remove the two screws and nuts from the brush bracket wrap-around cover. Remove the cover. See Figure F.26.

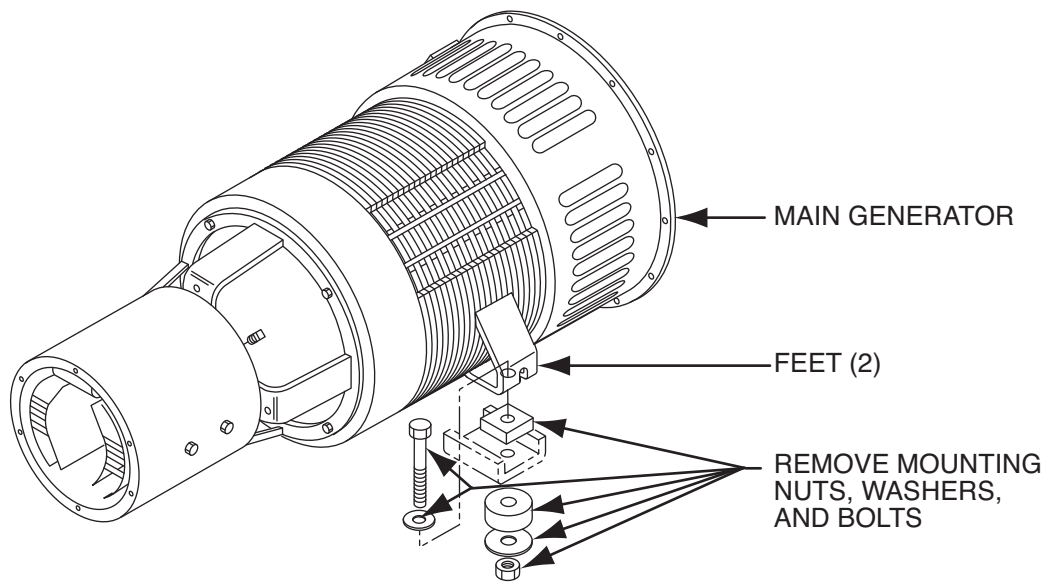
### FIGURE F.27 – MAIN GENERATOR BRUSH BRACKET CLAMPING BOLT



28. Lift the eight brushes from the main commutator. Note their positions for reassembly.
29. Using the 7/16" wrench, loosen (do not remove) the main generator brush bracket clamping bolt. Note the position of the drill spot for reassembly. See Figure F.27.

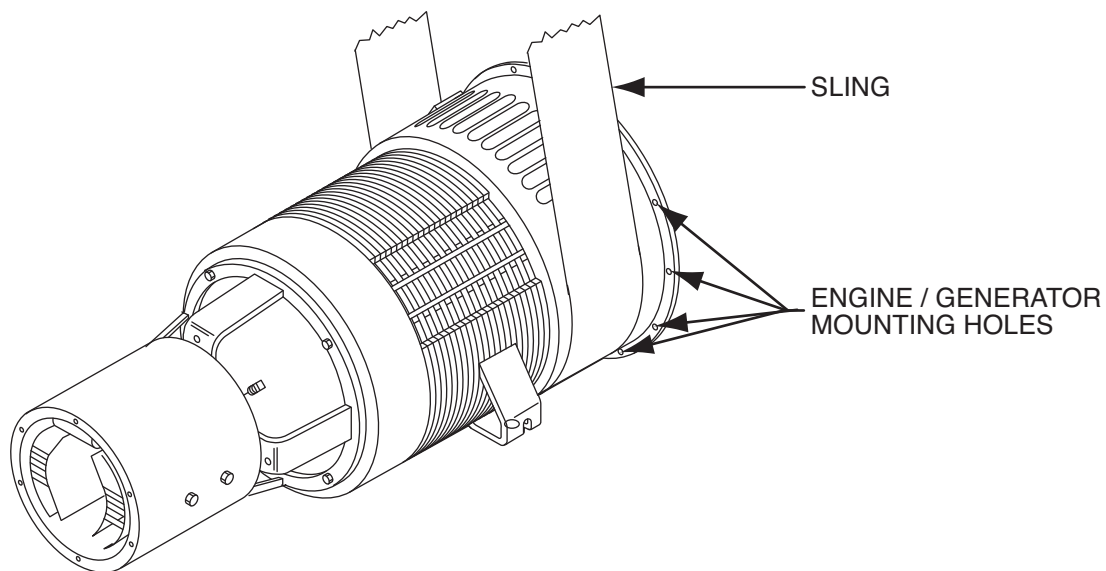
## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT (continued)

FIGURE F.28 – MAIN GENERATOR FEET MOUNTING



30. Using the 3/4" wrench, remove the frame mounting bolts, nuts, and washers from the feet of the main generator. See Figure F.28.

FIGURE F.29 – MAIN GENERATOR ENGINE MOUNTING



31. With the rope sling around the main generator frame, carefully lift the frame a small distance. Slide the wood or steel blocks under the engine. See Figure F.29.
32. Using the 9/16" wrench, remove the bolts and lock washers mounting the generator frame to the engine. See Figure F.29.

SA-200

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## MAIN GENERATOR FRAME REMOVAL AND REPLACEMENT (continued)

33. Using the rope sling and pry bars, carefully lift and “wiggle” the generator frame away from the engine and armature assembly. Be careful to support the generator frame as you remove it.

**NOTE:** The exciter frame is also removed with the main generator frame.

Reassembly: Refer to **Figures F.18 - F.29** as needed.

1. Using the rope sling, carefully lift and “wiggle” the generator frame onto the engine and armature assembly. Be careful to support the generator frame as you position it.
2. Using the 9/16” wrench, install the bolts and lock washers mounting the generator frame to the engine. Using the 3/4” wrench, install the frame mounting bolts, nuts, and washers to the feet of the main generator. Check air gap – min. of .035” for main generator.
3. Using the 7/16” wrench, tighten the main generator brush bracket clamping bolt. Note the position of the drill spot.
4. Install the eight brushes against the main commutator. Observe the positions you noted during disassembly.
5. Using the slot head screw driver, install the brush bracket wrap-around cover with two nuts and screws.
6. Carefully set the front panel assembly into position. Using the 3/8” nutdriver, install the screw for the lower middle of the front panel. Using the 9/16” wrench, install the four bolts, nuts, and washers for the bottom of the front panel assembly. Then install the two bolts, nuts, and washers that hold the front panel assembly to the horizontal rails.
7. Using the 3/8” nutdriver, connect the yellow wire from the oil pressure switch and the brown wire from the idler solenoid to the idler switch. Connect the blue wire and the black wire to the ammeter. See the Wiring Diagram.
8. Connect the white wire to the idler PC board. Connect the two red wires to the ignition switch. Connect the “H” lead to the START button switch. Connect the blue and brown main shunt leads at their quick disconnect splices. Connect the black lead between the idler PC board and the DC exciter.
9. Using the slot head screw driver, connect the red lead between the 115VDC receptacle and the DC exciter. Replace any cable ties cut during disassembly.
10. Using the slot head screw driver, install the choke control cable to the engine carburetor assembly, noting placement mark.
11. Using the 3/4” wrench, install the heavy lead to the positive output terminal and the copper strap lead and reed switch assembly to the negative output terminal.
12. Using the 1/2” wrench, install the five heavy flex leads to the selector switch as labeled during disassembly.
13. Carefully position the fuel tank to the mounting rails. Using the 9/16” wrench, install the four nuts, bolts, and washers holding the fuel tank assembly to the rails. Remove the plug from the fuel line and attach it to the fuel bowl.
14. Perform the **DC Exciter Armature Reassembly Procedure**.
15. Carefully set the top and doors assembly into place. Install the “L” shaped door hooks. Using the 1/2” wrench, install the four nuts and bolts holding the case top and doors assembly to the welder frame. Install the rubber gasket to the top.
16. Using the 1/2” wrench, install the negative battery cable. Slide the battery mounting panel back into place and using the 7/16” wrench, install the two bolts and washers that secure the panel.



Return to Section TOC

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## MAIN GENERATOR ARMATURE REMOVAL AND REPLACEMENT PROCEDURE

### WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

---

### TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Main Generator Armature. This procedure is for later production models. Many of the procedures will apply to older models.

### MATERIALS NEEDED

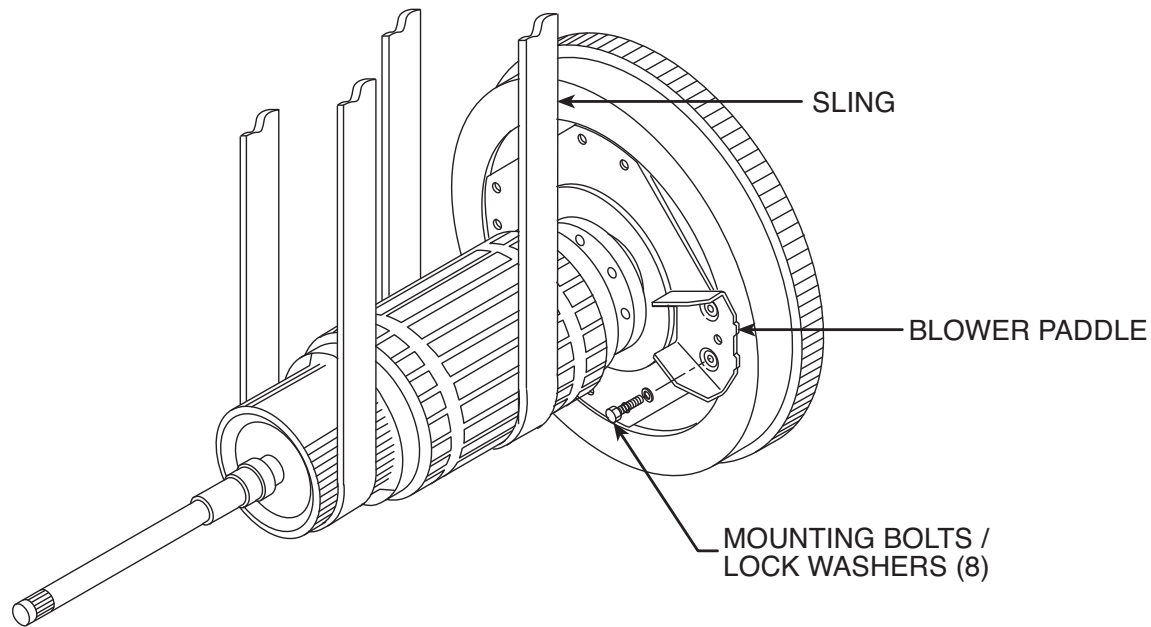
- Rope Sling
- 5/8" Wrench
- Wood Or Steel Blocks

SA-200



## MAIN GENERATOR ARMATURE REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.30 – MAIN GENERATOR ARMATURE MOUNTING



### PROCEDURE

1. Turn the engine OFF.
2. Perform the **DC Exciter Armature Removal** procedure.
3. Perform the **Main Generator Frame Removal** procedure.
4. Using the rope sling, support the armature.
5. Make sure the engine is supported with the wood or steel blocks.
6. Using the 5/8" wrench, remove the eight bolts and lock washers holding the blower paddles and the armature to the engine flywheel. See Figure F.30.
7. With the armature supported and "balanced" in the rope sling, carefully rotate the armature 1/8 turn in either direction to release it.

### ⚠ CAUTION

The armature is now free to be removed from the engine.

-----

**Replacement:** Refer to Figure F.30.

1. Support the armature with the rope sling. Mount the armature to the engine, rotating it 1/8 turn in either direction to achieve attachment. Before removing the rope sling, be careful to support the armature with the wood or steel blocks under the engine. With the 5/8" wrench, install the eight bolts and lock washers that attach the blower paddles and the armature to the engine flywheel.
2. Perform other replacement procedures according to each of the following:

**Generator Frame Removal and Replacement**

**DC Exciter Armature Removal and Replacement**

RETEST AFTER REPAIR

WELDER	MAX. IDLE				MIN. IDLE			MAX. 300 AMPS		200 AMPS		150 AMPS	100 AMPS	MIN. SHORT		ENGINE IDLE RPM	EXCITER		
	D.C. VOLTS	EXC. VOLTS	FIELD AMPS	RPM	D.C. VOLTS	EXC. VOLTS	FIELD AMPS	VOLTS	RPM	VOLTS	RPM	VOLTS	VOLTS	VOLTS	AMPS		AMPS	VOLTS	VOLTS
SA200 F162 FJW 4 TAP	$\frac{83}{89}$	$\frac{125}{133}$	$\frac{2.35}{2.65}$	$\frac{1490}{1510}$	$\frac{44}{54}$	$\frac{126}{134}$	$\frac{1.05}{1.30}$	$\frac{39}{45}$	$\frac{1300}{1400}$	$\frac{33}{39}$	$\frac{1390}{1490}$	$\frac{21}{27}$	$\frac{1}{5}$	$\frac{105}{120}$	$\frac{950}{1050}$	10	$\frac{123}{131}$	$\frac{.63}{.70}$	
F163 OR C175 L200 FJW-FDW 5 TAP CODE 7699 & LOWER	$\frac{87}{93}$	$\frac{121}{129}$	$\frac{2.35}{2.65}$	$\frac{1540}{1560}$	$\frac{47}{57}$	$\frac{121}{129}$	$\frac{1.00}{1.25}$	$\frac{35}{41}$	$\frac{1440}{1500}$	$\frac{37}{43}$	$\frac{1475}{1535}$	$\frac{36}{42}$	$\frac{37}{43}$	$\frac{1}{5}$	$\frac{105}{120}$	$\frac{1000}{1050}$	10	$\frac{122}{130}$	$\frac{.63/.70}{.78/.85}$
WELDER	MAX. IDLE				MIN. IDLE			MAX. TAP 300 AMPS		SHORT OUTPUTS				ENGINE IDLE RPM	POWER PLUG EXCITER LOAD				
	O.C. VOLTS	EXC. VOLTS	FIELD AMPS	RPM	O.C. VOLTS	EXC. VOLTS	FIELD AMPS	VOLTS	RPM	200 TAP AMPS	150 TAP AMPS	100 TAP AMPS	MIN. AMPS		AMPS	VOLTS	FIELD AMPS		
L200 F163 ABOVE CODE 7700 SA-200	$\frac{88}{95}$	$\frac{123}{132}$	$\frac{2.35}{2.65}$	$\frac{1540}{1560}$	$\frac{47}{57}$	$\frac{124}{133}$	$\frac{1.00}{1.25}$	$\frac{33}{39}$	$\frac{1440}{1500}$		$\frac{325}{385}$	$\frac{245}{285}$	$\frac{165}{195}$	$\frac{110}{130}$	$\frac{1000}{1050}$	15	$\frac{115^*}{125}$	$\frac{.79^\Delta}{.87}$	
SA250 D3.152 DIESEL	$\frac{94}{100}$	$\frac{121}{130}$	$\frac{2.3}{2.6}$	$\frac{1790}{1810}$	$\frac{47}{57}$	$\frac{122}{130}$	$\frac{.95}{1.20}$	$\frac{43}{49}$	$\frac{1700}{1770}$		$\frac{340}{410}$	$\frac{255}{310}$	$\frac{175}{220}$	$\frac{115}{130}$	$\frac{1325}{1375}$	15	$\frac{125^{**}}{134}$	$\frac{.85}{.94}$	

\* Taken at receptacle after removing generator field ammeter from the circuit (black exciter lead connected directly to right hand exciter brush holder.)

\*\* Taken across exciter brush holders.

Δ Field amps limit for units other than SA--200:  $\frac{.85}{.94}$

**Long Test:**

If additional voltage for quick heating of fields is not available, run machine at max. control settings and no load until field current and open circuit voltage stops decreasing. This will take one hour or more. Then at this time short circuit the output terminals at max control settings for 30 seconds. Then proceed with rest of testing.

**NOTE:** If the welder under test does not fall within the above limits, and in the opinion & experience of the test and the Inspection Department the welder is still passable, a test sheet shall be made out and submitted to the Engineering Department for approval. If the Engineering Department approves the test, the welder may be passed. The serial number of the machine is to appear on the test sheet and the sheet will be filled in the Engineering Department.



Return to Section TOC

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Return to Master TOC

**Electrical Diagrams** ..... **G-1**

Code 215-3312 - Diagrams (Short Hood, Std. Exciter, Oversize Opt.) ..... G-2

Code 3417-5841 - Diagrams (Red Face, Long Hood, Oversize Exciter Std.) ..... G-8

Code 5957-7242 - Diagrams (Black Face, Vacuum Idler, P-23 Parts) ..... G-18

Code 7276-9530 - Diagrams (Electronic Idler, P-111 Parts) ..... G-25

Return to Master TOC

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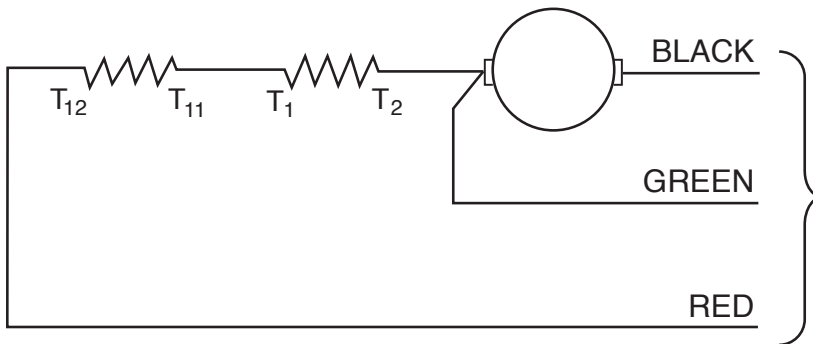
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**CODES**  
**215 - 3312**  
**(Short Hood, Std. Exciter, Oversize Opt.)**

# STANDARD SPECIFICATIONS FOR MANUFACTURING

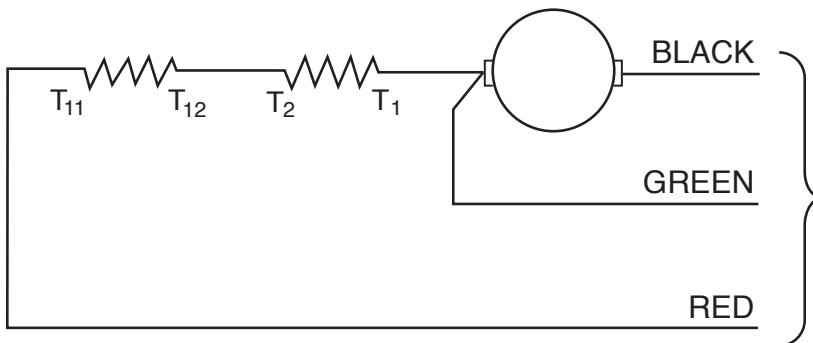
## EXCITER WIRING DIAGRAMS

### COUNTER CLOCKWISE ROTATION FACING EXCITER COMMUTATOR



TO REVERSING SWITCH  
SEE CONTROL BOX  
WIRING DIAGRAM

### CLOCKWISE ROTATION FACING EXCITER COMMUTATOR

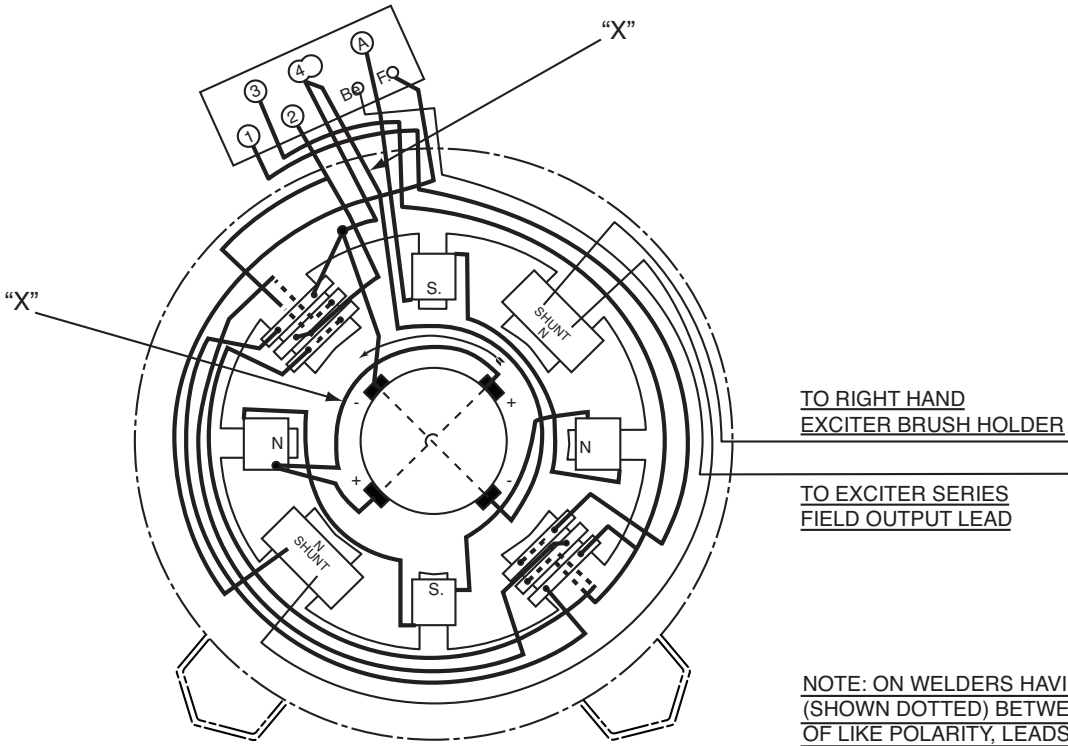


TO REVERSING SWITCH  
SEE CONTROL BOX  
WIRING DIAGRAM

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Return to Master TOC  
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Return to Section TOC  
Return to Master TOC



M-6478



NOTE: ON WELDERS HAVING CROSS CONNECTORS (SHOWN DOTTED) BETWEEN BRUSH HOLDER STUDS OF LIKE POLARITY, LEADS "X" WERE OMITTED.

COUNTER-CLOCKWISE ROTATION

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Return to Master TOC

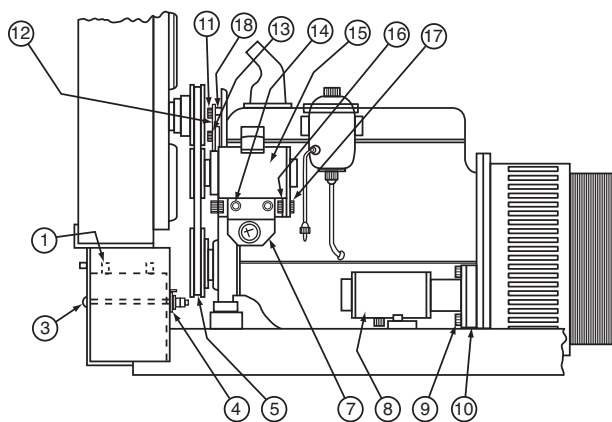
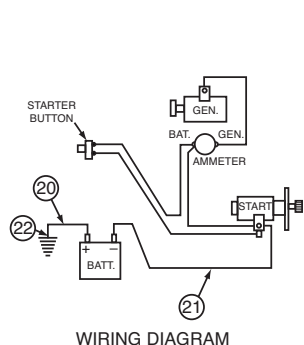
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## M-6996



MATERIAL REQ'D TO CHANGE OVER STD. MAGNETO HAND CRANK UNIT TO BATTERY SELF START UNIT WITH GENERATOR ETC.

ITEM	DESCRIPTION	PART NO.	REQ	ITEM	DESCRIPTION	PART NO.	REQ	ITEM	DESCRIPTION	PART NO.	REQ
1	BATTERY *	M-69622	1	9	7/16-14 HEX HD. CAP SCR. X 1 1/2 LG. 7/16 LOCKWASHER (E-106-A-B)	STARTER MTG.	2	16	GENERATOR BRACKET	S-10249	1
2				10	STARTER SPACER	S-8073	1	17	5/16 - 18 X 1 HEX HD CAP SCR. 5/16 LOCKWASHER (E-106-A-3) 5/16 - 18 HEX NUT	GEN. BRKT TO GEN.	2
3	T-11827-16 CARRIAGE BOLT (2 REQ'D) S-9262-23 FLATWASHER (2 REQ'D) HEX. NUT (4 REQ'D)			11	3/8-16 HEX HD. CAP SCR X 1 1/2 LG 3/8 LOCKWASHER (E-106-A-4)	ADJ. STRAP TO ENG.	1	18	GEN. ADJ. SPACER	S-10731-3	1
4	BATTERY STRAP	S-8069	1	12	ADJ. STRAP	S-8533	1	19			
5	FAN BELT	S-8074	1	13	5/16 X 18 X 7/8 HEX HD. CAP SCR. 5/16 LOCKWASHER (E-106-A-3) S-9262-30 PLAIN WASHER	GEN. TO ADJ. STRAP	1	20	GROUND STRAP (POS.)	S-8070	1
6	INSTRUCTIONS	M-6996	1	14	T-9087 STUD 3/8 - 16 HEX NUT	GEN. BRACKET TO ENG BLOCK	2	21	BATTERY CABLE (NEG.)	S-8070-3	1
7	AMMETER PANEL ASSEMBLY (INCLUDES SWITCH S-13145)	M-7010	1	15	GENERATOR DELCO #1100037 FAN DELCO #1866400 PULLEY DELCO #1881877		1 1 1	22	5/16 - 18 X 1/2 HEX SCREW AND WASHER TO BE USED GROUND STRAP TO GOVERNOR		1
8	STARTER MOTOR DELCO #1109460	M-7010	1								

### INSTRUCTIONS (For F-162 FJW Engine Welders)

#### STARTER MOTOR: (PACK IN T-7396-8 CARTON)

1. Remove starter hole cover plate from engine housing plate.
2. Insert spacer ring between starter and housing plate. Mount starter motor to housing plate with two 7/16 - 14 x 1 1/2 hex. hd. cap screws and two lockwashers. Motor mounting plate and spacer ring must be flat to ensure proper alignment between starter motor gear and engine ring gear.

#### GENERATOR: (PACK IN T-7396-12 CARTON)

1. Remove and discard present fan belt.
2. Insert two 3/8 studs in side of engine block.
3. Attach generator mounting bracket and ammeter panel and fasten with two 3/8-16 hex. nuts.
4. Mount generator on bracket with two 5/16 - 18 x 1 hex. hd. cap screws, 5/16 lockwashers and 5/16 - 18 hex. nuts. Voltage regulator in generator to be at the top.
5. Attach adjustment strap to generator with 5/16 x 7/8 hex. hd. cap screw, 5/16 lockwasher and S-9262-30 plain washer.
6. Attach adjustment strap to front of engine with 3/8 - 16 x 7/8 hex. hd. cap screws and 3/8 lockwasher.
7. Install new fan belt and adjust to proper tension before tightening all generator mounting screws.

#### STARTER PUSH BUTTON:

1. Insert push button in hole in right front radiator support and tighten in place.

#### BATTERY:

1. Remove front center panel below radiator.
2. Attach positive and negative leads to battery and slide battery in position below radiator.
3. Replace center panel and tighten in place.
4. Clamp battery to front panel with battery strap, (2) T-11827-16 carriage bolts, (2) washers and (4) nuts. Put on washer and first nut finger tight so battery is snug. Second nut is to be jammed against first nut without further tightening against battery.

#### CONNECTIONS:

1. Connect negative battery lead to starter.
2. Connect battery ground lead to governor with 5/16 - 18 x 1/2 hex head cap screw and lockwasher. Use tapped hole on outside of governor just below adjusting screw.
3. Finish connections as shown by wiring diagram.

\* For domestic use only include S-10590.

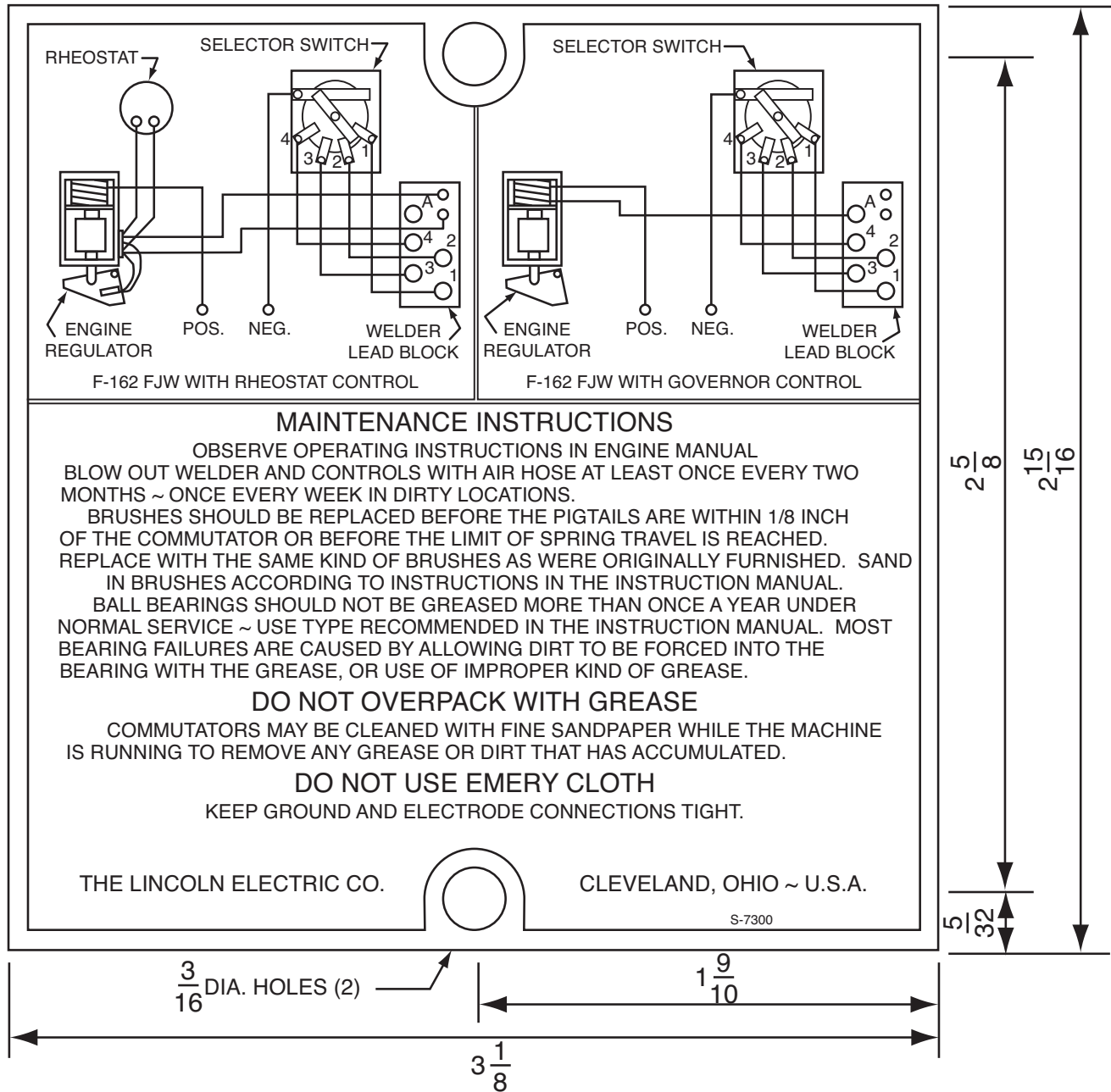
Δ L.E. CO. will not furnish these parts (obtain from Delco or any United Motors distributor).

SA-200

**LINCOLN**  
ELECTRIC



## S-7300



**NOTE:** View shown double size.

.003" To .005" ETCH

All letters, figures, border & diagrams to be polished finish on a black background.

2 15/16 x .025" x 3 1/8 Aluminum

Part No. S-7300

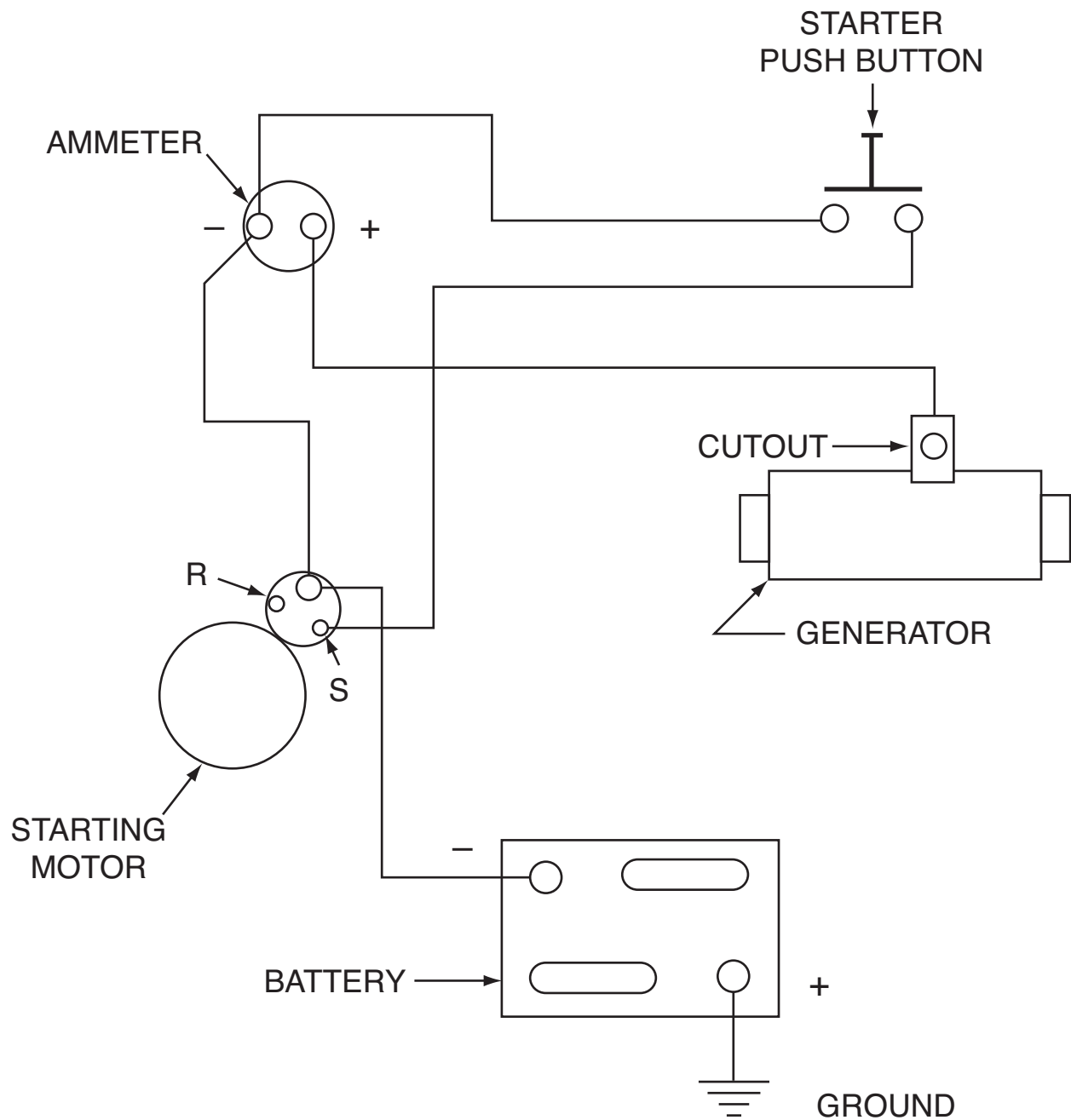
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**LINCOLN**  
ELECTRIC

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**CODES**  
**3417 - 5841**  
**(Red Face, Long Hood, Oversize Exciter Opt.)**

T-12505

**NOTE:**

**Limit of  $\pm 1/2^\circ$**  on all angles unless otherwise specified.

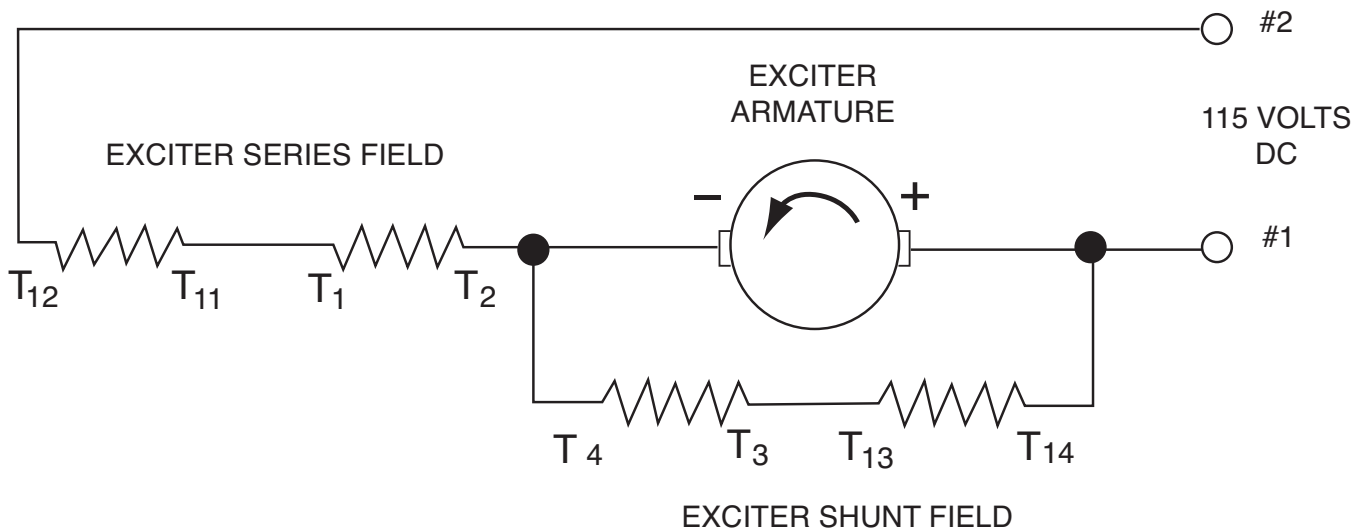
**Limit of  $\pm 1/64$**  on all fractional dimensions unless otherwise specified.

**Limit of  $\pm .002$**  on all decimal dimensions unless otherwise specified.

SA-200

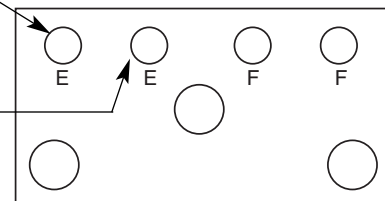
**LINCOLN**  
 ELECTRIC

## E276-C

COMPOUND EXCITER CONNECTIONS FOR COUNTER CLOCKWISE  
ROTATION FACING THE EXCITER COMMUTATOR

## Series Field

- \* T1 Connect to T11.
  - T2 Connect to the left hand exciter brush holder.
  - T12 Bring out a lead through the lower or left hand lead block hole "E" and connect to the reversing switch or to power plug receptacle as shown in the control box diagram.
- Bring out a lead from the right hand exciter brush holder through the top or right hand lead block hole "E" and to the reversing switch or power plug receptacle as shown in the control box diagram.



Coil with tags T1, T2, T3, T4 goes on the left hand pole piece. Coil with the tags T11, T12, T13, T14 goes on the right hand pole piece.

## Shunt Field

- \* T3 Connect to T13.
- T4 Connect to left hand exciter brush holder.
- T14 Connect to the right hand exciter brush holder.

## Leads for Accessory Drive or Power Plug

See control box diagram for connection when power plug is on right hand side of control box (standard for "L" & "E" control). Where power plug is in such a place that it is best to connect the leads at the exciter, connect the power plug leads to T12 and to the right hand exciter brush holder.

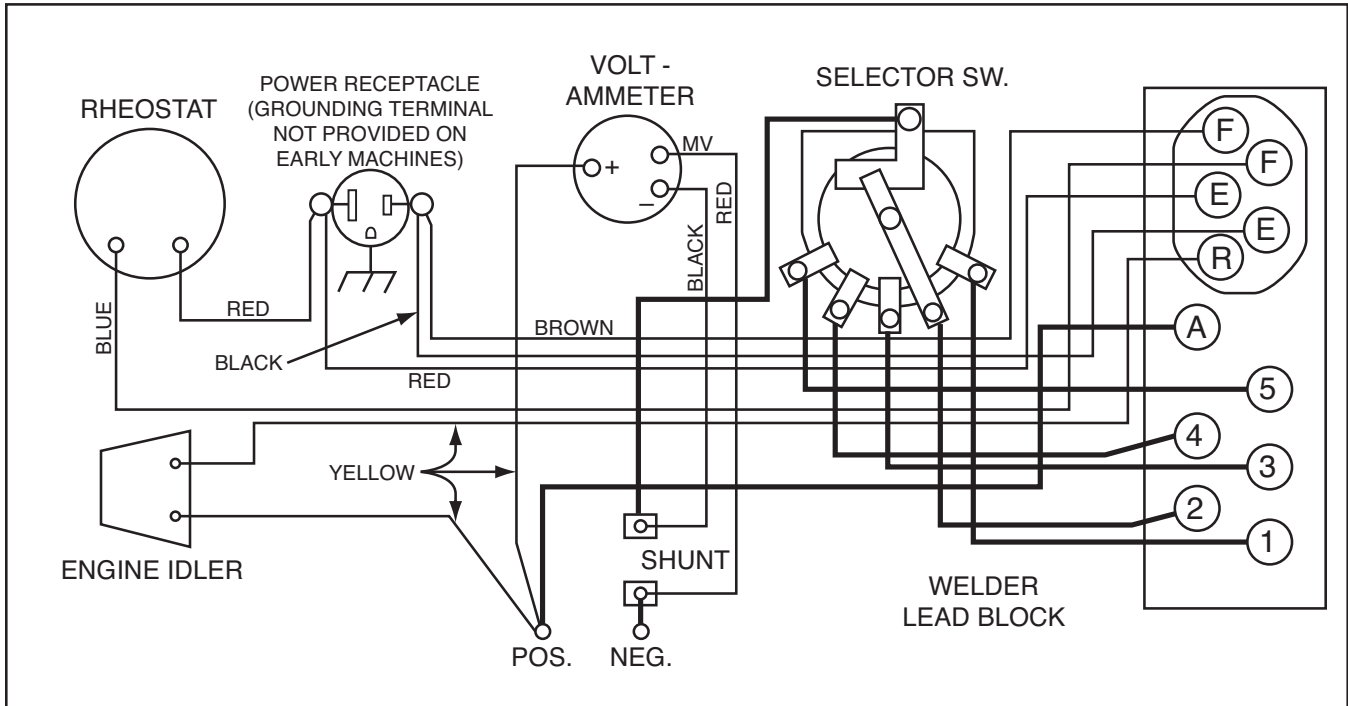
When using this diagram on M.G. set bring out and tag #1 and #2 as above.

For F162-FJW with power plug on panel, connect one side of receptacle to R.H. brush holder, and the other side of receptacle to exciter lead T12 at rheostat terminal.

\* Should be soldered.

SA-200

S-11319



## MAINTENANCE INSTRUCTIONS

Observe operating instructions in engine manual.

Blow out welder and controls with air hose at least once every two months – once every week in dirty locations.

Brushes should be replaced before the pigtails are within 1/8 inch of the commutator or before the limit of spring travel is reached. Replace with the same kind of brushes as were originally furnished. Sand in brushes according to instructions in the instruction manual.

Ball bearings should not be greased more than once a year under normal service - use type recommended in the instruction manual. Most bearing failures are caused by allowing dirt to be forced into the bearing with the grease or use of improper kind of grease.

### DO NOT OVERPACK WITH GREASE

Commutators may be cleaned with fine sandpaper while the machine is running to remove any grease or dirt that has accumulated.

### DO NOT USE EMERY CLOTH

Keep ground and electrode connections tight.

THE LINCOLN ELECTRIC CO.  
CLEVELAND, OHIO U.S.A.

L-200 FJW, FDW WELDER WITH  
"R" IDLER & METER

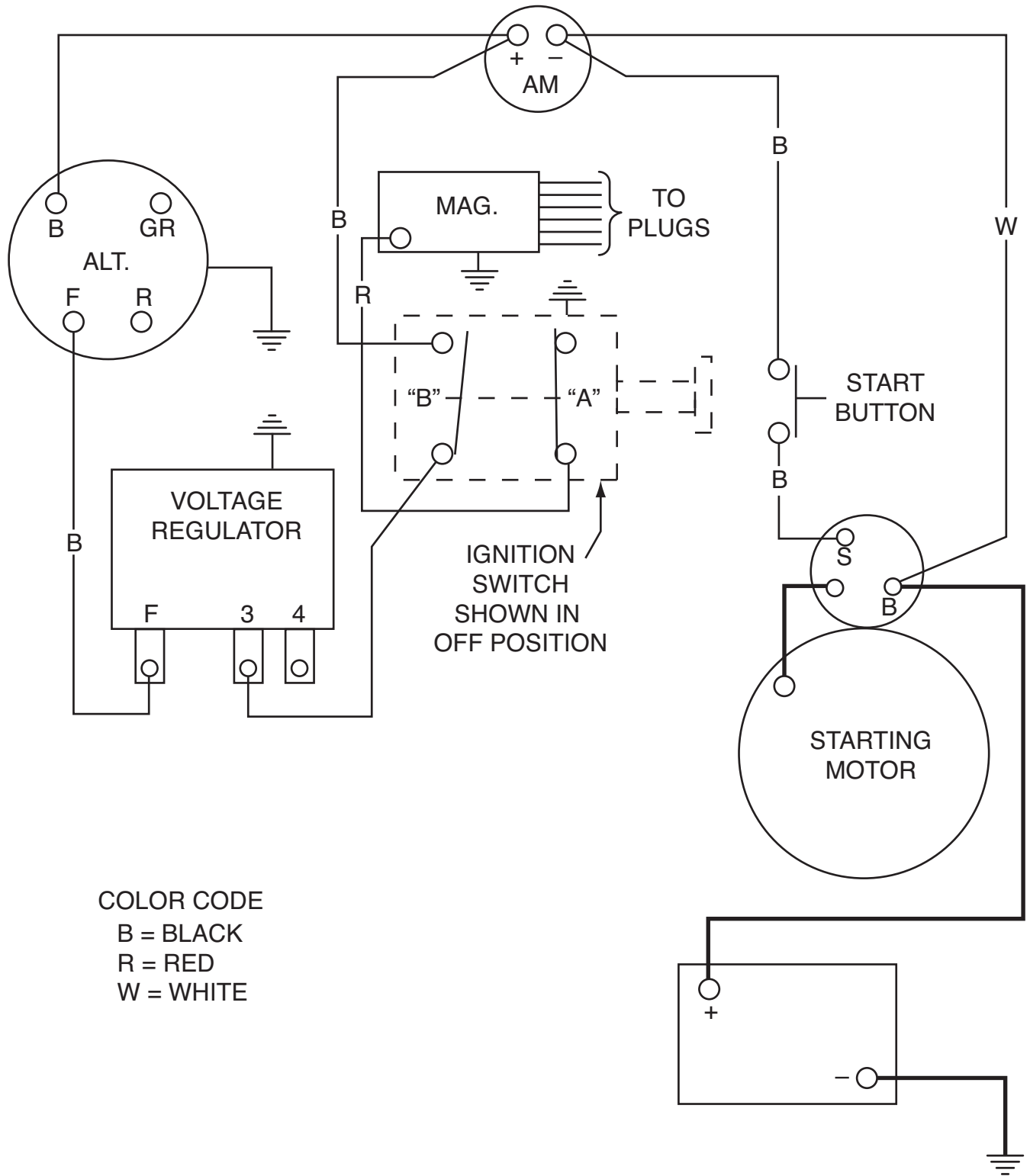
S-11319

SA-200

**LINCOLN**  
ELECTRIC



T-13076



A.S.A. ELECTRICAL SYMBOLS PER E-1537

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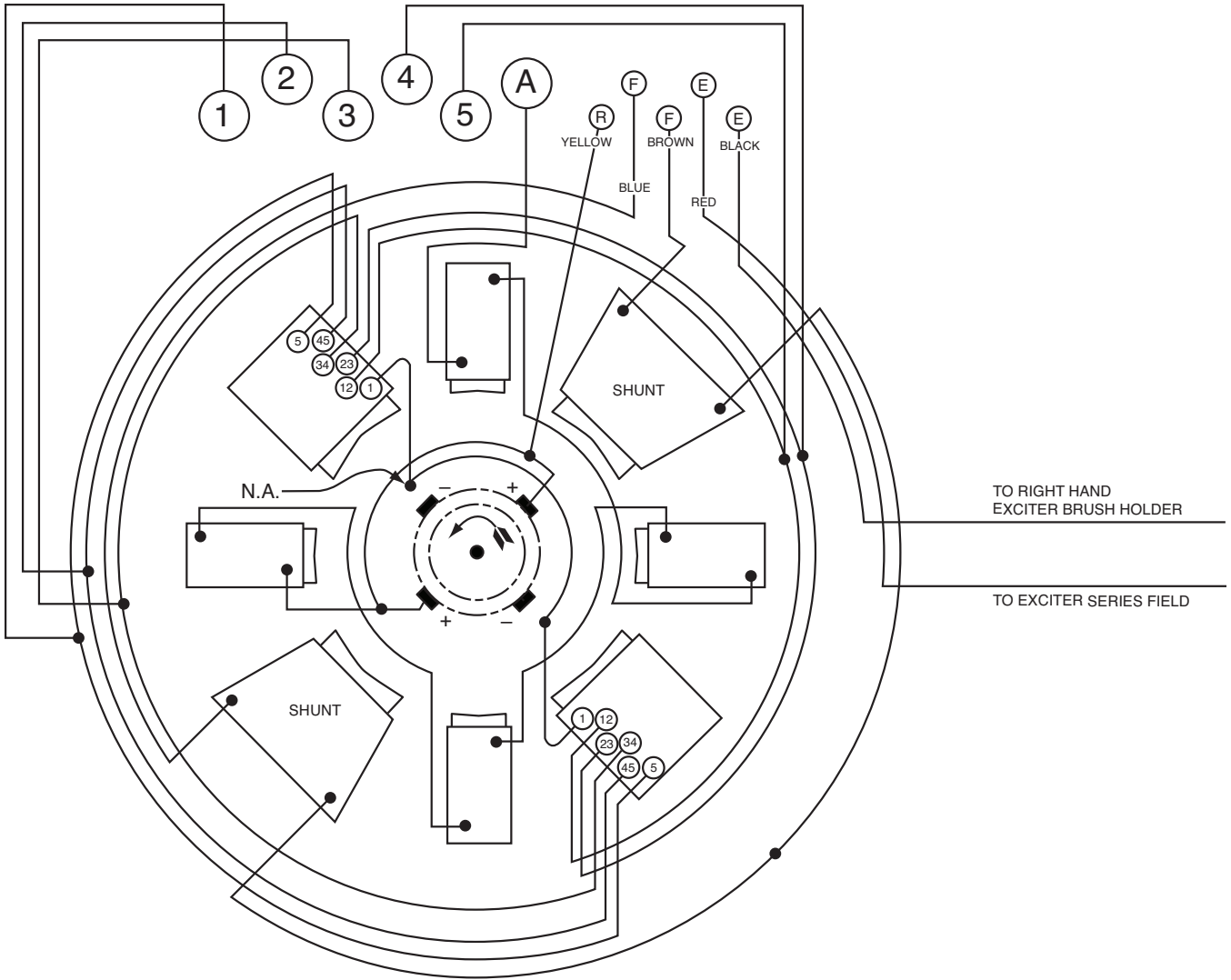
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M-8791



COUNTER CLOCKWISE ROTATION

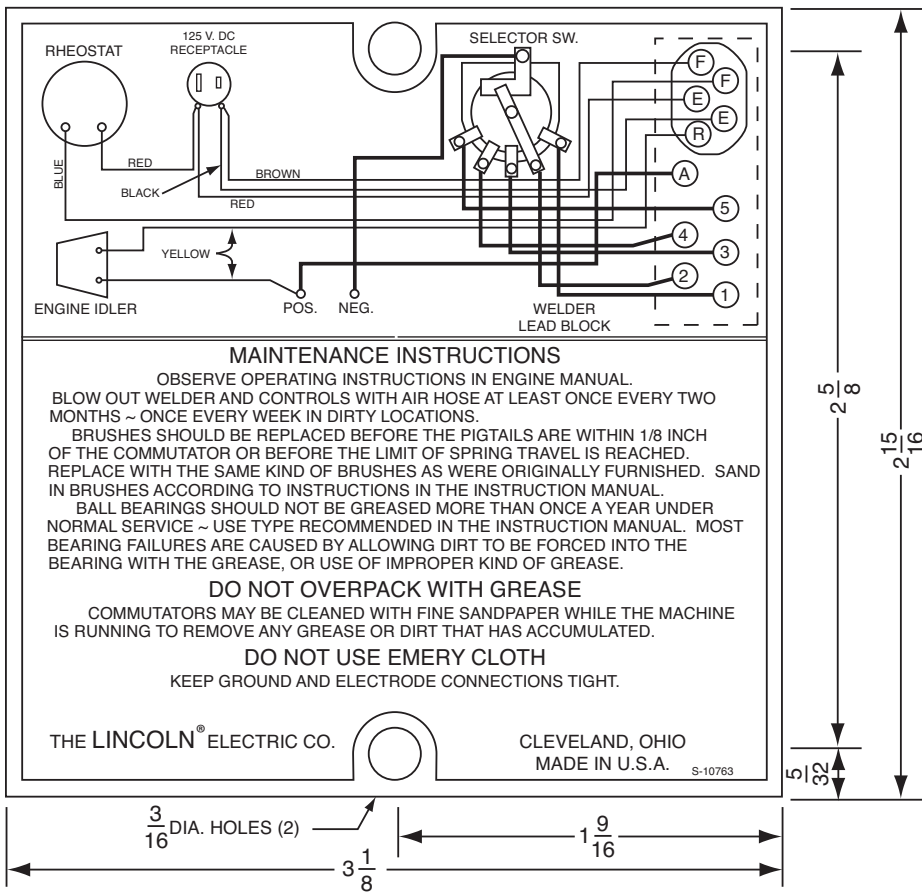
NOTE: (R) LEAD USED ONLY ON UNITS WITH VACUUM IDLER.

N.A. When optional CV adapter is installed, the thermostat is connected to this brush holder.

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S-10763



NOTE: View Shown

Double Size

Color per federal std. #595

Lithograph

All letters, figures, border & diagrams to be polished finish on a color #17038 background.

2 15/16 x .025 x 3 1/8 Aluminum.

NOTE:

LIMIT OF ± 1/64 ON ALL FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

LIMIT OF ± .002 ON ALL DECIMAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

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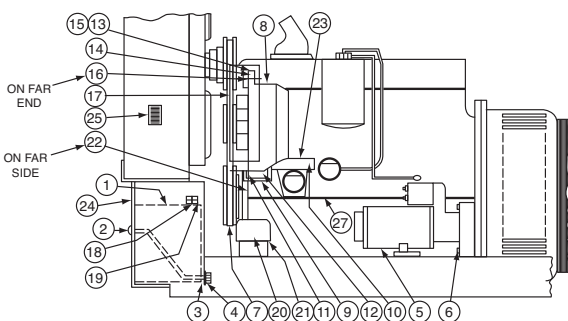
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M-12078



NOTES

- Item 4 - Attaches batt. to plate.
- Item 6 - for attaching starter motor.
- Item 10 - mounts amm. panel & atl. mtg. brkt. to engine block.
- Item 12 - mts. alt. to brkt.
- Item 14 - for alt. adj. strap to alternator.
- Item 16 - mts. adj. strap to engine.
- Item 17 - mtg. of alt. fan guard to adj. strap.
- Item 21 - mounts volt. reg.
- Item 22 - for attaching neg. batt. lead to gear cover.
- Item 23 - (includes ignition, start switches and leads.)

MATERIAL REQD. TO CHANGE OVER STD. MAGNETO HAND CRANK UNIT TO BATTERY SELF START UNIT WITH ALTERNATOR ETC.												
ITEM	DESCRIPTION	PART NO.	REQ.	ITEM	DESCRIPTION	PART NO.	REQ.	ITEM	DESCRIPTION	PART NO.	REQ.	
1	BATTERY*	M-9399-1	1		LOCK WASHER (3/8)	E-106-A-4	1	20	VOLTAGE REGULATOR	M-11567	1	
2	FORMED BOLT	T-11888	2	12	HEX. NUT	3/8 - 16	1		HEX. HD. BOLT	1/4 - 20 x .75	2	
3	BATTERY BRACKET	S-12128	1		HEX. HD. CAP SCR.	3/8 - 16 x 3.75	1	21	LOCK WASHER	T-9860-6	2	
4	FLAT WASHER (1/4)	S-9262-23	2	13	ALT. ADJ. STRAP	M-11566	1		HEX. NUT	1/4 - 20	2	
	LOCK WASHER (1/4)	E-106-A-2	2		HEX. HD. BOLT	5/16 - 18 x 1.00	1		HEX. HD. BOLT	5/16 - 18 x .50	1	
	HEX. NUT	1/4 - 20	2	14	LOCK WASHER (5/16)	E-106A-3	1	22	WASHER (5/16)	S-9262-30	1	
5	STARTING MOTOR	L-4334	1		FLAT WASHER (5/16)	S-9262-30	1		LOCKWASHER (5/16)	E-106A-3	1	
6	HEX. HD. CAP SCREW	T-8833-1	2	15	SPACER (.75 LONG)	S-10731-3	1	23	AMMETER PANEL ASBLY.	M-12040	1	
	LOCK WASHER (7/16)	E-106A-8	2	16	HEX. HD. BOLT (3/8)	3/8 - 16 x 1.50	1	24	SWITCH PLATE	T-9061-1	1	
7	FAN BELT	T13274	1		LOCKWASHER (3/8)	E-106A-4	1	25	CAUTION DECAL	S-14108	1	
8	ALTERNATOR ASBLY.	L-4722-3	1		ALT. FAN GUARD	M-12067	1	26	WIRING DIAGRAM	T-13076	1	
9	ALTERNATOR MTG. BRKT.	S-14426	1		HEX. HD. BOLT	5/16 - 18 x .75	1	27	LEAD CLIP	T-9402	2	
10	STUD	T-9087	3	17	FLAT WASHER	S-9262-30	1	28	INSTRUCTIONS	M-12078	1	
	LOCK WASHER (3/8)	E-106-A-4	3			LOCK WASHER	E-106-A-3	1	29	GROUND LEAD (NOT SHOWN)	B-10-10-22-36	1
	HEX. NUT	3/8 - 16	3			HEX. NUT	5/16 - 18	1				
	FLAT WASHER (3/8)	S-9262-36	1		18	POS. BATTERY CABLE	S-13147-1	1	*	FOR DOMESTIC USE ONLY INCLUDE		
11	SPACER (.75 LONG)	S-10731-3	1	19	NEG. BATTERY CABLE	S-8070-28	1		S-10590 ELECTROLYTE			

Instructions for F-163 FJW engine welders

Start Motor: (Pack in T-7396-6 carton)

- Remove starter hole cover plate from engine housing plate.
- Mount starter motor to housing plate with two 7/16-14 x 1.00 hex hd. cap screws and two 7/16 lockwashers. Motor mounting surface must be flat against housing plate to ensure proper alignment between starter motor gear and engine ring gear.

Alternator: (Pack in T-7396-4 carton)

- Remove and discard fan belt.
- Remove three hex hd. bolts in side of block. Apply thread sealant to the three studs and insert into engine block. Position flat washer (item 10) on upper stud. Position ammeter panel on lower two studs. Position alternator mounting bracket. Using the three 3/8 lockwashers and hex nuts, tighten panel and bracket securely into position.
- Mount alternator to bracket using items 11 and 12.
- Attach alternator adjusting strap to engine using items 15 and 16.
- Attach alternator adjusting strap to alternator using items 14.
- Install new fan belt and adjust to proper tension before tightening all alternator mounting bolts.
- Attach alternator fan guard to alternator adjusting strap. Use mountings in item 17.
- Attach voltage regulator to front engine support channel using items 21. The regulator is to be positioned so that connection tabs are pointing away from radiator fan. If holes are not present in front engine support channel, drill per sketch #2 below.

Start Button and Ignition Switch:

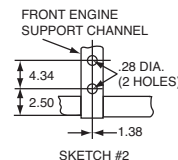
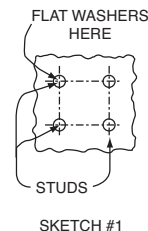
- Disconnect low voltage lead from magneto and remove ignition switch. Discard old ignition switch plate.
- Route leads (with ignition switch) between front mount and oil pan. Using new switch plate, mount ignition switch in proper sized hole in left front radiator support.
- Insert start button in hole in right front radiator support and tighten in place.

Connections: (See Wiring Diagram)

- Connect red lead from ignition switch to magneto.
- Connect green lead from ammeter to alternator.
- Snap connector into alternator completing the regulator to field circuit.
- Connect the black lead to the "F" terminal on the voltage regulator.
- Connect the yellow lead to the #3 terminal on the voltage regulator.
- Connect the black lead and the white lead to the starting motor. See diagram.
- Two lead clips are provided. One is to be placed under the pan bolt directly under the oil filter tube. The other one is to be placed behind the governor on the front end plate screw. Crimp lead clips so as to support the leads.
- Connect positive battery cable to starter.
- Connect negative battery cable to governor with 5/16-18 x .50 hex head screw and lock washer. Use tapped hole on outside of governor just below adjusting screw. Attach grounding lead from regulator mounting bolt to a pan bolt. Make sure area in contact with lead is free of paint.

Battery:

- Remove front cover panel below radiator.
- Service battery with weld.
- Clamp battery to center panel with battery strap and two formed carriage bolts, flat washers, lockwashers and nuts. Be sure battery is positioned properly so that battery polarity matches the lead polarity.
- Attach leads to battery.
- Replace center panel and tighten in place.
- Attach caution decal provided to side of radiator shroud in area of alternator.



Return to Section TOC

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Return to Section TOC

Return to Section TOC

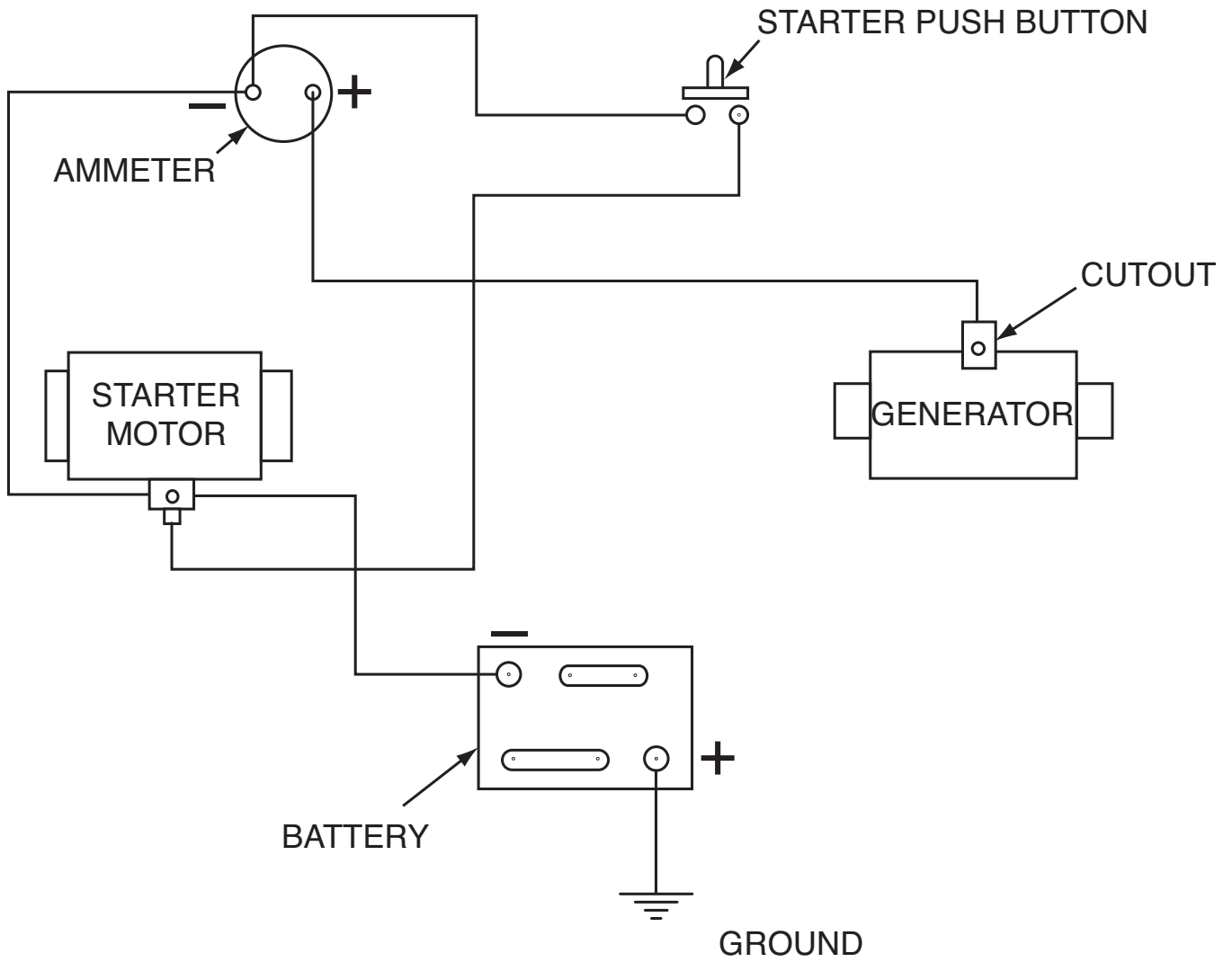
Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

T-9088



NOTE: Limit of  $\pm 1/64$  on all dimensions.

Return to Section TOC

Return to Section TOC

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Return to Master TOC

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Return to Master TOC

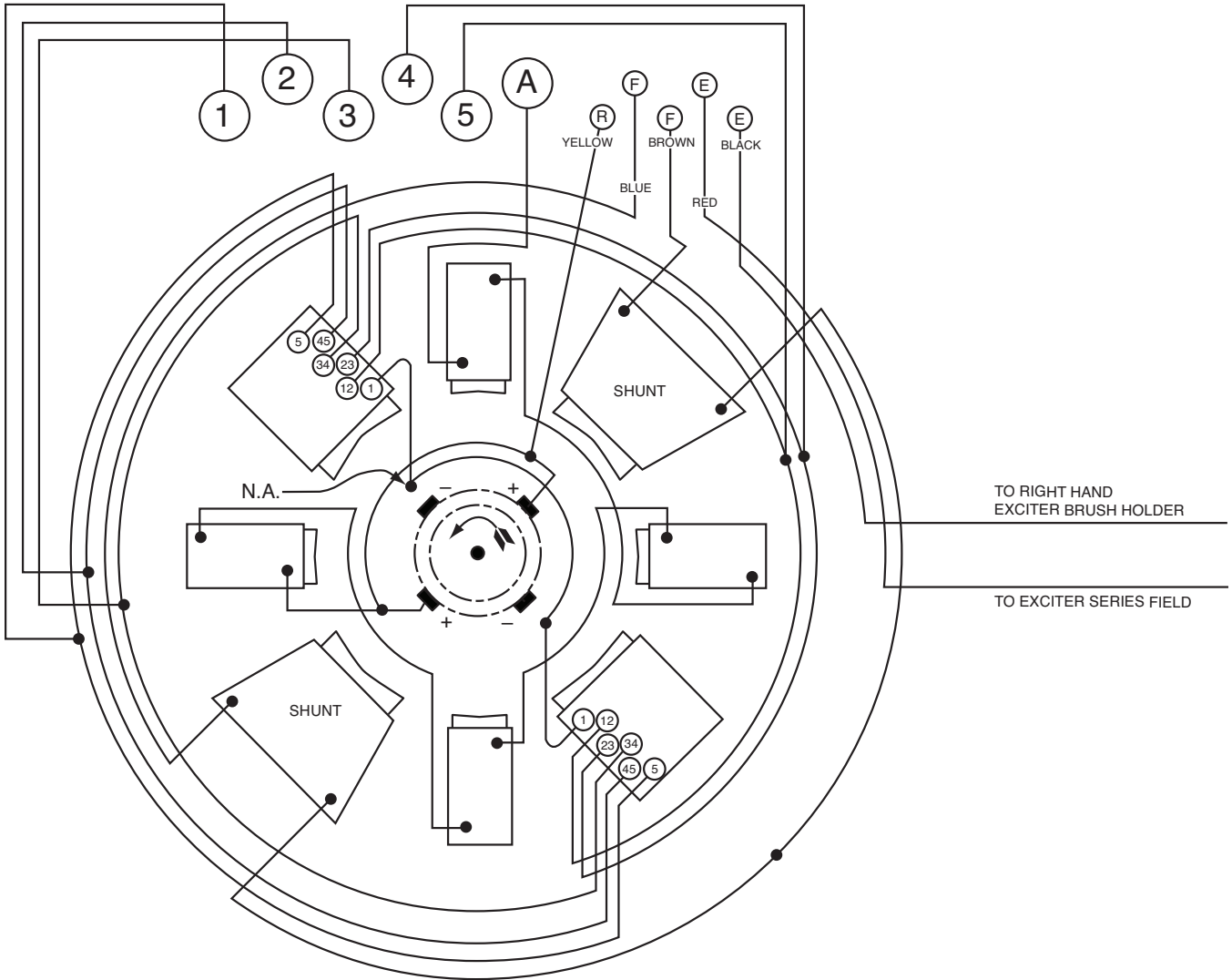
Return to Master TOC







M-8791



COUNTER CLOCKWISE ROTATION

NOTE: (R) LEAD USED ONLY ON UNITS WITH VACUUM IDLER.

N.A. When optional CV adapter is installed, the thermostat is connected to this brush holder.

Return to Section TOC  
 Return to Section TOC  
 Return to Section TOC  
 Return to Section TOC  
 Return to Master TOC  
 Return to Master TOC  
 Return to Master TOC  
 Return to Master TOC

## S-11663

## MAINTENANCE INSTRUCTIONS

OBSERVE OPERATING INSTRUCTIONS IN ENGINE MANUAL.  
 BLOW OUT WELDERS AND CONTROLS WITH AIR HOSE AT LEAST ONCE EVERY TWO MONTHS ~ ONCE EVERY WEEK IN DIRTY LOCATIONS.  
 BRUSHES SHOULD BE REPLACED BEFORE THE PIGTAILS ARE WITHIN 1/8 INCH OF THE COMMUTATOR OR BEFORE THE LIMIT OF SPRING TRAVEL IS REACHED. REPLACE WITH THE SAME KIND OF BRUSHES AS WERE ORIGINALLY FURNISHED. SAND IN BRUSHES ACCORDING TO INSTRUCTIONS IN THE INSTRUCTION MANUALS.

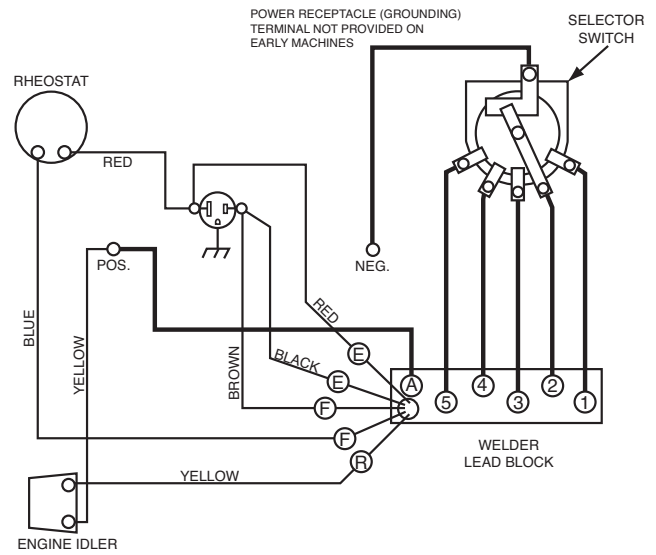
BALL BEARINGS SHOULD NOT BE GREASED MORE THAN ONCE A YEAR UNDER NORMAL SERVICE ~ USE TYPE RECOMMENDED IN THE INSTRUCTION MANUAL. MOST BEARING FAILURES ARE CAUSED BY ALLOWING DIRT TO BE FORCED INTO THE BEARING WITH THE GREASE, OR USE OF IMPROPER KIND OF GREASE.

## DO NOT OVERPACK WITH GREASE

COMMUTATORS MAY BE CLEANED WITH FINE SANDPAPER WHILE THE MACHINE IS RUNNING TO REMOVE ANY GREASE OR DIRT THAT HAS ACCUMULATED.

## DO NOT USE EMERY CLOTH

KEEP GROUND AND ELECTRODE CONNECTIONS TIGHT.



THE LINCOLN ELECTRIC CO.

CLEVELAND, OHIO

MADE IN U.S.A.

S-11663

PRINT ABOVE TO 4 1/2 X 10 1/2 SIZE

NOTE:

LIMIT OF  $\pm 1/2^\circ$  ON ALL ANGLES UNLESS OTHERWISE SPECIFIED.

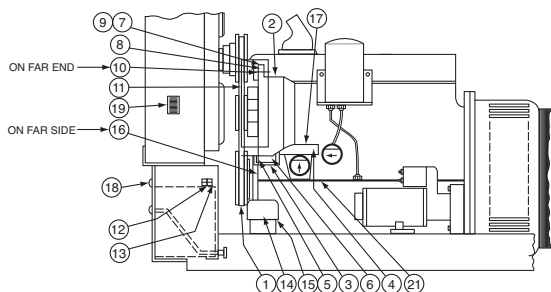
LIMIT OF  $\pm 1/64$  ON ALL FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

LIMIT OF  $\pm .002$  ON ALL DECIMAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

SA-200

**LINCOLN**  
ELECTRIC

M-12103



NOTES

- Item 6 mounts alt. to brkt.
- Item 8 for alt. adj. strap to alternator.
- Item 10 mts. adj. strap to engine.
- Item 11 mtg. of alt. fan guard to adj. strap.
- Item 15 mounts volt regulator.
- Item 16 for attaching neg. batt. lead to gear cover.
- Item 17 includes ignition, start switches and leads.

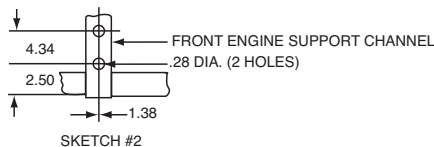
MATERIAL REQ. TO CHANGE OVER BATTERY CHARGING GENERATOR TO ALTERNATOR

ITEM	DESCRIPTION	PART NO.	REQ	ITEM	DESCRIPTION	PART NO.	REQ	ITEM	DESCRIPTION	PART NO.	REQ
1	FAN BELT	T-13274	1		HEX HD. BOLT	$\frac{5}{16}$ -18 x 1.0	1	14	VOLTAGE REGULATOR	M-11567	1
2	ALTERNATOR ASBLY.	L-4722-3	1	8	LOCKWASHER (5/16)	E-106-A-3	1		HEX. HD. BOLT	$\frac{1}{4}$ -20 x $\frac{3}{4}$	2
3	ALTERNATOR MTG. BRKT.	S-14426	1		PLAINWASHER (5/16)	S-9262-121	1	15	LOCKWASHER	T-9860-6	2
4	STUD	T-9087	1	9	SPACER (3/4 LONG)	S-10731-3	1		HEX. NUT	1/4 - 20	2
	LOCKWASHER (3/8)	E-106-A-4	3	10	HEX HD. BOLT (3/8)	$\frac{3}{8}$ -16 x $1\frac{1}{2}$	1		HEX. HD. BOLT	$\frac{5}{16}$ -18 x $\frac{1}{2}$	1
	HEX NUT	3/8 - 16	3		LOCKWASHER (3/8)	E-106-A-4	1	16	PLAINWASHER (5/16)	S-9262-121	1
	PLAINWASHER (3/8)	S-9262-56	1		ALT. FAN GUARD	M-12067	1		LOCKWASHER (5/16)	E-106-A-3	1
5	SPACER (3/4 LONG)	S-10731-3	1	11	HEX HD. BOLT	$\frac{5}{16}$ -18 x $\frac{3}{4}$	1	17	AMMETER PANEL ASBLY.	M-12040-1	1
6	LOCKWASHER (3/8)	E-106-A-4	1		PLAINWASHER	S-9262-121	1	18	SWITCH PLATE	T-9061-1	1
	HEX NUT	3/8 - 16	1		LOCKWASHER	E-106-A-3	1	19	CAUTION DECAL	S-17851	1
	HEX HD CAP SCREW	$\frac{3}{8}$ -16 x $3\frac{3}{4}$	1		HEX NUT	$\frac{5}{16}$ -18 x 18	1	20	WIRING DIAGRAM	T-13076	1
7	ALT. ADJ. STRAP	M-11566	1	12	POS. BATTERY CABLE	S-13147-1	1	21	LEAD CLIP	T-9402	2
				13	NEG. BATTERY CABLE	S-8070-28	1	22	INSTRUCTIONS	M-12103	1
								23	GROUND LEAD (NOT SHOWN)	B-10-10-22-36	1

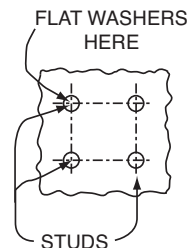
INSTRUCTIONS FOR F-163 FJW ENGINE WELDERS

ALTERNATOR:

1. Remove the following items from the engine.
  - A. Fan belt.
  - B. Remove battery. Disconnect and discard battery cables.
  - C. Battery charging generator, adjusting strap, ammeter panel, leads, and generator mounting bracket.
  - D. Ignition switch and related wiring. Discard old ignition switch plate.
2. Drill two holes in the front engine support channel (alternator side -- see sketch below).



3. Enlarge ignition switch mounting hole to .51 diameter.
4. Remove one hex hd. bolt to upper left of studs used to mount generator bracket. Apply thread sealant to the stud supplied and insert into engine block. Position plain washer (item 4) on upper stud. See sketch. Position ammeter panel on lower two studs. Position alternator mounting bracket. Using the three 3/8 lock washers and hex nuts, tighten panel and bracket securely into position.
5. Mount alternator to bracket using items 5 and 6.
6. Attach alternator adjusting strap to engine using items 9 and 10.
7. Attach alternator adjusting strap to alternator using item 8.
8. Install new fan belt and adjust to proper tension before tightening all alternator mounting bolts.
9. Attach alternator fan guard to alternator adjusting strap. Use mounting in item 11.
10. Attach voltage regulator to front engine support channel using item 15. The regulator is to be positioned so that connection tabs are pointing away from radiator fan.



CONNECTIONS: (See wiring diagram.)

1. Route leads (with ignition switch) between front mount and oil pan. Using new switch plate, mount ignition switch in
2. two black leads to start button.
3. red lead from ignition switch to magneto.
4. green lead from ammeter to alternator.
5. ctor into alternator completing the regulator to field circuit.
6. black lead to the "F" terminal on the voltage regulator.
7. yellow lead to the #3 terminal on the voltage regulator.
8. black lead and the white lead to the starting motor. See diagram.
9. are provided. One is to be placed under the pan bolt directly under the oil filter tube. The other one
10. ced behind the governor on the front end plate screw. Crimp lead clips so as to support the leads.
11. ive battery cable to starter.
12. ive battery cable to governor with 5/16-18 x 1/2 hex head screw and lock washer. Use tapped hole on outside
13. st below adjusting screw.
14. ng lead from regulator mounting bolt to a pan bolt. Make sure area in contact with lead is free of paint.

OBSOLETE  
NO REPLACEMENT  
AVAILABLE

- Bat
1. in its holder 180° so that battery polarity matches the lead polarity.
  2. Attach leads to battery.
  3. Replace center panel and tighten in place.
  4. Attach caution decal provided to side of radiator shroud in area of alternator.

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

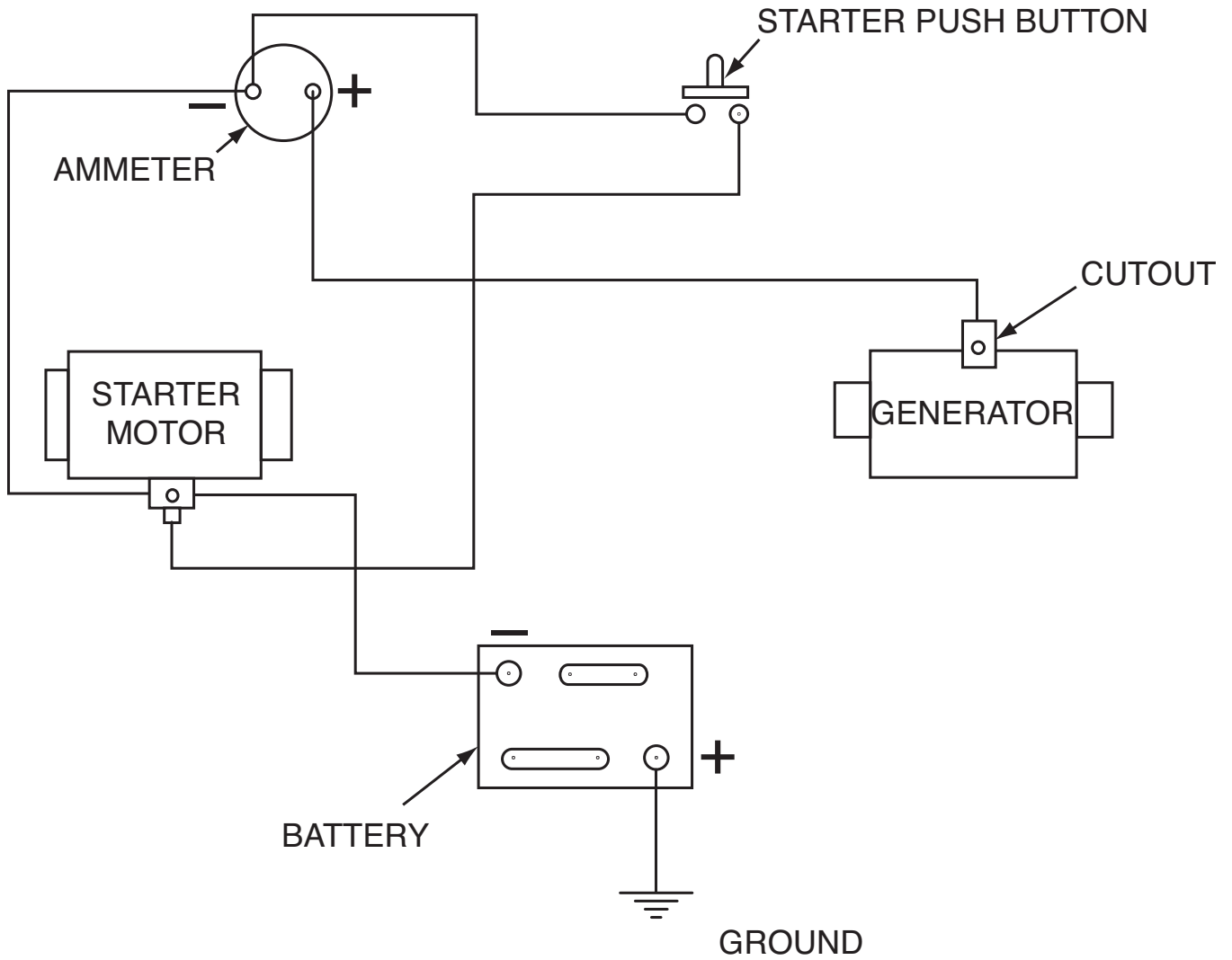
Return to Master TOC

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Return to Master TOC

T-9088



**NOTE:** Limit of  $\pm 1/64$  on all dimensions.

Return to Section TOC

Return to Section TOC

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Return to Section TOC

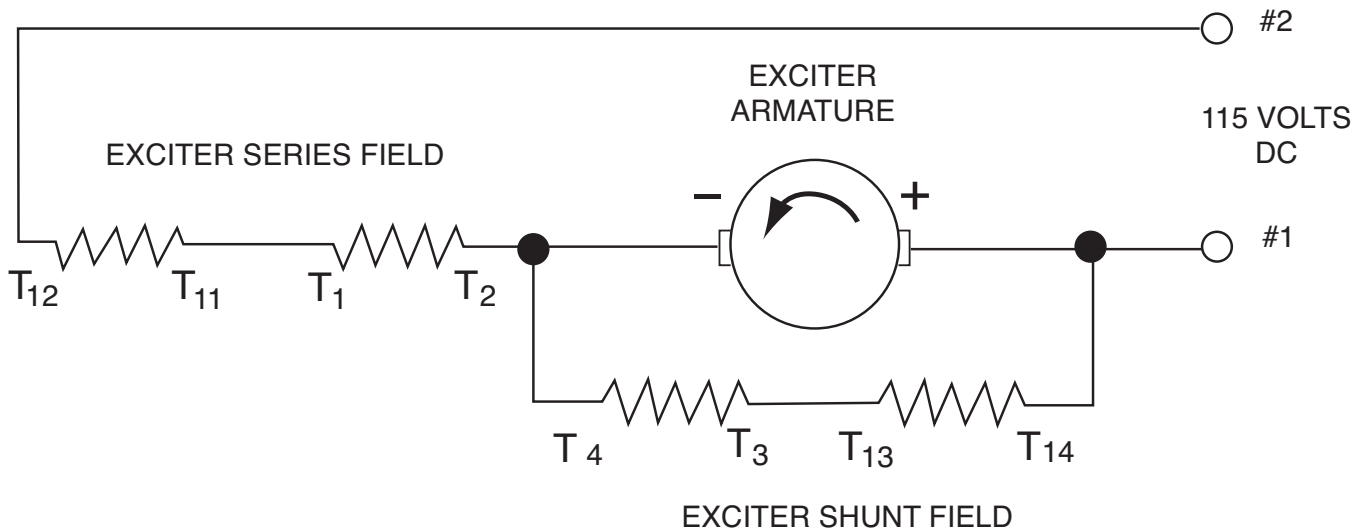
Return to Master TOC

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## E276-C

COMPOUND EXCITER CONNECTIONS FOR COUNTER CLOCKWISE  
ROTATION FACING THE EXCITER COMMUTATOR

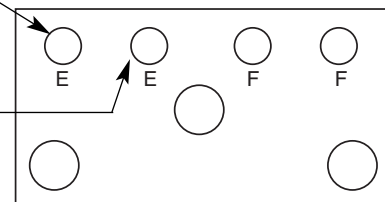
## Series Field

\* T1 Connect to T11.

T2 Connect to the left hand exciter brush holder.

T12 Bring out a lead through the lower or left hand lead block hole "E" and connect to the reversing switch or to power plug receptacle as shown in the control box diagram.

Bring out a lead from the right hand exciter brush holder through the top or right hand lead block hole "E" and to the reversing switch or power plug receptacle as shown in the control box diagram.



Coil with tags T1, T2, T3, T4 goes on the left hand pole piece. Coil with the tags T11, T12, T13, T14 goes on the right hand pole piece.

## Shunt Field

\* T3 Connect to T13.

T4 Connect to left hand exciter brush holder.

T14 Connect to the right hand exciter brush holder.

## Leads for Accessory Drive or Power Plug

See control box diagram for connection when power plug is on right hand side of control box (standard for "L" & "E" control). Where power plug is in such a place that it is best to connect the leads at the exciter, connect the power plug leads to T12 and to the right hand exciter brush holder.

When using this diagram on M.G. set bring out and tag #1 and #2 as above.

For F162-FJW with power plug on panel, connect one side of receptacle to R.H. brush holder, and the other side of receptacle to exciter lead T12 at rheostat terminal.

\* Should be soldered.

SA-200

Return to Section TOC

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Return to Section TOC

Return to Master TOC

Return to Master TOC

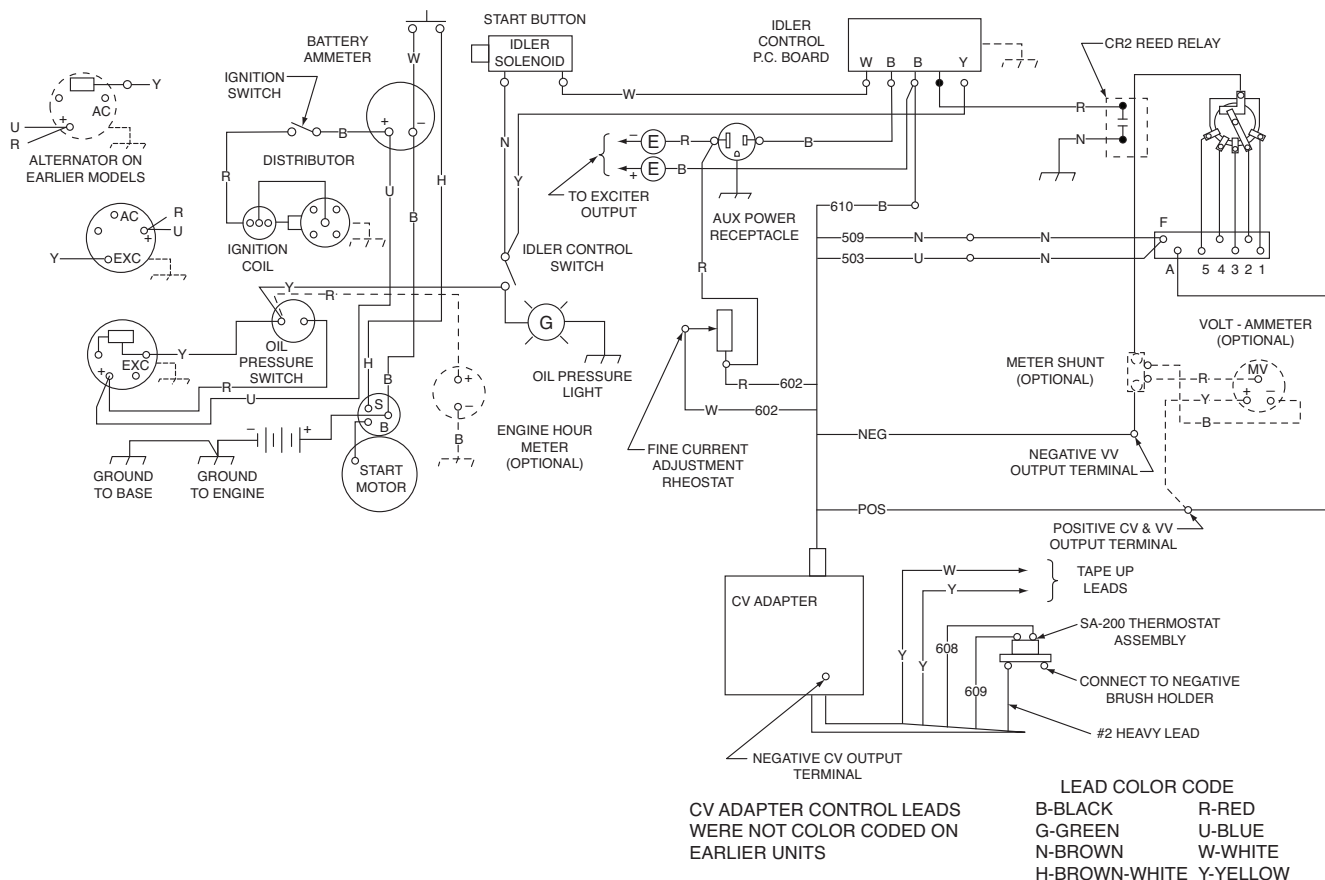
Return to Master TOC

Return to Master TOC

**CODES**  
**7276 - 9530**  
**(Electronic Idler, P-111 Parts)**



S-17701



ELECTRICAL SYMBOLS PER E-1537

**GENERAL MAINTENANCE INSTRUCTIONS FOR ENGINE DRIVEN ARC WELDING POWER SOURCES**

**⚠ WARNING**



**ELECTRIC SHOCK CAN KILL**



**MOVING PARTS CAN INJURE**

- Turn engine off before maintenance work unless the maintenance work requires it to be running.
- Keep hands, hair, clothing and tools away from moving parts.
- Ensure all guards or covers are replaced after servicing.
- Only qualified persons should install, use or service this machine.

**Maintenance Instructions**

**Daily Checks:**

- Electrode and work connections are tight
- Rotate the current control twice to clean contacts
- All equipment in serviceable condition
- Engine oil, coolant, air cleaner and fuel strainer are at proper operating level and clean

**As Required:**

- Blow dust from the machine using clean low-pressure air
- Clean commutators or slip rings with fine sandpaper--not emery cloth
- Replace brushes before the pigtail is within .25" of the commutator
- Grease may be added to bearings no more than once a year.

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

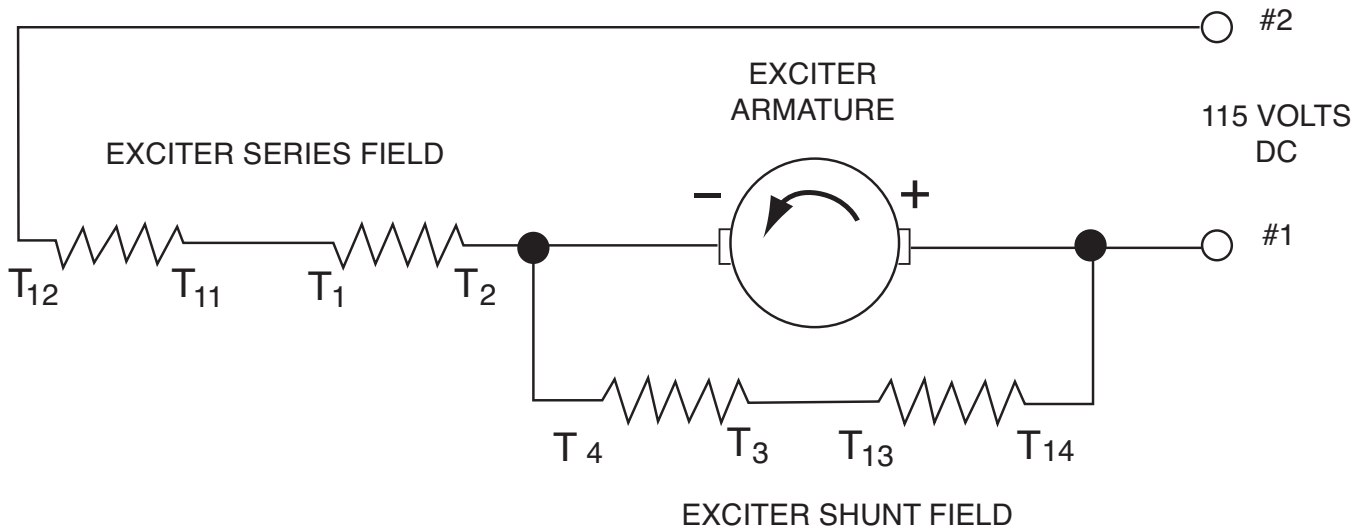
Return to Master TOC

Return to Master TOC

Return to Master TOC



## E276-C

COMPOUND EXCITER CONNECTIONS FOR COUNTER CLOCKWISE  
ROTATION FACING THE EXCITER COMMUTATOR

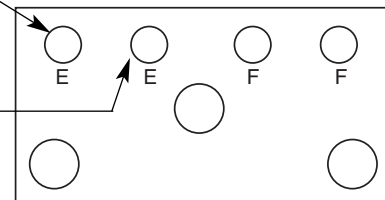
## Series Field

\* T1 Connect to T11.

T2 Connect to the left hand exciter brush holder.

T12 Bring out a lead through the lower or left hand lead block hole "E" and connect to the reversing switch or to power plug receptacle as shown in the control box diagram.

Bring out a lead from the right hand exciter brush holder through the top or right hand lead block hole "E" and to the reversing switch or power plug receptacle as shown in the control box diagram.



Coil with tags T1, T2, T3, T4 goes on the left hand pole piece. Coil with the tags T11, T12, T13, T14 goes on the right hand pole piece.

## Shunt Field

\* T3 Connect to T13.

T4 Connect to left hand exciter brush holder.

T14 Connect to the right hand exciter brush holder.

## Leads for Accessory Drive or Power Plug

See control box diagram for connection when power plug is on right hand side of control box (standard for "L" & "E" control). Where power plug is in such a place that it is best to connect the leads at the exciter, connect the power plug leads to T12 and to the right hand exciter brush holder.

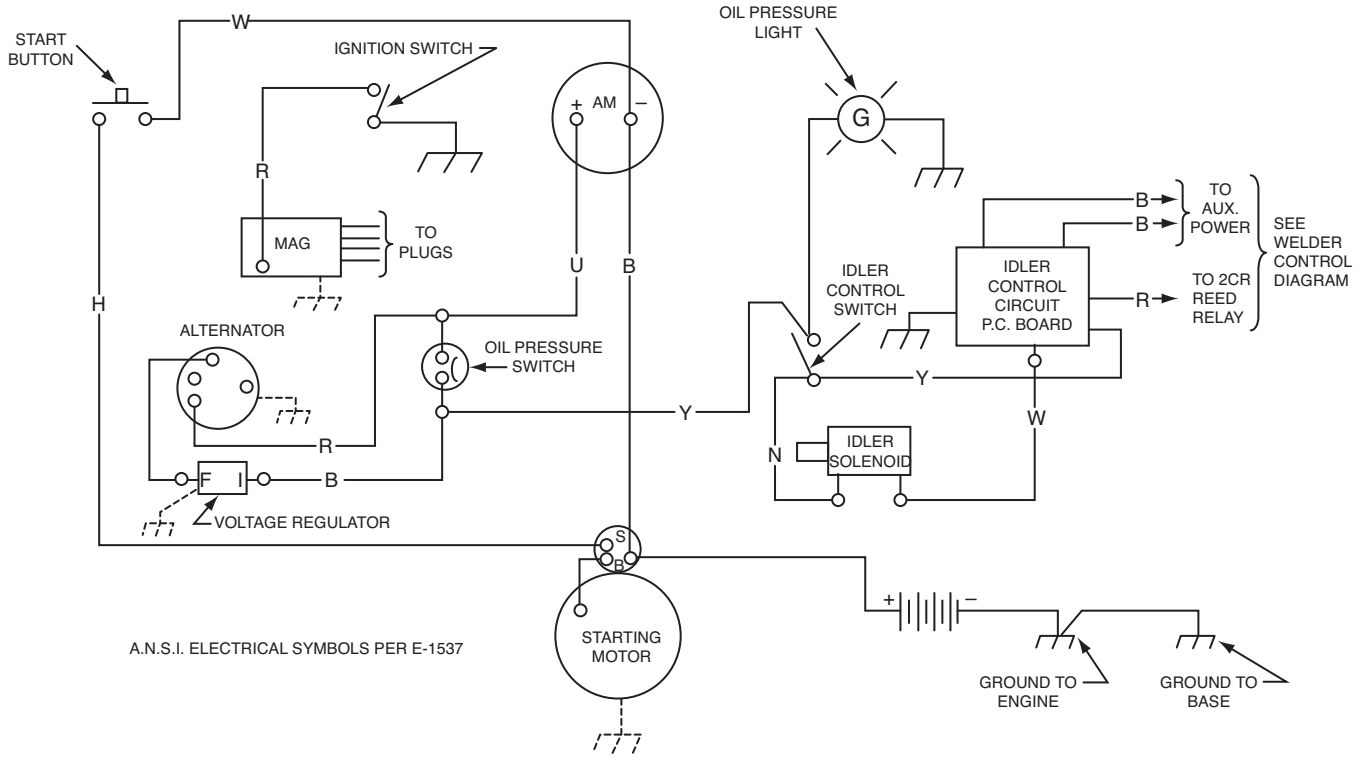
When using this diagram on M.G. set bring out and tag #1 and #2 as above.

For F162-FJW with power plug on panel, connect one side of receptacle to R.H. brush holder, and the other side of receptacle to exciter lead T12 at rheostat terminal.

\* Should be soldered.

SA-200

S-14919



LEAD COLOR CODE

- B = Black
- R = Red
- W = White
- H = Brown & White
- N = Brown
- Y = Yellow
- B = Blue

Return to Section TOC

Return to Master TOC

Return to Section TOC

Return to Master TOC

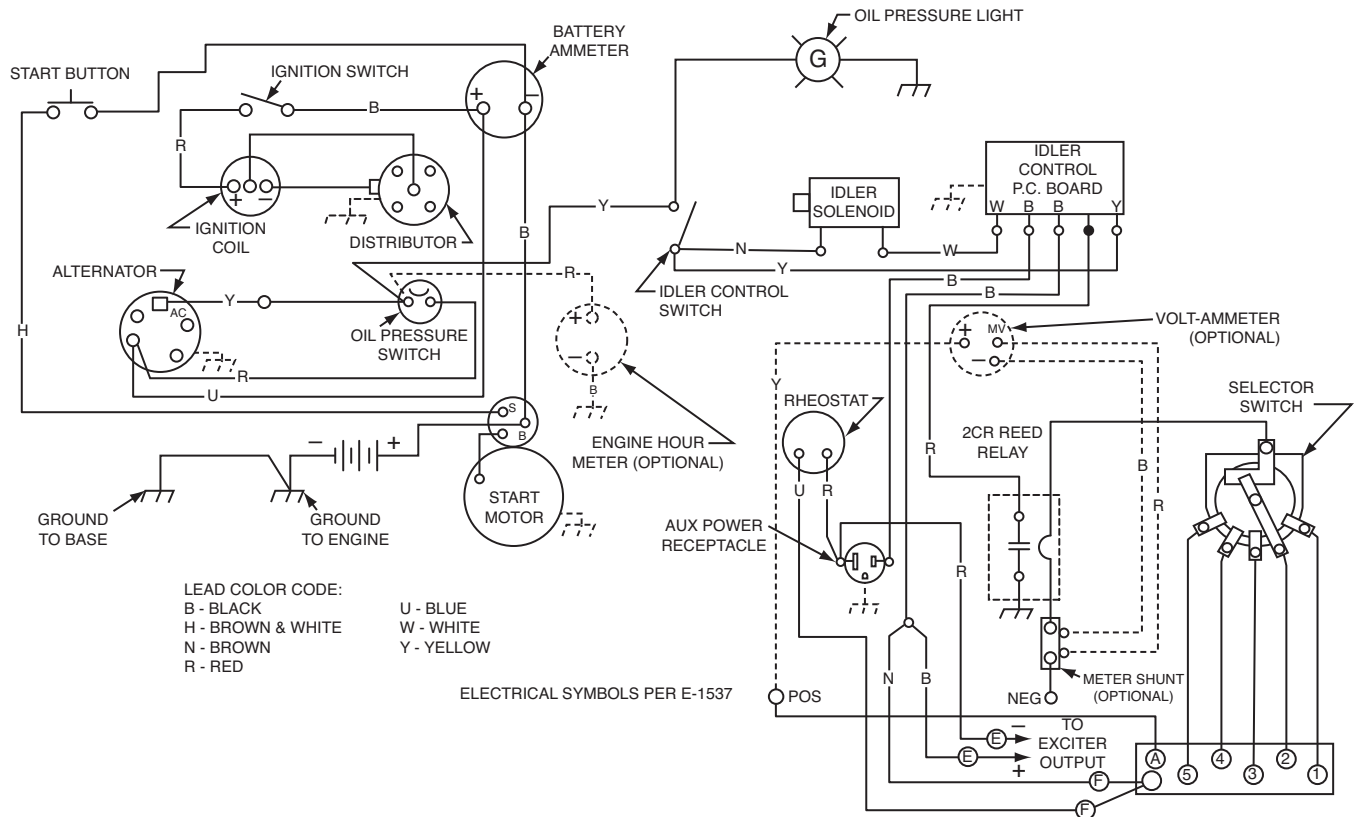
Return to Section TOC

Return to Master TOC

Return to Section TOC

Return to Master TOC

## S-17298



## MAINTENANCE INSTRUCTIONS

Observe operating and maintenance instructions in engine manual.

Blow out welders and controls with air hose at least once every two months – once every week in dirty locations.

Brushes should be replaced before the pigtails are within .12" of the commutator or before the limit of spring travel is reached.

Replace with the same kind of brushes as were originally furnished.

Sand in brushes according to instructions in the instruction manuals. Commutators may be cleaned with fine sandpaper while the machine is running to remove any grease or dirt that has accumulated.

**DO NOT USE EMERY CLOTH**

Ball bearings should not be greased more than once a year under normal service. Most bearing failures are caused by allowing dirt to be forced onto the bearing with the grease, or use of improper kind of grease. **DO NOT OVERPACK WITH GREASE**

Keep ground and electrode connections tight.

SA-200

## S-11663

## MAINTENANCE INSTRUCTIONS

OBSERVE OPERATING INSTRUCTIONS IN ENGINE MANUAL.  
BLOW OUT WELDERS AND CONTROLS WITH AIR HOSE AT LEAST ONCE EVERY TWO MONTHS ~ ONCE EVERY WEEK IN DIRTY LOCATIONS.

BRUSHES SHOULD BE REPLACED BEFORE THE PIGTAILS ARE WITHIN 1/8 INCH OF THE COMMUTATOR OR BEFORE THE LIMIT OF SPRING TRAVEL IS REACHED. REPLACE WITH THE SAME KIND OF BRUSHES AS WERE ORIGINALLY FURNISHED. SAND IN BRUSHES ACCORDING TO INSTRUCTIONS IN THE INSTRUCTION MANUALS.

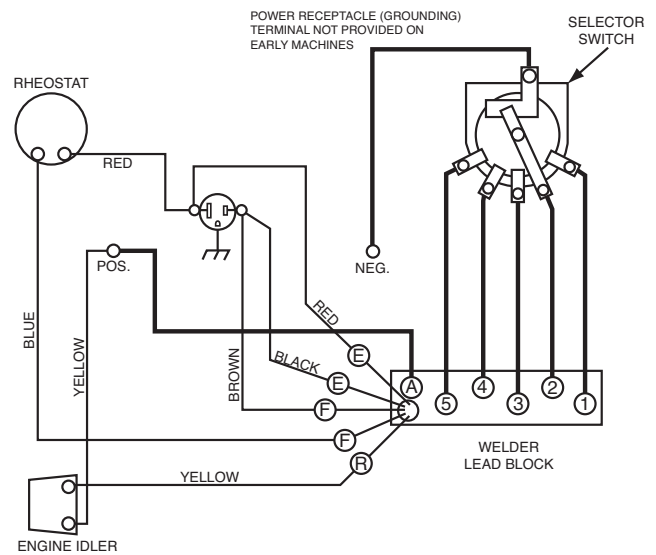
BALL BEARINGS SHOULD NOT BE GREASED MORE THAN ONCE A YEAR UNDER NORMAL SERVICE ~ USE TYPE RECOMMENDED IN THE INSTRUCTION MANUAL. MOST BEARING FAILURES ARE CAUSED BY ALLOWING DIRT TO BE FORCED INTO THE BEARING WITH THE GREASE, OR USE OF IMPROPER KIND OF GREASE.

## DO NOT OVERPACK WITH GREASE

COMMUTATORS MAY BE CLEANED WITH FINE SANDPAPER WHILE THE MACHINE IS RUNNING TO REMOVE ANY GREASE OR DIRT THAT HAS ACCUMULATED.

## DO NOT USE EMERY CLOTH

KEEP GROUND AND ELECTRODE CONNECTIONS TIGHT.



THE LINCOLN ELECTRIC CO.

CLEVELAND, OHIO

MADE IN U.S.A.

S-11663

PRINT ABOVE TO 4 1/2 X 10 1/2 SIZE

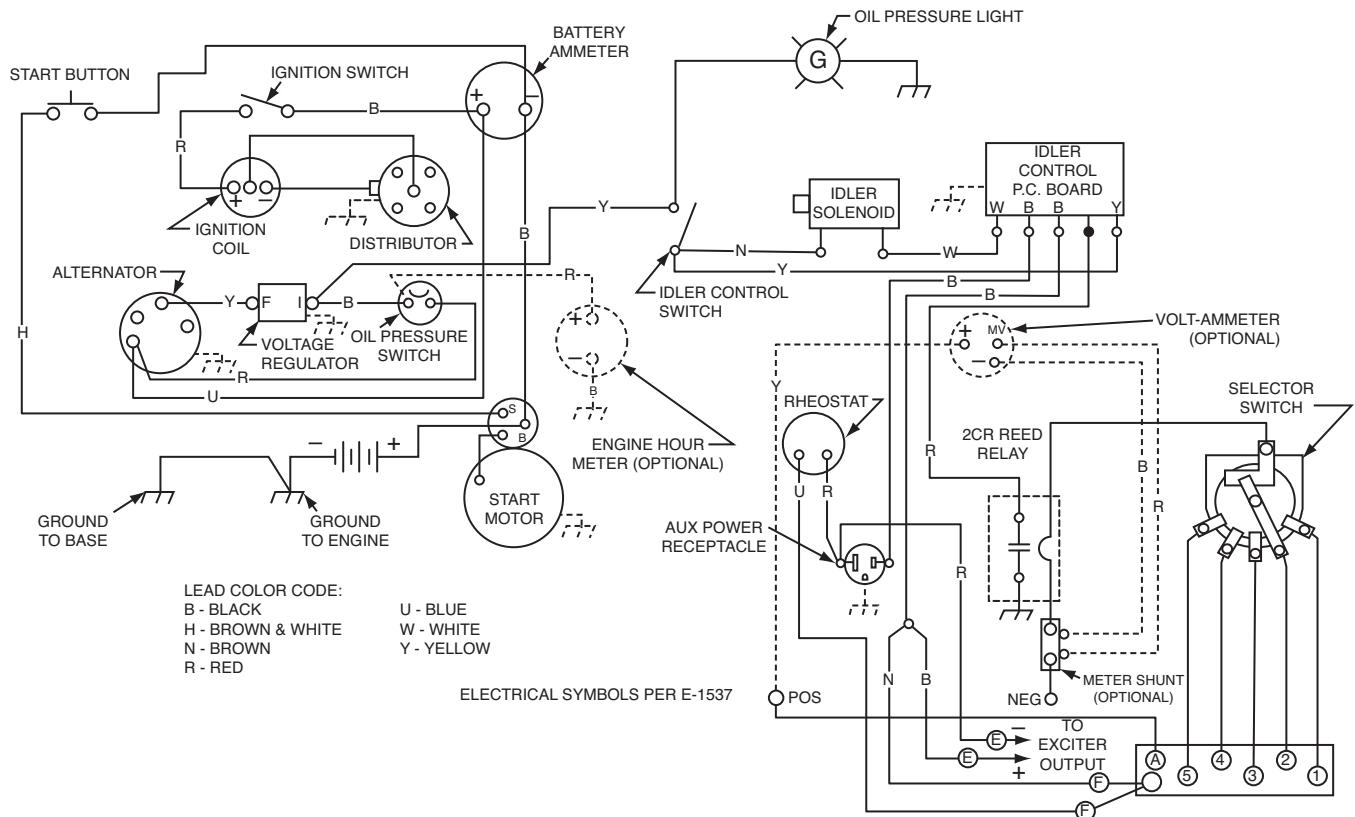
**NOTE:**

LIMIT OF  $\pm 1/2^\circ$  ON ALL ANGLES UNLESS OTHERWISE SPECIFIED.

LIMIT OF  $\pm 1/64$  ON ALL FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

LIMIT OF  $\pm .002$  ON ALL DECIMAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

## S-16483



## MAINTENANCE INSTRUCTIONS

Observe operating and maintenance instructions in engine manual.

Blow out welders and controls with air hose at least once every two months – once every week in dirty locations.

Brushes should be replaced before the pigtails are within .12" of the commutator or before the limit of spring travel is reached.

Replace with the same kind of brushes as were originally furnished.

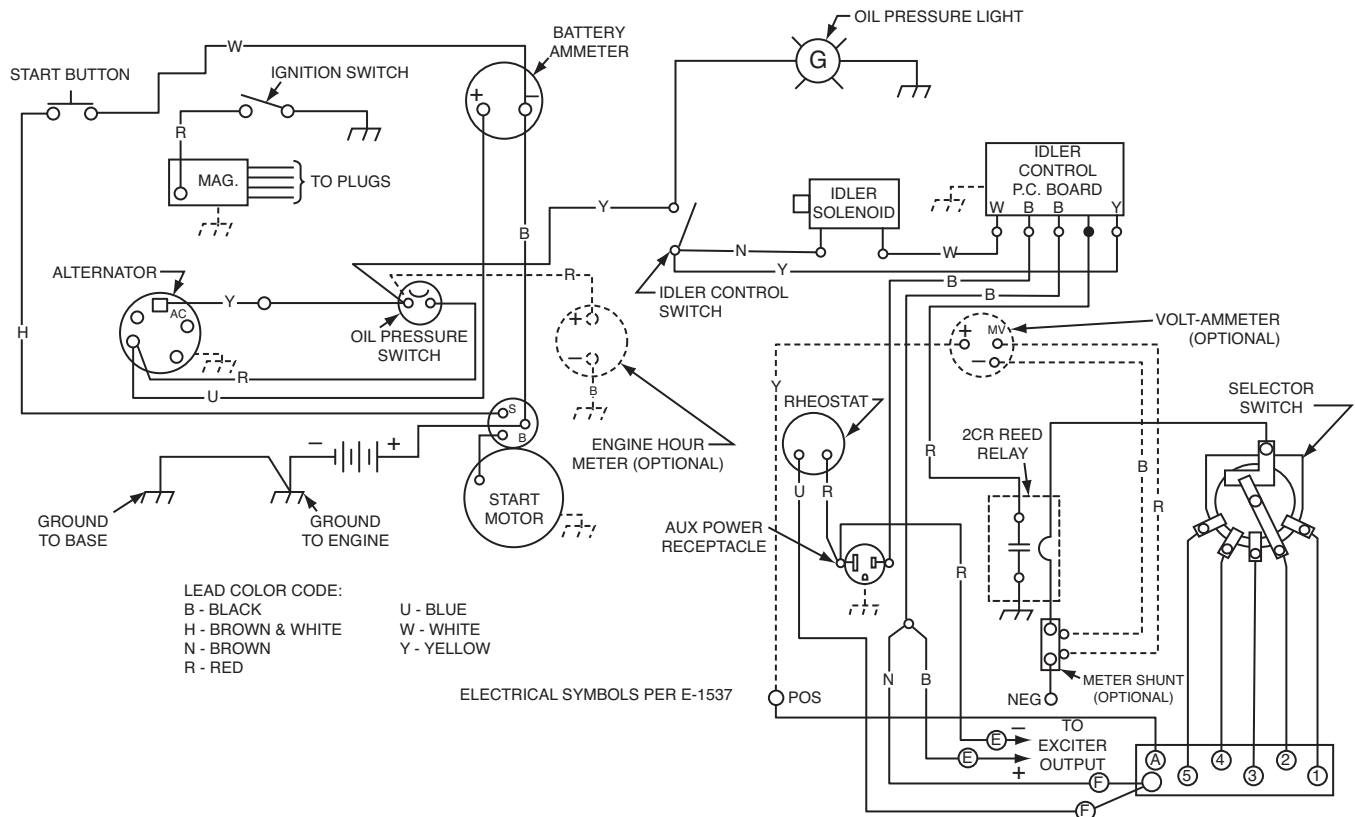
Sand in brushes according to instructions in the instruction manuals. Commutators may be cleaned with fine sandpaper while the machine is running to remove any grease or dirt that has accumulated.

**DO NOT USE EMERY CLOTH**

Ball bearings should not be greased more than once a year under normal service. Most bearing failures are caused by allowing dirt to be forced into the bearing with the grease, or use of improper kind of grease. **DO NOT OVERPACK WITH GREASE**

Keep ground and electrode connections tight.

## S-17297

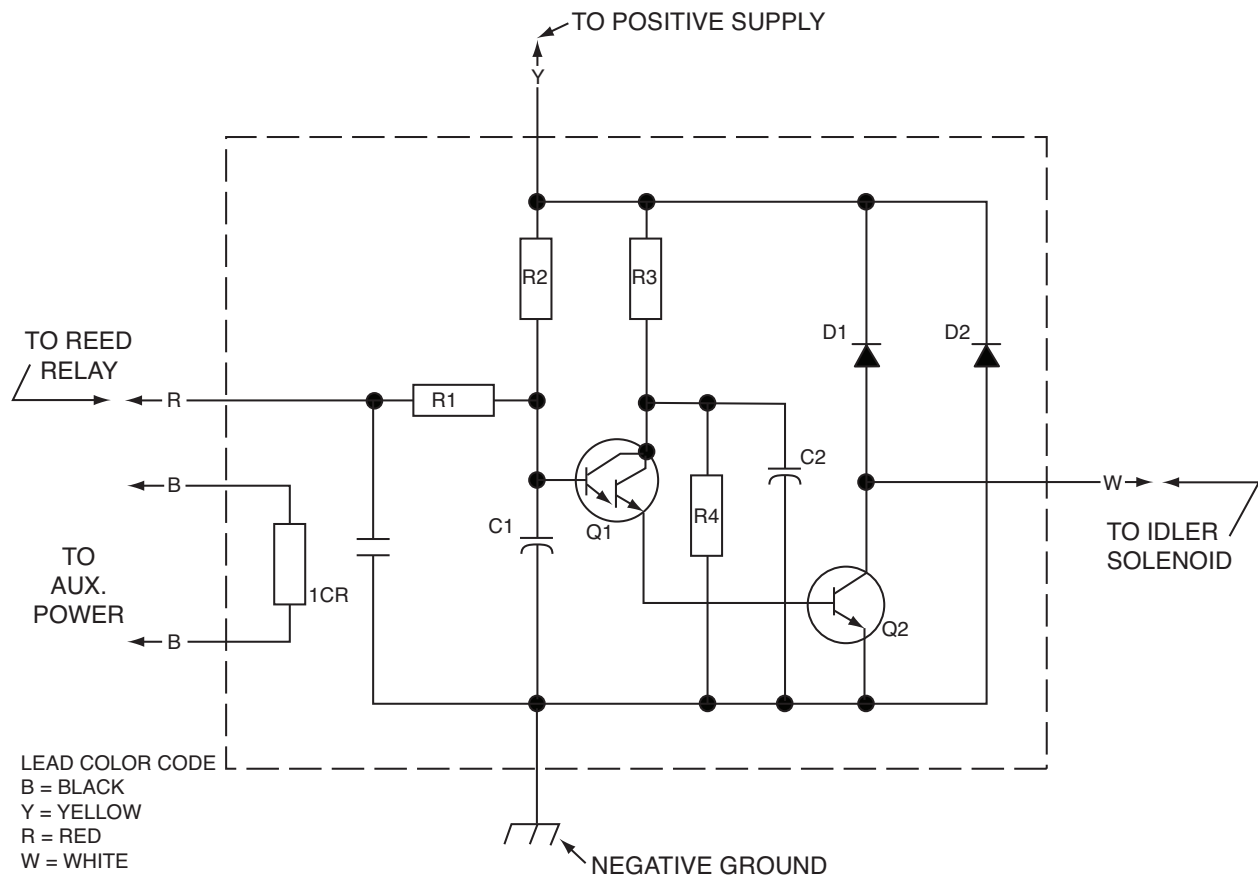


## MAINTENANCE INSTRUCTIONS

**WARNING:** Only qualified personnel should service this equipment. Stop engine before servicing. Read maintenance instructions in power source and engine operating manuals. Blow out welders and controls with air hose at least once every two months – once every week in dirty locations. Brushes should be replaced before the pigtails are within .12" of the commutator or before the limit of spring travel is reached. Replace with the same kind of brushes as were originally furnished. Sand in brushes according to instructions in the instruction manuals. Ball bearings should not be greased more than once a year under normal service. Most bearing failures are caused by allowing dirt to be forced into the bearing with the grease, or use of improper kind of grease. **DO NOT OVERPACK WITH GREASE** Keep work and electrode connections tight.

SA-200

## S-16129



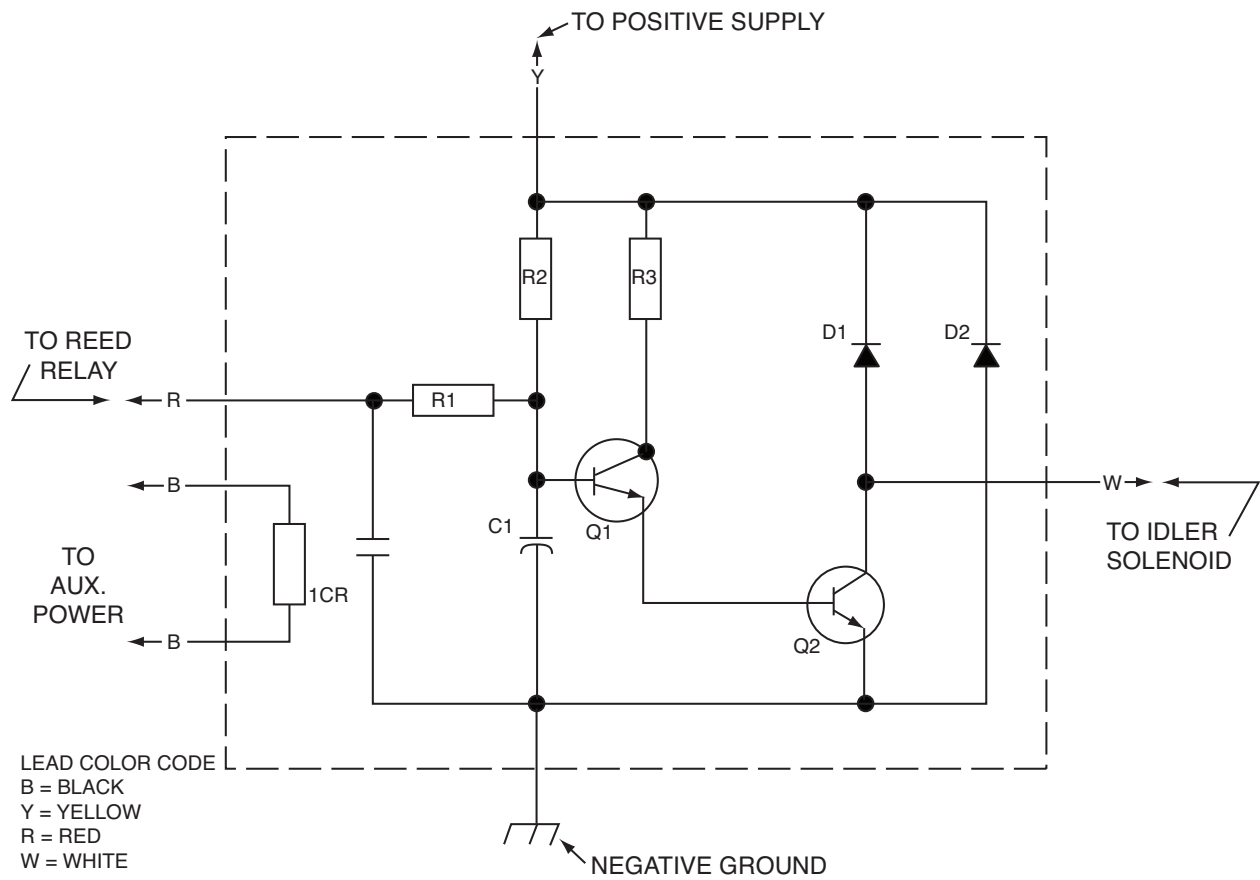
ELECTRICAL SYMBOLS PER E-1537

**LEGEND**

C1	200MFD
C2	.22 MFD
R1	47 $\Omega$
R2	270 $\Omega$
R3	220 $\Omega$
R4	150 $\Omega$
D1	1 AMP.
D2	1 AMP.
Q1	.5 AMP., 30 VOLT
Q2	3 AMP., 80 VOLT
1CR	REED RELAY

SA-200

## S-14931



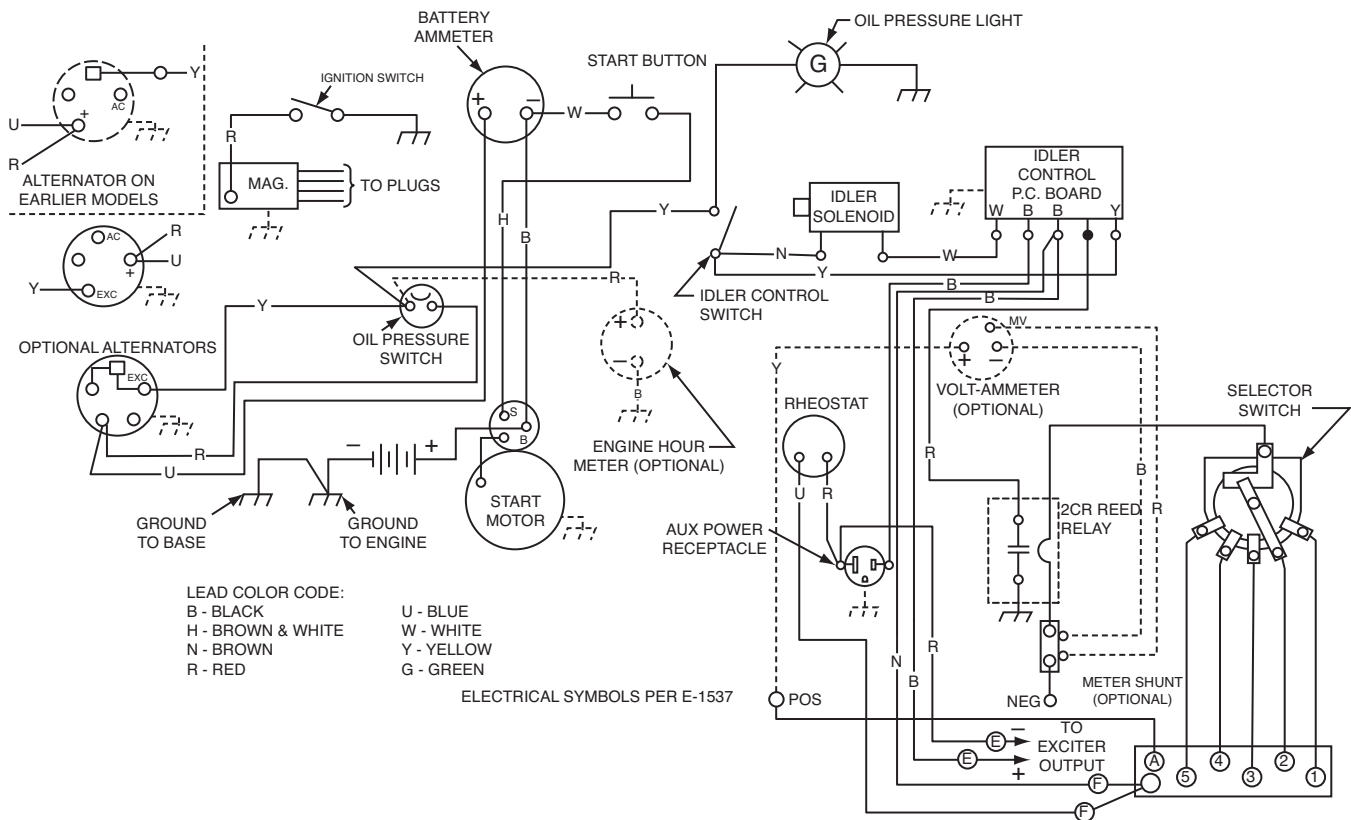
## LEGEND

C1	200MFD
1CR	REED RELAY
R1	47 $\Omega$
R2	470 K $\Omega$
R3	470 $\Omega$
D1	1 AMP
D2	1 AMP
Q1	2N3390
Q2	D40D3

SA-200



## S-17382



## GENERAL MAINTENANCE INSTRUCTIONS FOR ENGINE DRIVEN ARC WELDING POWER SOURCES

### WARNING



MOVING  
PARTS  
CAN INJURE

- Have only qualified personnel perform maintenance work.
- Turn the engine OFF before maintenance work unless the maintenance work requires it to be running.
- Keep hands, hair, clothing and tools away from moving parts, and ensure all guards or covers are replaced after servicing.

### Maintenance Instructions

#### Daily Checks:

- Electrode and work connections are tight
- Rotate the current control twice to clean contacts
- All equipment in serviceable condition
- Engine oil, coolant, air cleaner and fuel strainer are at proper operating level and clean

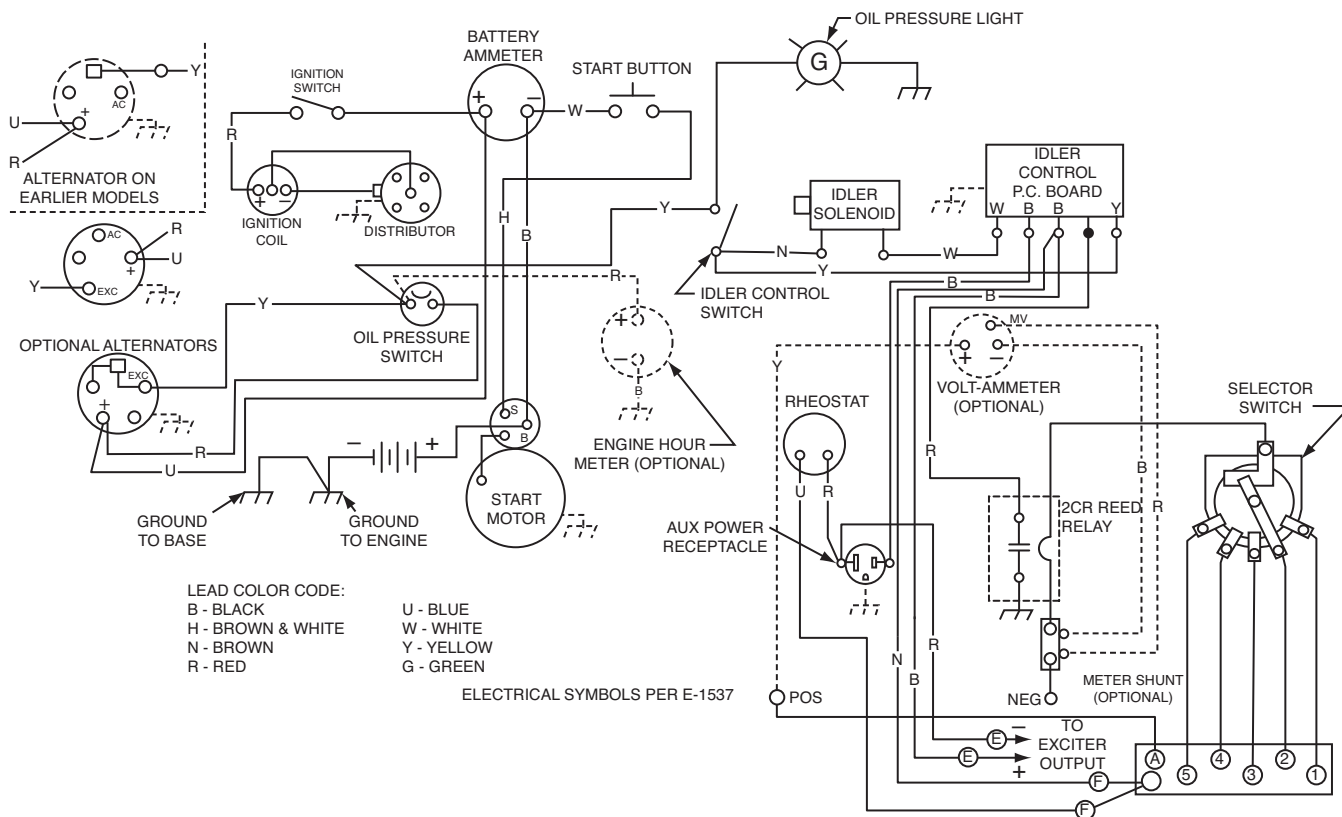
#### As Required:

- Blow dust from the machine using clean low pressure air
- Clean commutators or slip rings with fine sandpaper--not emery cloth
- Replace brushes before the pigtail is within .25" of the commutator
- Grease may be added to bearings no more than once a year.

SA-200

LINCOLN  
ELECTRIC

## S-17383



## GENERAL MAINTENANCE INSTRUCTIONS FOR ENGINE DRIVEN ARC WELDING POWER SOURCES

### ⚠ WARNING



**MOVING PARTS  
CAN INJURE**

- Have only qualified personnel perform maintenance work.
- Turn the engine OFF before maintenance work unless the maintenance work requires it to be running.
- Keep hands, hair, clothing and tools away from moving parts, and ensure all guards or covers are replaced after servicing.

### Maintenance Instructions

#### Daily Checks:

- Electrode and work connections are tight
- Rotate the current control twice to clean contacts
- All equipment in serviceable condition
- Engine oil, coolant, air cleaner and fuel strainer are at proper operating level and clean

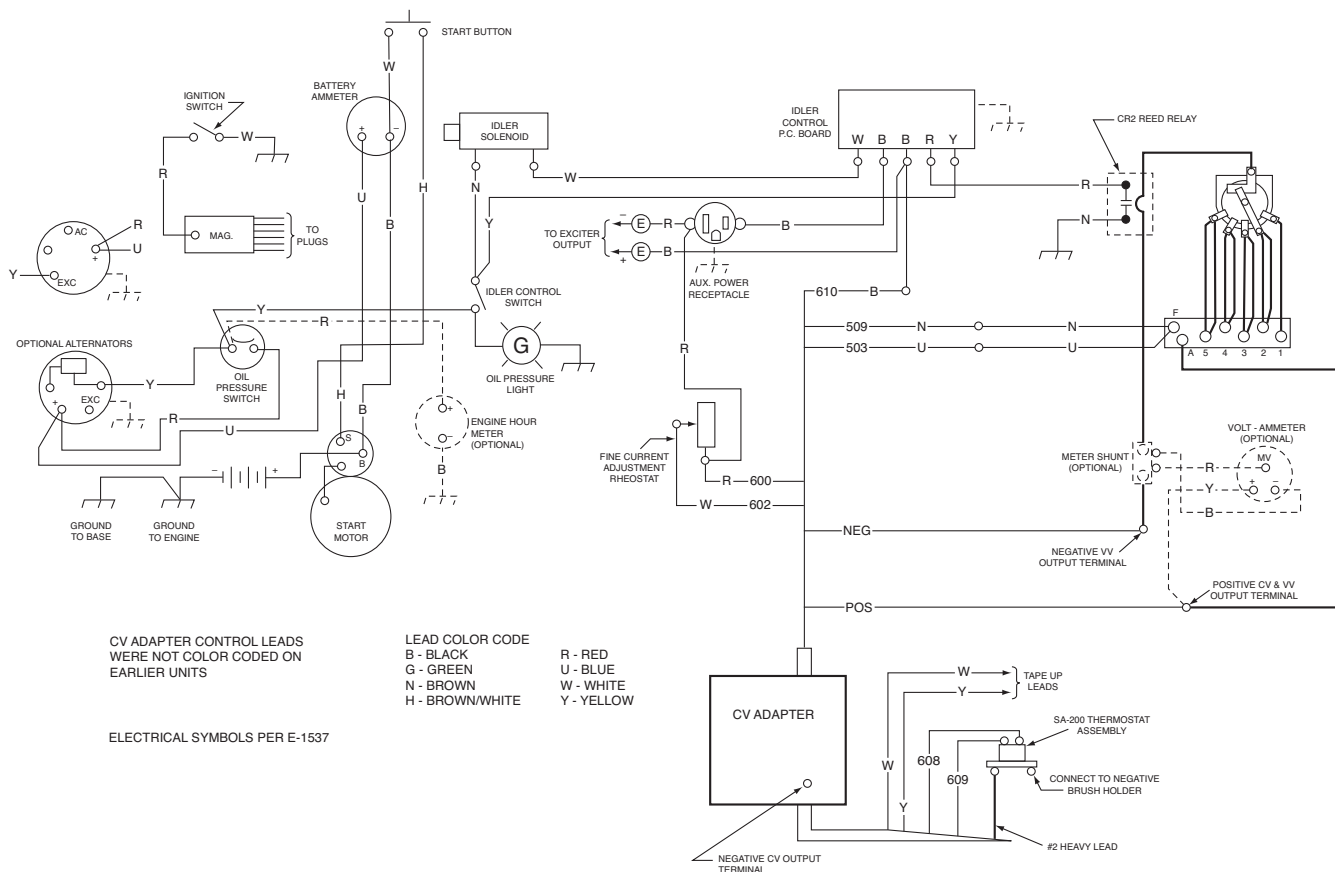
#### As Required:

- Blow dust from the machine using clean low pressure air
- Clean commutators or slip rings with fine sandpaper--not emery cloth
- Replace brushes before the pigtail is within .25" of the commutator
- Grease may be added to bearings no more than once a year.

SA-200

**LINCOLN**  
ELECTRIC

S-18866



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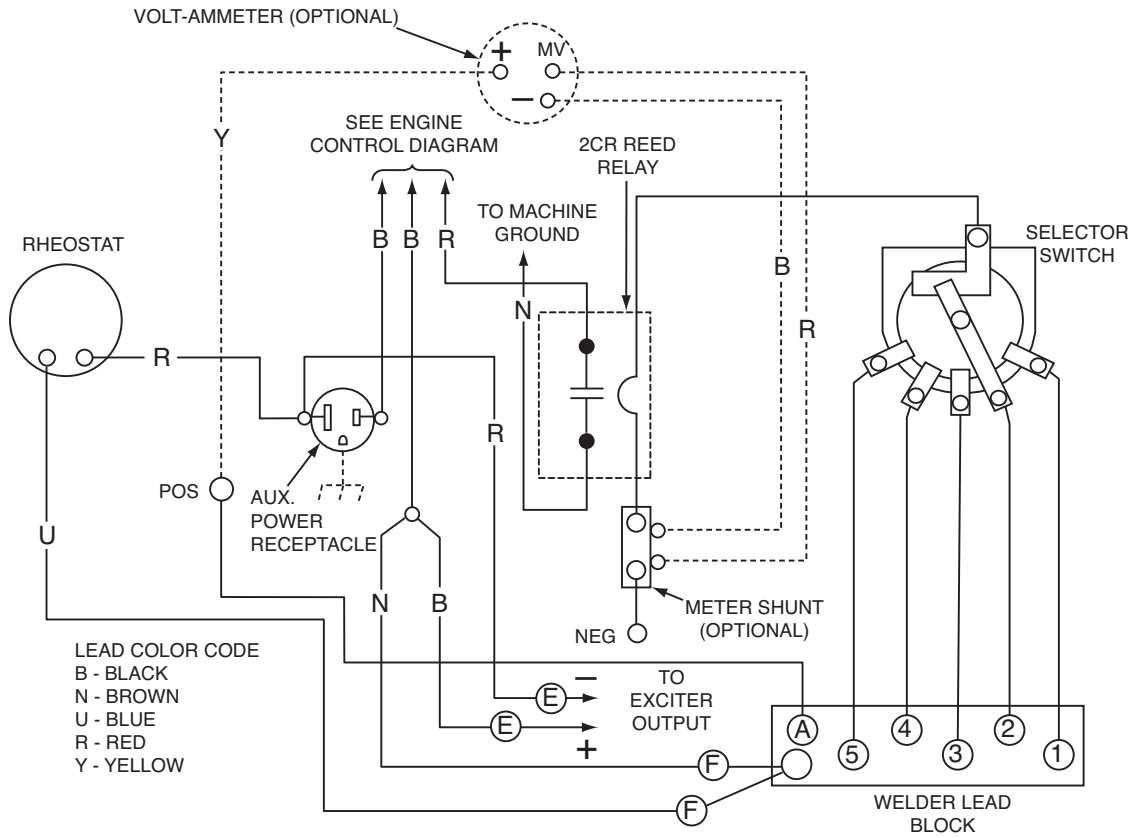
Return to Master TOC

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## S-14930



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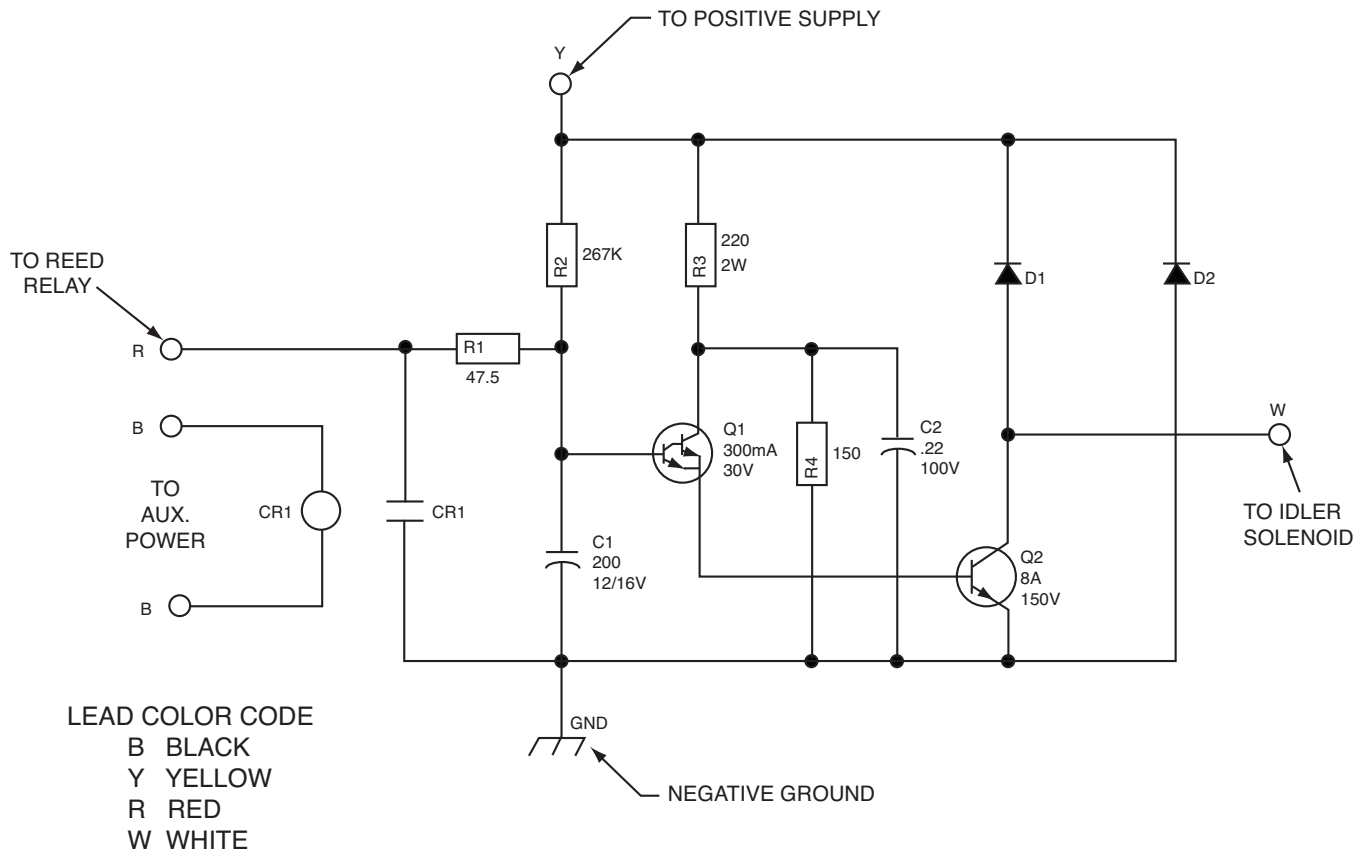
Return to Section TOC

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Return to Master TOC

S-20334



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**NOTES:**

N.A. Since components or circuitry on a printed circuit board may change without affecting the interchangeability of a complete board, this diagram may not show the exact components or circuitry of controls having a common code number.

**GENERAL INFORMATION**

Electrical symbols per E1537

Capacitors = MFD (.022/50V unless otherwise specified)

Resistors = Ohms (1/4W unless otherwise specified)

Diodes = 1A, 400V (unless otherwise specified)

**LABELS**

↑ Supply Voltage Net

▽ Common Connection

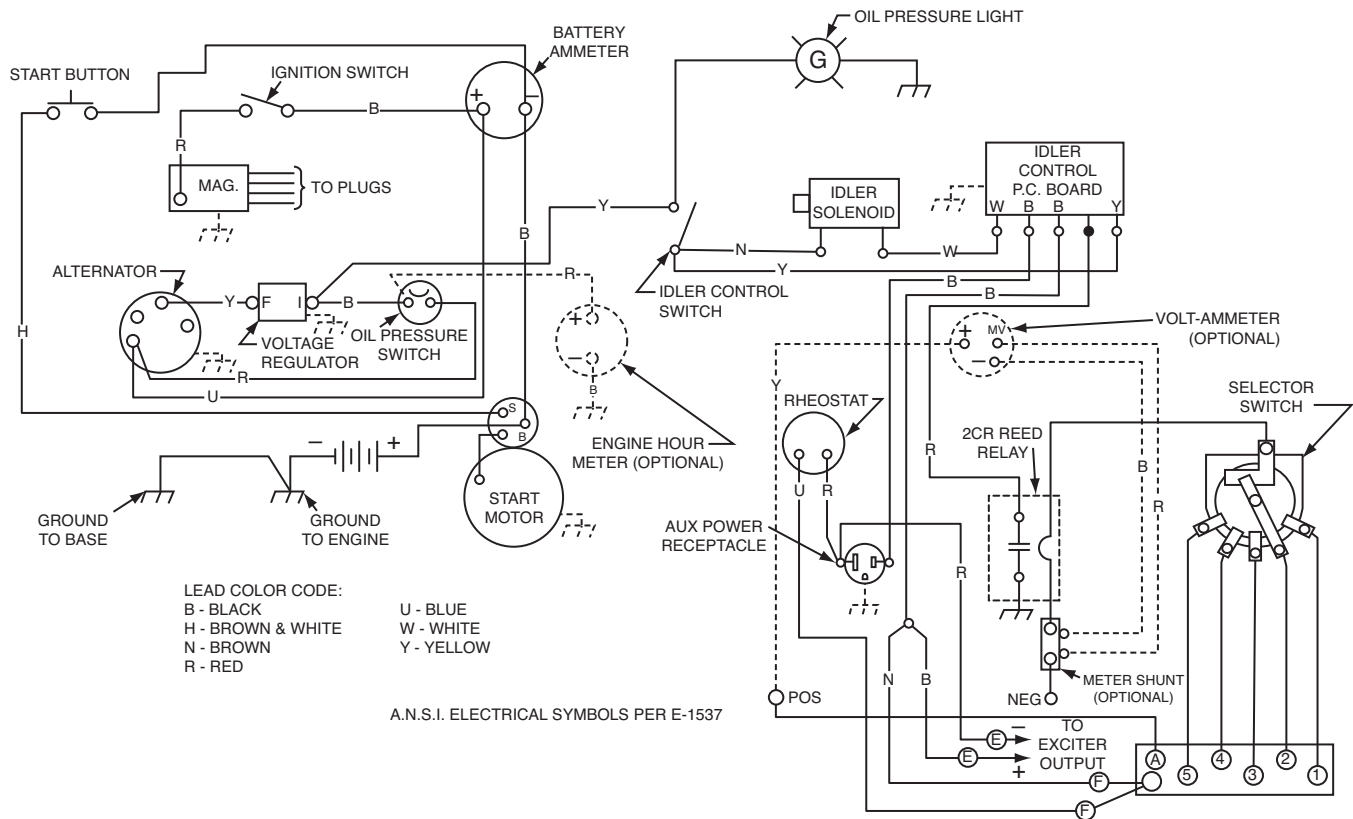
⏏ Frame Connection

⏏ Earth Ground Connection

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Return to Master TOC

## S-15197

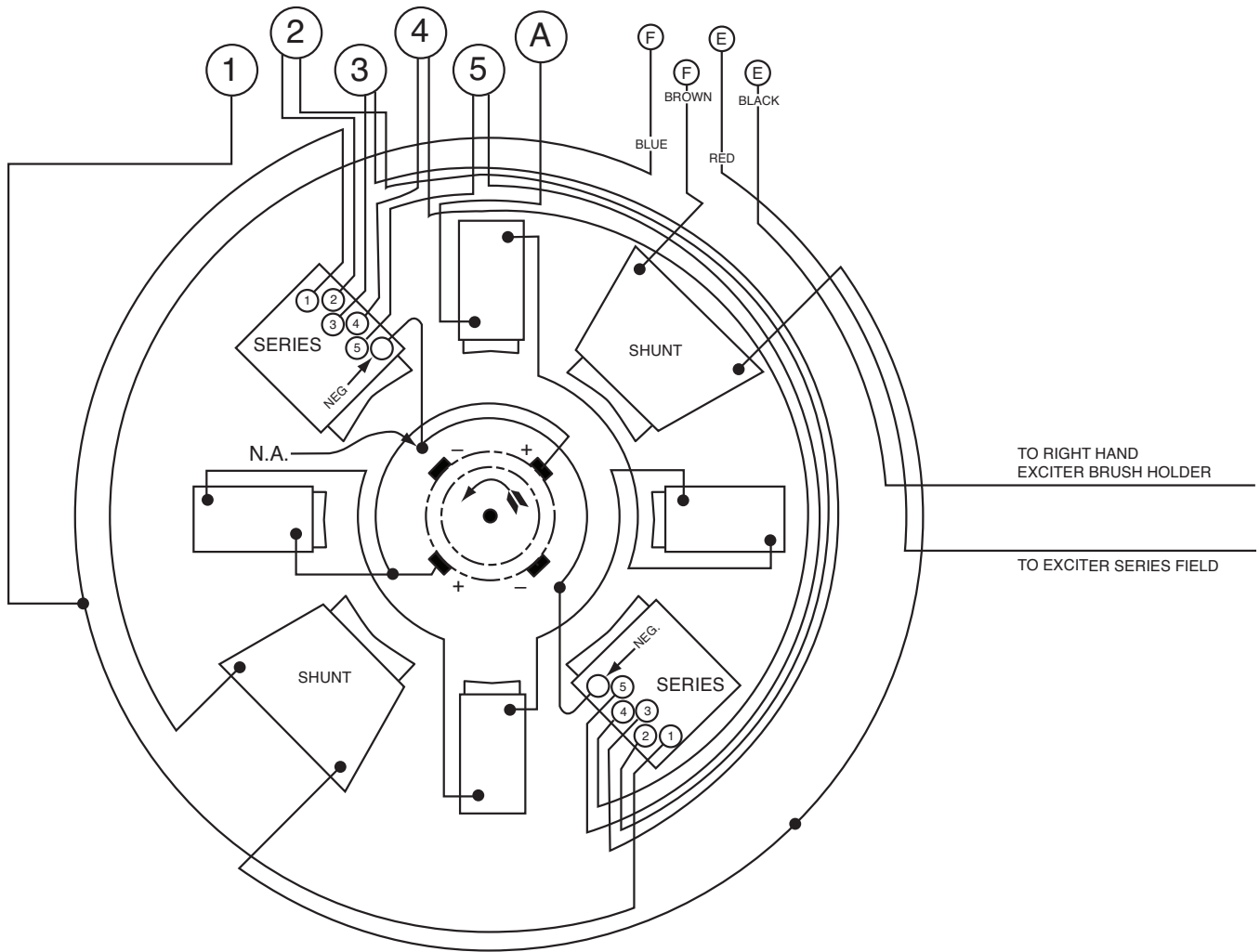


## MAINTENANCE INSTRUCTIONS

**WARNING:** Only qualified personnel should service this equipment. Stop engine before servicing. Read maintenance instructions in power source and engine operating manuals. Blow out welders and controls with air hose at least once every two months – once every week in dirty locations. Brushes should be replaced before the pigtails are within .12" of the commutator or before the limit of spring travel is reached. Replace with the same kind of brushes as were originally furnished. Sand in brushes according to instructions in the instruction manuals. Ball bearings should not be greased more than once a year under normal service. Most bearing failures are caused by allowing dirt to be forced into the bearing with the grease, or use of improper kind of grease. **DO NOT OVERPACK WITH GREASE** Keep work and electrode connections tight.

SA-200

M-15733

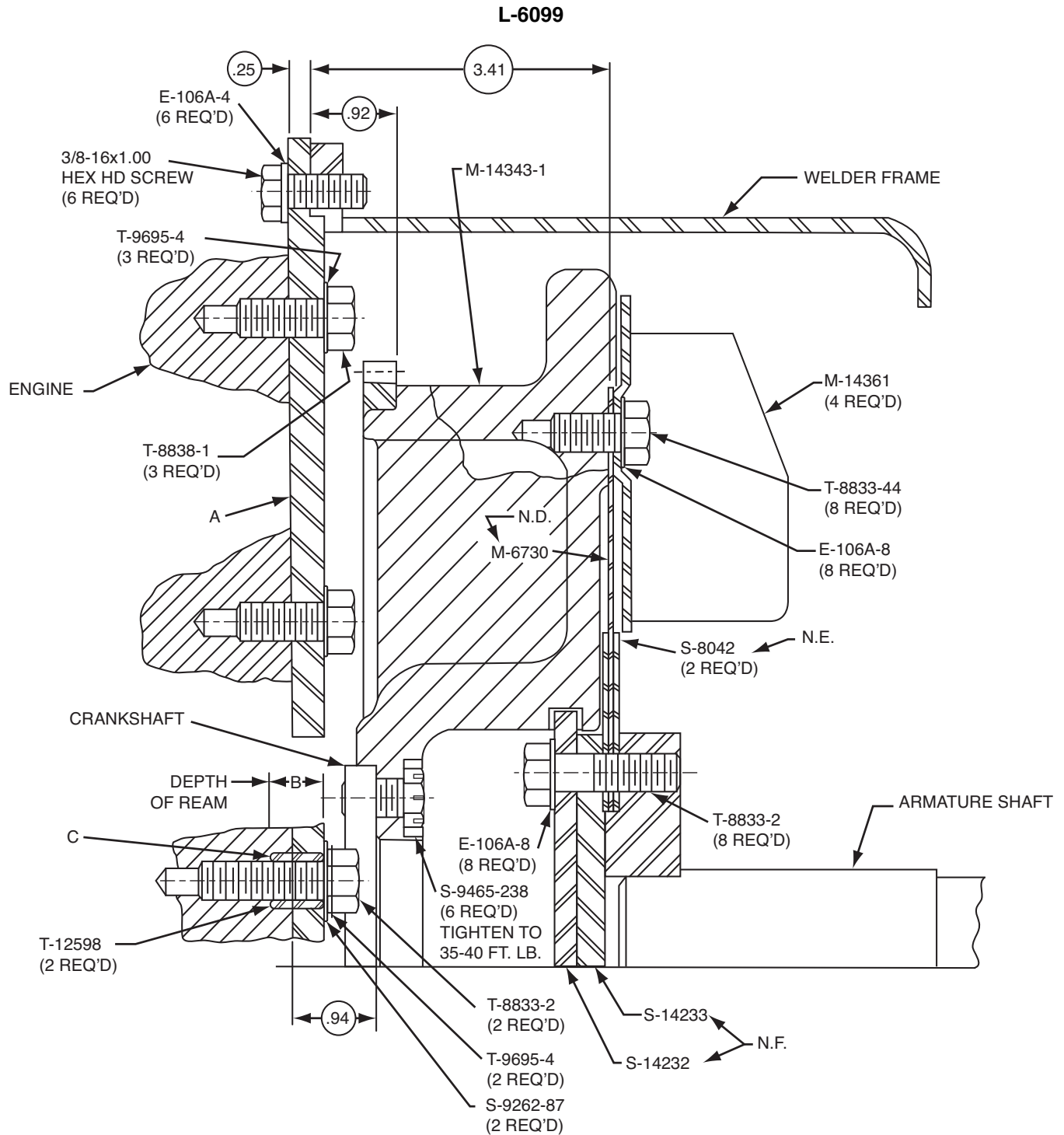


COUNTER CLOCKWISE ROTATION

N.A. When optional CV adapter is installed, the thermostat is connected to this brush holder.

N.B. Flex lead connections to interpoles may be bolted or soldered depending on type of interpoles.

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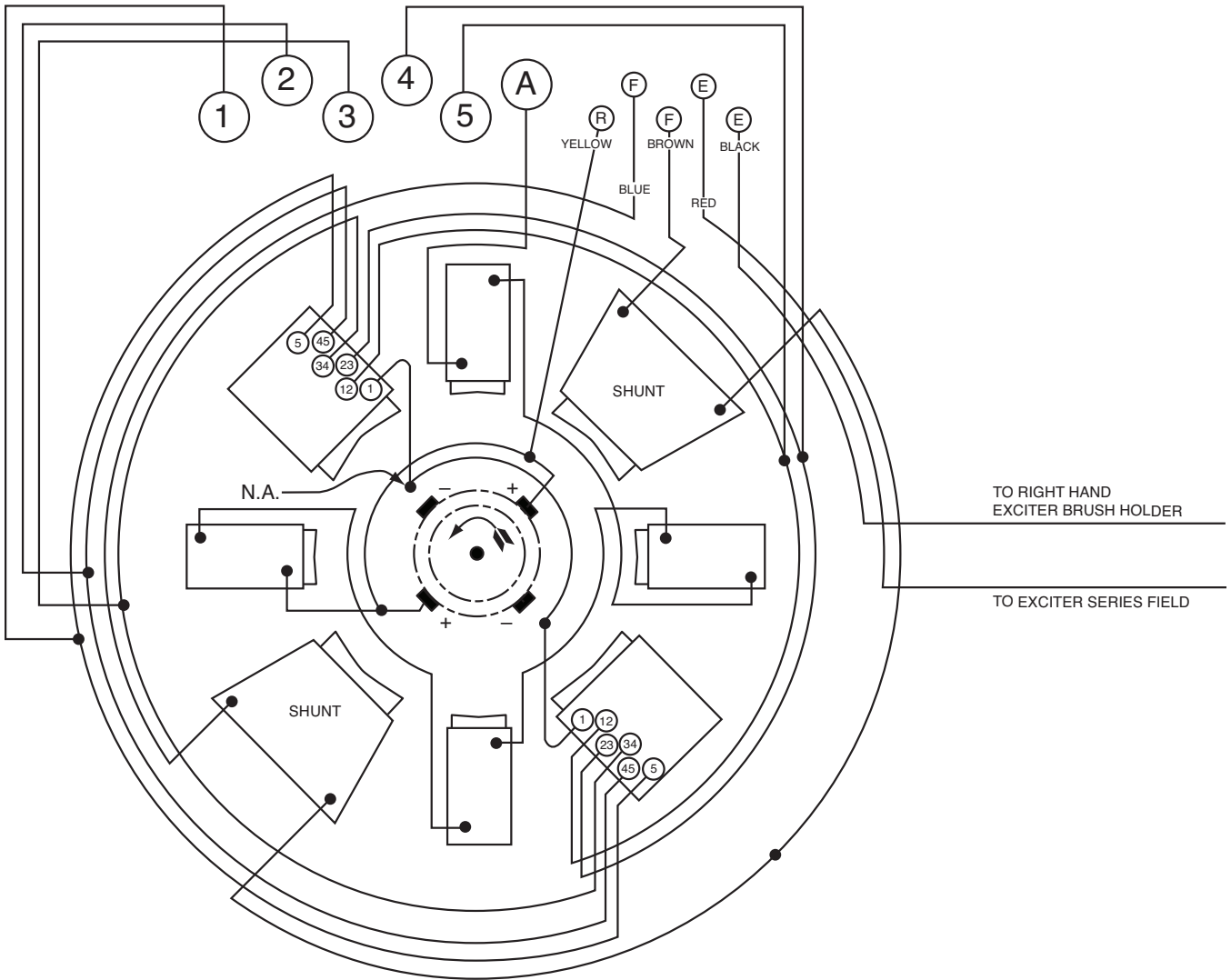
## NOTES:

- N.A. Runout of flywheel diameter and face not to exceed .010 max. f.1.m after assembly.
- N.B. Flywheel housing face runout from flywheel not to exceed .020 max f.1.m after assembly.
- N.C. Flywheel housing diameter runout from flywheel not to exceed .010 max f.1.m after assembly.
- N.D. Burr on coupling disc to face blower paddles.
- N.E. Burr on both backing plates to face away from coupling disc.
- N.F. Burr on both clamp rings to face each other.

SA-200



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COUNTER CLOCKWISE ROTATION

NOTE: (R) LEAD USED ONLY ON UNITS WITH VACUUM IDLER.

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