THERMAL ARC®

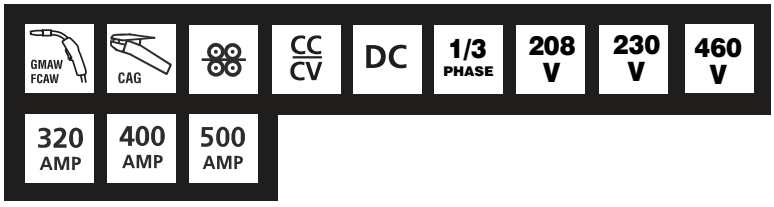
320SP
400SP
500SP

POWERMASTER

Service Manual

Revision: AC **Issue Date:** March 3, 2008 **Manual No.:** 0-4968

Operating Features:



THERMAL ARC®

WARNINGS

Read and understand this entire Manual and your employer's safety practices before installing, operating, or servicing the equipment.

While the information contained in this Manual represents the Manufacturer's best judgement, the Manufacturer assumes no liability for its use.

Setrvice Manual Number 0-4969 for:

PowerMaster 320SP (US)	W1000102
PowerMaster 400SP Bw (US)	W1000202
PowerMaster 400SP (US) Compact	W1000304
PowerMaster 500SP Bw (US)	W1000502
Wirefeeder SP4000W Thermal Arc (US)	W3000202
Wirefeeder SP4000R Thermal Arc (US)	W3000302

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82 Benning Street
West Lebanon, New Hampshire, USA 03784
(603) 298-5711

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Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Equipment Serial #: _____

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SECTION 1:
SAFETY INSTRUCTIONS AND WARNINGS

WARNING

PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS KEEP AWAY UNTIL CONSULTING YOUR DOCTOR. DO NOT LOSE THESE INSTRUCTIONS. READ OPERATING/INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.

Welding products and welding processes can cause serious injury or death, or damage to other equipment or property, if the operator does not strictly observe all safety rules and take precautionary actions.

Safe practices have developed from past experience in the use of welding and cutting. These practices must be learned through study and training before using this equipment. Some of these practices apply to equipment connected to power lines; other practices apply to engine driven equipment. Anyone not having extensive training in welding and cutting practices should not attempt to weld.

Safe practices are outlined in the American National Standard Z49.1 entitled: SAFETY IN WELDING AND CUTTING. This publication and other guides to what you should learn before operating this equipment are listed at the end of these safety precautions. **HAVE ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR WORK PERFORMED ONLY BY QUALIFIED PEOPLE.**

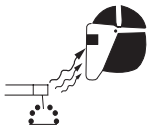
1.01 Arc Welding Hazards

WARNING

ELECTRIC SHOCK can kill.

Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

1. Do not touch live electrical parts.
2. Wear dry, hole-free insulating gloves and body protection.
3. Insulate yourself from work and ground using dry insulating mats or covers.
4. Disconnect input power or stop engine before installing or servicing this equipment. Lock input power disconnect switch open, or remove line fuses so power cannot be turned on accidentally.
5. Properly install and ground this equipment according to its Owner's Manual and national, state, and local codes.
6. Turn off all equipment when not in use. Disconnect power to equipment if it will be left unattended or out of service.
7. Use fully insulated electrode holders. Never dip holder in water to cool it or lay it down on the ground or the work surface. Do not touch holders connected to two welding machines at the same time or touch other people with the holder or electrode.
8. Do not use worn, damaged, undersized, or poorly spliced cables.
9. Do not wrap cables around your body.
10. Ground the workpiece to a good electrical (earth) ground.
11. Do not touch electrode while in contact with the work (ground) circuit.
12. Use only well-maintained equipment. Repair or replace damaged parts at once.
13. In confined spaces or damp locations, do not use a welder with AC output unless it is equipped with a voltage reducer. Use equipment with DC output.
14. Wear a safety harness to prevent falling if working above floor level.
15. Keep all panels and covers securely in place.



WARNING

ARC RAYS can burn eyes and skin; NOISE can damage hearing. Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin. Noise from some processes can damage hearing.

1. Wear a welding helmet fitted with a proper shade of filter (see ANSI Z49.1 listed in Safety Standards) to protect your face and eyes when welding or watching.
2. Wear approved safety glasses. Side shields recommended.
3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.
5. Use approved ear plugs or ear muffs if noise level is high.

WARNING

FUMES AND GASES can be hazardous to your health.

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

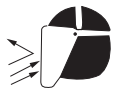
1. Keep your head out of the fumes. Do not breath the fumes.
2. If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
3. If ventilation is poor, use an approved air-supplied respirator.
4. Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for metals, consumables, coatings, and cleaners.
5. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.
6. Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.
7. Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.

WARNING

WELDING can cause fire or explosion.

Sparks and spatter fly off from the welding arc. The flying sparks and hot metal, weld spatter, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.

1. Protect yourself and others from flying sparks and hot metal.
2. Do not weld where flying sparks can strike flammable material.
3. Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
4. Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
5. Watch for fire, and keep a fire extinguisher nearby.
6. Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
7. Do not weld on closed containers such as tanks or drums.
8. Connect work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock and fire hazards.
9. Do not use welder to thaw frozen pipes.
10. Remove stick electrode from holder or cut off welding wire at contact tip when not in use.



WARNING

FLYING SPARKS AND HOT METAL can cause injury.

Chipping and grinding cause flying metal. As welds cool, they can throw off slag.

Eye protection filter shade selector for welding or cutting (goggles or helmet), from AWS A6.2-73.

Welding or cutting	*Electrode Size*	*Filter*	*Welding or cutting*	*Electrode Size*	*Filter*
Torch soldering		2	**Gas metal-arc**		
Torch brazing		3 or 4	Non-ferrous base metal	All	11
Oxygen Cutting			Ferrous base metal	All	12
Light	Under 1 in., 25 mm	3 or 4	Gas tungsten arc welding	All	12
Medium	1 to 6 in., 25-150 mm	4 or 5	(TIG)	All	12
Heavy	Over 6 in., 150 mm	5 or 6	Atomic hydrogen welding	All	12
Gas welding			Carbon arc welding	All	12
Light	Under 1/8 in., 3 mm	4 or 5	Plasma arc welding		
Medium	1/8 to 1/2 in., 3-12 mm	5 or 6	**Carbon arc air gouging**		
Heavy	Over 1/2 in., 12 mm	6 or 8	Light		12
Shielded metal-arc	Under 5/32 in., 4 mm	10	Heavy		14
	5/32 to 1/4 in.,	12	**Plasma arc cutting**		
	Over 1/4 in., 6.4 mm	14	Light	Under 300 Amp	9
			Medium	300 to 400 Amp	12
			Heavy	Over 400 Amp	14

1. Wear approved face shield or safety goggles. Side shields recommended.
2. Wear proper body protection to protect skin.

WARNING

CYLINDERS can explode if damaged.

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

1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
3. Keep cylinders away from any welding or other electrical circuits.
4. Never allow a welding electrode to touch any cylinder.
5. Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
6. Turn face away from valve outlet when opening cylinder valve.
7. Keep protective cap in place over valve except when cylinder is in use or connected for use.
8. Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards.

WARNING

Engines can be dangerous.

WARNING

ENGINE EXHAUST GASES can kill.

Engines produce harmful exhaust gases.

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

WARNING

ENGINE FUEL can cause fire or explosion.

Engine fuel is highly flammable.

1. Stop engine before checking or adding fuel.
2. Do not add fuel while smoking or if unit is near any sparks or open flames.
3. Allow engine to cool before fueling. If possible, check and add fuel to cold engine before beginning job.
4. Do not overfill tank — allow room for fuel to expand.
5. Do not spill fuel. If fuel is spilled, clean up before starting engine.

WARNING

MOVING PARTS can cause injury.

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

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

WARNING

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

Batteries contain acid and generate explosive gases.

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

WARNING

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

The coolant in the radiator can be very hot and under pressure.

1. Do not remove radiator cap when engine is hot. Allow engine to cool.
2. Wear gloves and put a rag over cap area when removing cap.
3. Allow pressure to escape before completely removing cap.

WARNING

This product, when used for welding or cutting, produces fumes or gases which contain chemicals know to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety code Sec. 25249.5 et seq.)

NOTE

Considerations About Welding And The Effects of Low Frequency Electric and Magnetic Fields

The following is a quotation from the General Conclusions Section of the U.S. Congress, Office of Technology Assessment, Biological Effects of Power Frequency Electric & Magnetic Fields - Background Paper, OTA-BP-E-63 (Washington, DC: U.S. Government Printing Office, May 1989): "...there is now a very large volume of scientific findings based on experiments at the cellular level and from studies with animals and people which clearly establish that low frequency magnetic fields and interact with, and produce changes in, biological systems. While most of this work is of very high quality, the results are complex. Current scientific understanding does not yet allow us to interpret the evidence in a single coherent framework. Even more frustrating, it does not yet allow us to draw definite conclusions about questions of possible risk or to offer clear science-based advice on strategies to minimize or avoid potential risks."

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

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

ABOUT PACEMAKERS:

The above procedures are among those also normally recommended for pacemaker wearers. Consult your doctor for complete information.

1.02 Principal Safety Standards

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

Safety and Health Standards, OSHA 29 CFR 1910, from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, American Welding Society Standard AWS F4.1, from American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

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

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

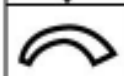
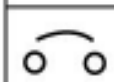
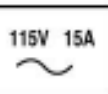
Code for Safety in Welding and Cutting, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

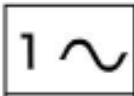
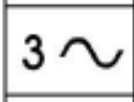
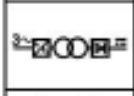
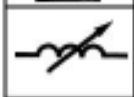
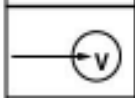
Safe Practices for Occupation and Educational Eye and Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 1430 Broadway, New York, NY 10018.

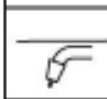
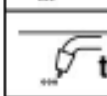
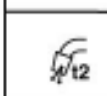
Cutting and Welding Processes, NFPA Standard 51B, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

1.03 Symbol Chart

Note that only some of these symbols will appear on your model.

	On
	Off
	Dangerous Voltage
	Increase/Decrease
	Circuit Breaker
	AC Auxiliary Power
	Fuse
	Amperage
	Voltage
	Hertz (cycles/sec)
	Frequency
	Negative
	Positive
	Direct Current (DC)
	Protective Earth (Ground)
	Line
	Line Connection
	Auxiliary Power
 115V 15A	Receptacle Rating-Auxiliary Power

	Single Phase
	Three Phase
	Three Phase Static Frequency Converter-Transformer-Rectifier
	Remote
	Duty Cycle
	Percentage
	Panel/Local
	Shielded Metal Arc Welding (SMAW)
	Gas Metal Arc Welding (GMAW)
	Gas Tungsten Arc Welding (GTAW)
	Air Carbon Arc Cutting (CAC-A)
	Constant Current
	Constant Voltage Or Constant Potential
	High Temperature
	Fault Indication
	Arc Force
	Touch Start (GTAW)
	Variable Inductance
	Voltage Input

	Wire Feed Function
	Wire Feed Towards Workpiece With Output Voltage Off.
	Welding Gun
	Purging Of Gas
	Continuous Weld Mode
	Spot Weld Mode
	Spot Time
	Preflow Time
	Postflow Time
	2 Step Trigger Operation Press to initiate wirefeed and welding, release to stop.
	4 Step Trigger Operation Press and hold for preflow, release to start arc. Press to stop arc, and hold for preflow.
	Burnback Time
	Disturbance In Ground System
IPM	Inches Per Minute
MPM	Meters Per Minute

Art # A-04130

1.04 Precautions De Securite En Soudage A L'arc

MISE EN GARDE

LE SOUDAGE A L'ARC EST DANGEREUX

PROTEGEZ-VOUS, AINSI QUE LES AUTRES, CONTRE LES BLESSURES GRAVES POSSIBLES OU LA MORT. NE LAISSEZ PAS LES ENFANTS S'APPROCHER, NI LES PORTEURS DE STIMULATEUR CARDIAQUE (A MOINS QU'ILS N'AIENT CONSULTE UN MEDECIN). CONSERVEZ CES INSTRUCTIONS. LISEZ LE MANUEL D'OPERATION OU LES INSTRUCTIONS AVANT D'INSTALLER, UTILISER OU ENTRETENIR CET EQUIPEMENT.

Les produits et procédés de soudage peuvent sauser des blessures graves ou la mort, de même que des dommages au reste du matériel et à la propriété, si l'utilisateur n'adhère pas strictement à toutes les règles de sécurité et ne prend pas les précautions nécessaires.

En soudage et coupage, des pratiques sécuritaires se sont développées suite à l'expérience passée. Ces pratiques doivent être apprises par étude ou entraînement avant d'utiliser l'equipement. Toute personne n'ayant pas suivi un entraînement intensif en soudage et coupage ne devrait pas tenter de souder. Certaines pratiques concernent les équipements raccordés aux lignes d'alimentation alors que d'autres s'adressent aux groupes électrogènes.

La norme Z49.1 de l'American National Standard, intitulée "SAFETY IN WELDING AND CUTTING" présente les pratiques sécuritaires à suivre. Ce document ainsi que d'autres guides que vous devriez connaître avant d'utiliser cet équipement sont présentés à la fin de ces instructions de sécurité.

SEULES DES PERSONNES QUALIFIEES DOIVENT FAIRE DES TRAVAUX D'INSTALLATION, DE REPARATION, D'ENTRETIEN ET D'ESSAI.

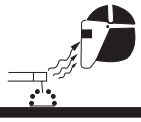
1.05 Dangers relatifs au soudage à l'arc

AVERTISSEMENT

L'ELECTROCUTION PEUT ETRE MORTELLE.

Une décharge électrique peut tuer ou brûler gravement. L'électrode et le circuit de soudage sont sous tension dès la mise en circuit. Le circuit d'alimentation et les circuits internes de l'équipement sont aussi sous tension dès la mise en marche. En soudage automatique ou semi-automatique avec fil, ce dernier, le rouleau ou la bobine de fil, le logement des galets d'entrainement et toutes les pièces métalliques en contact avec le fil de soudage sont sous tension. Un équipement inadéquatement installé ou inadéquatement mis à la terre est dangereux.

1. Ne touchez pas à des pièces sous tension.
2. Portez des gants et des vêtements isolants, secs et non troués.
3 Isolez-vous de la pièce à souder et de la mise à la terre au moyen de tapis isolants ou autres.
4. Déconnectez la prise d'alimentation de l'équipement ou arrêtez le moteur avant de l'installer ou d'en faire l'entretien. Bloquez le commutateur en circuit ouvert ou enlevez les fusibles de l'alimentation afin d'éviter une mise en marche accidentelle.
5. Veuillez à installer cet équipement et à le mettre à la terre selon le manuel d'utilisation et les codes nationaux, provinciaux et locaux applicables.
6. Arrêtez tout équipement après usage. Coupez l'alimentation de l'équipement s'il est hors d'usage ou inutilisé.
7. N'utilisez que des porte-électrodes bien isolés. Ne jamais plonger les porte-électrodes dans l'eau pour les refroidir. Ne jamais les laisser traîner par terre ou sur les pièces à souder. Ne touchez pas aux porte-électrodes raccordés à deux sources de courant en même temps. Ne jamais toucher quelqu'un d'autre avec l'électrode ou le porte-électrode.
8. N'utilisez pas de câbles électriques usés, endommagés, mal épissés ou de section trop petite.
9. N'enroulez pas de câbles électriques autour de votre corps.
10. N'utilisez qu'une bonne prise de masse pour la mise à la terre de la pièce à souder.
11. Ne touchez pas à l'électrode lorsqu'en contact avec le circuit de soudage (terre).
12. N'utilisez que des équipements en bon état. Réparez ou remplacez aussitôt les pièces endommagées.
13. Dans des espaces confinés ou mouillés, n'utilisez pas de source de courant alternatif, à moins qu'il soit muni d'un réducteur de tension. Utilisez plutôt une source de courant continu.
14. Portez un harnais de sécurité si vous travaillez en hauteur.
15. Fermez solidement tous les panneaux et les capots.



AVERTISSEMENT

LE RAYONNEMENT DE L'ARC PEUT BRÛLER LES YEUX ET LA PEAU; LE BRUIT PEUT ENDOMMAGER L'OUIE.

L'arc de soudage produit une chaleur et des rayons ultraviolets intenses, susceptibles de brûler les yeux et la peau. Le bruit causé par certains procédés peut endommager l'ouïe.

1. Portez une casque de soudeur avec filtre oculaire de nuance appropriée (consultez la norme ANSI Z49 indiquée ci-après) pour vous protéger le visage et les yeux lorsque vous soudez ou que vous observez l'exécution d'une soudure.
2. Portez des lunettes de sécurité approuvées. Des écrans latéraux sont recommandés.
3. Entourez l'aire de soudage de rideaux ou de cloisons pour protéger les autres des coups d'arc ou de l'éblouissement; avertissez les observateurs de ne pas regarder l'arc.
4. Portez des vêtements en matériaux ignifuges et durables (laine et cuir) et des chaussures de sécurité.
5. Portez un casque antibruit ou des bouchons d'oreille approuvés lorsque le niveau de bruit est élevé.

AVERTISSEMENT

LES VAPEURS ET LES FUMEES SONT DANGEREUSES POUR LA SANTE.

Le soudage dégage des vapeurs et des fumées dangereuses à respirer.

1. Eloignez la tête des fumées pour éviter de les respirer.
2. A l'intérieur, assurez-vous que l'aire de soudage est bien ventilée ou que les fumées et les vapeurs sont aspirées à l'arc.
3. Si la ventilation est inadequate, portez un respirateur à adduction d'air approuvé.
4. Lisez les fiches signalétiques et les consignes du fabricant relatives aux métaux, aux produits consummables, aux revêtements et aux produits nettoyants.
5. Ne travaillez dans un espace confiné que s'il est bien ventilé; sinon, portez un respirateur à adduction d'air. Les gaz protecteurs de soudage peuvent déplacer l'oxygène de l'air et ainsi causer des malaises ou la mort. Assurez-vous que l'air est propre à la respiration.
6. Ne soudez pas à proximité d'opérations de dégraissage, de nettoyage ou de pulvérisation. La chaleur et les rayons de l'arc peuvent réagir avec des vapeurs et former des gaz hautement toxiques et irritants.

SELECTION DES NUANCES DE FILTRES OCULAIRS POUR LA PROTECTION DES YEUX EN COUPAGE ET SOUDAGE (selon AWS á 8.2-73)

Opération de coupage ou soudage	Dimension d'électrode ou Epiasseur de métal ou Intensité de courant	Nuance de filtre oculaire	Opération de coupage ou soudage	Dimension d'électrode ou Epiasseur de métal ou Intensité de courant	Nuance de filtre oculaire
Brassage tendre au chalumeau	toutes conditions	2	Soudage á l'arc sous gaz avec fil plein (GMAW)		
Brassage fort au chalumeau	toutes conditions	3 ou 4	métaux non-ferreux	toutes conditions	11
Oxycoupage			métaux ferreux	toutes conditions	12
mince	moins de 1 po. (25 mm)	2 ou 3	Soudage á l'arc sous gaz avec électrode de tungstène (GTAW)	toutes conditions	12
moyen	de 1 á 6 po. (25 á 150 mm)	4 ou 5	Soudage á l'hydrogène atomique (AHW)	toutes conditions	12
épais	plus de 6 po. (150 mm)	5 ou 6	Soudage á l'arc avec électrode de carbone (CAW)	toutes conditions	12
Soudage aux gaz			Soudage á l'arc Plasma (PAW)	toutes dimensions	12
mince	moins de 1/8 po. (3 mm)	4 ou 5	Gougeage Air-Arc avec électrode de carbone		
moyen	de 1/8 á 1/2 po. (3 á 12 mm)	5 ou 6	mince		12
épais	plus de 1/2 po. (12 mm)	6 ou 8	épais		14
Soudage á l'arc avec électrode enrobees (SMAW)	moins de 5/32 po. (4 mm)	10	Coupage á l'arc Plasma (PAC)		
	5/32 á 1/4 po. (4 á 6.4 mm)	12	mince	moins de 300 amperès	9
	plus de 1/4 po. (6.4 mm)	14	moyen	de 300 á 400 amperès	12
			épais	plus de 400 amperès	14

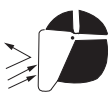
7. Ne soudez des tôles galvanisées ou plaquées au plomb ou au cadmium que si les zones à souder ont été grattées à fond, que si l'espace est bien ventilé; si nécessaire portez un respirateur à adduction d'air. Car ces revêtements et tout métal qui contient ces éléments peuvent dégager des fumées toxiques au moment du soudage.

AVERTISSEMENT

LE SOUDAGE PEUT CAUSER UN INCENDIE OU UNE EXPLOSION

L'arc produit des étincellies et des projections. Les particules volantes, le métal chaud, les projections de soudure et l'équipement surchauffé peuvent causer un incendie et des brûlures. Le contact accidentel de l'électrode ou du fil-électrode avec un objet métallique peut provoquer des étincelles, un échauffement ou un incendie.

1. Protégez-vous, ainsi que les autres, contre les étincelles et du métal chaud.
2. Ne soudez pas dans un endroit où des particules volantes ou des projections peuvent atteindre des matériaux inflammables.
3. Enlevez toutes matières inflammables dans un rayon de 10, 7 mètres autour de l'arc, ou couvrez-les soigneusement avec des bâches approuvées.
4. Méfiez-vous des projections brulantes de soudage susceptibles de pénétrer dans des aires adjacentes par de petites ouvertures ou fissures.
5. Méfiez-vous des incendies et gardez un extincteur à portée de la main.
6. N'oubliez pas qu'une soudure réalisée sur un plafond, un plancher, une cloison ou une paroi peut enflammer l'autre côté.
7. Ne soudez pas un récipient fermé, tel un réservoir ou un baril.
8. Connectez le câble de soudage le plus près possible de la zone de soudage pour empêcher le courant de suivre un long parcours inconnu, et prévenir ainsi les risques d'électrocution et d'incendie.
9. Ne dégelez pas les tuyaux avec un source de courant.
10. Otez l'électrode du porte-électrode ou coupez le fil au tube-contact lorsqu'inutilisé après le soudage.
11. Portez des vêtements protecteurs non huileux, tels des gants en cuir, une chemise épaisse, un pantalon revers, des bottines de sécurité et un casque.



AVERTISSEMENT

LES ETINCELLES ET LES PROJECTIONS BRULANTES PEUVENT CAUSER DES BLESSURES.

Le piquage et le meulage produisent des particules métalliques volantes. En refroidissant, la soudure peut projeter du éclats de laitier.

1. Portez un écran facial ou des lunettes protectrices approuvées. Des écrans latéraux sont recommandés.
2. Portez des vêtements appropriés pour protéger la peau.

AVERTISSEMENT

LES BOUTEILLES ENDOMMAGEES PEUVENT EXPLOSER

Les bouteilles contiennent des gaz protecteurs sous haute pression. Des bouteilles endommagées peuvent exploser. Comme les bouteilles font normalement partie du procédé de soudage, traitez-les avec soin.

1. Protégez les bouteilles de gaz comprimé contre les sources de chaleur intense, les chocs et les arcs de soudage.
2. Enchainez verticalement les bouteilles à un support ou à un cadre fixe pour les empêcher de tomber ou d'être renversées.
3. Eloignez les bouteilles de tout circuit électrique ou de tout soudage.
4. Empêchez tout contact entre une bouteille et une électrode de soudage.
5. N'utilisez que des bouteilles de gaz protecteur, des détendeurs, des boyauxs et des raccords conçus pour chaque application spécifique; ces équipements et les pièces connexes doivent être maintenus en bon état.
6. Ne placez pas le visage face à l'ouverture du robinet de la bouteille lors de son ouverture.
7. Laissez en place le chapeau de bouteille sauf si en utilisation ou lorsque raccordé pour utilisation.
8. Lisez et respectez les consignes relatives aux bouteilles de gaz comprimé et aux équipements connexes, ainsi que la publication P-1 de la CGA, identifiée dans la liste de documents ci-dessous.

AVERTISSEMENT

LES MOTEURS PEUVENT ETRE DANGEREUX

LES GAZ D'ECHAPPEMENT DES MOTEURS PEUVENT ETRE MORTELS.

Les moteurs produisent des gaz d'échappement nocifs.

1. Utilisez l'équipement à l'extérieur dans des aires ouvertes et bien ventilées.
2. Si vous utilisez ces équipements dans un endroit confiné, les fumées d'échappement doivent être envoyées à l'extérieur, loin des prises d'air du bâtiment.

AVERTISSEMENT

LE CARBURANT PEUR CAUSER UN INCENDIE OU UNE EXPLOSION.

Le carburant est hautement inflammable.

1. Arrêtez le moteur avant de vérifier le niveau e carburant ou de faire le plein.
2. Ne faites pas le plein en fumant ou proche d'une source d'étincelles ou d'une flamme nue.
3. Si c'est possible, laissez le moteur refroidir avant de faire le plein de carburant ou d'en vérifier le niveau au début du soudage.
4. Ne faites pas le plein de carburant à ras bord: prévoyez de l'espace pour son expansion.
5. Faites attention de ne pas renverser de carburant. Nettoyez tout carburant renversé avant de faire démarrer le moteur.

AVERTISSEMENT

DES PIECES EN MOUVEMENT PEUVENT CAUSER DES BLESSURES.

Des pièces en mouvement, tels des ventilateurs, des rotors et des courroies peuvent couper doigts et mains, ou accrocher des vêtements amples.

1. Assurez-vous que les portes, les panneaux, les capots et les protecteurs soient bien fermés.
2. Avant d'installer ou de connecter un système, arrêtez le moteur.
3. Seules des personnes qualifiées doivent démonter des protecteurs ou des capots pour faire l'entretien ou le dépannage nécessaire.
4. Pour empêcher un démarrage accidentel pendant l'entretien, débranchez le câble d'accumulateur à la borne négative.
5. N'approchez pas les mains ou les cheveux de pièces en mouvement; elles peuvent aussi accrocher des vêtements amples et des outils.
6. Réinstallez les capots ou les protecteurs et fermez les portes après des travaux d'entretien et avant de faire démarrer le moteur.

AVERTISSEMENT

DES ETINCELLES PEUVENT FAIRE EXPLOSER UN ACCUMULATEUR; L'ELECTROLYTE D'UN ACCUMU-LATEUR PEUT BRULER LA PEAU ET LES YEUX.

Les accumulateurs contiennent de l'électrolyte acide et dégagent des vapeurs explosives.

1. Portez toujours un écran facial en travaillant sur un accumulateur.
2. Arrêtez le moteur avant de connecter ou de déconnecter des câbles d'accumulateur.
3. N'utilisez que des outils anti-étincelles pour travailler sur un accumulateur.
4. N'utilisez pas une source de courant de soudage pour charger un accumulateur ou survolter momentanément un véhicule.
5. Utilisez la polarité correcte (+ et –) de l'accumulateur.

AVERTISSEMENT

LA VAPEUR ET LE LIQUIDE DE REFROIDISSEMENT BRULANT SOUS PRESSION PEUVENT BRULER LA PEAU ET LES YEUX.

Le liquide de refroidissement d'un radiateur peut être brûlant et sous pression.

1. N'ôtez pas le bouchon de radiateur tant que le moteur n'est pas refroidi.
2. Mettez des gants et posez un torchon sur le bouchon pour l'ôter.
3. Laissez la pression s'échapper avant d'ôter complètement le bouchon.

1.06 Principales Normes De Securite

Safety in Welding and Cutting, norme ANSI Z49.1, American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33128.

Safety and Health Standards, OSHA 29 CFR 1910, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, norme AWS F4.1, American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33128.

National Electrical Code, norme 70 NFPA, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Safe Handling of Compressed Gases in Cylinders, document P-1, Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

Code for Safety in Welding and Cutting, norme CSA W117.2 Association canadienne de normalisation, Standards Sales, 276 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

Safe Practices for Occupation and Educational Eye and Face Protection, norme ANSI Z87.1, American National Standards Institute, 1430 Broadway, New York, NY 10018.

Cutting and Welding Processes, norme 51B NFPA, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

1.07 Graphique de Symbole

Seulement certains de ces symboles apparaîtront sur votre modèle.

	Sous Tension
	Hors Tension
	Tension dangereuse
	Augmentez/Diminuer
	Disjoncteur
	Source AC Auxiliaire
	Fusible
A	Intensité de Courant
V	Tension
Hz	Hertz (cycles/sec)
f	Fréquence
	Négatif
	Positif
	Courant Continue (DC)
	Terre de Protection
	Ligne
	Connexion de la Ligne
	Source Auxiliaire
115V 15A	Classement de Prise-Source Auxiliaire

1	Mono Phasé
3	Trois Phasé
	Tri-Phase Statique Fréquence Convertisseur Transformateur-Redresseur
	Distant
X	Facteur de Marche
%	Pourcentage
	Panneau/Local
	Soudage Arc Electrique Avec Electrode Enrobé (SMAW)
	Soudage á L'arc Avec Fil Electrodes Fusible (GMAW)
	Soudage á L'arc Avec Electrode Non Fusible (GTAW)
	Decoupe Arc Carbone (CAC-A)
	Courant Constant
	Tension Constante Ou Potentiel Constant
	Haute Température
	Force d'Arc
	Amorçage de L'arc au Contact (GTAW)
	Inductance Variable
V	Tension

	Déroulement du Fil
	Alimentation du Fil Vers la Pièce de Fabrication Hors Tension
	Torch de Soudage
	Purge Du Gaz
	Mode Continu de Soudure
	Soudure Par Point
t	Duréc du Pulse
t1	Durée de Pré-Dèbit
t2	Durée de Post-Dèbit
	Détente à 2-Temps Appuyez pour dèruarer l'alimentation du fils et la soudure, le relâcher pour arrêter.
	Détente à 4-Temps Maintenez appuyez pour pré-dèbit, relailez pour initier l'arc. Appuyez pour arrêter l'arc, et mainteuir pour pré-dèbit.
t	Probléme de Terre
IPM	Pouces Par Minute
MPM	Mètres Par Minute
	Art # A-07639

SECTION 2: INTRODUCTION

2.01 How To Use This Manual

This Owner's Manual applies to just specification or part numbers listed on page i.

To ensure safe operation, read the entire manual, including the chapter on safety instructions and warnings.

Throughout this manual, the words **WARNING, CAUTION**, and **NOTE** may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:

WARNING

A WARNING gives information regarding possible personal injury.

CAUTION

A CAUTION refers to possible equipment damage.

NOTE

A NOTE offers helpful information concerning certain operating procedures.

Additional copies of this manual may be purchased by contacting Thermal Arc at the address and phone number listed in the inside back cover of this manual. Include the Owner's Manual number and equipment identification numbers.

Electronic copies of this manual can also be downloaded at no charge in Acrobat PDF format by going to the Thermal Arc web site listed below and clicking on the Literature Library link:

http://www.thermalarc.com

2.02 Equipment Identification

The unit's identification number (specification or part number), model, and serial number usually appear on a nameplate attached to the control panel. In some cases, the nameplate may be attached to the rear panel. Equipment which does not have a control panel such as gun and cable assemblies is identified only by the specification or part number printed on the shipping container. Record these numbers on the bottom of page i for future reference.

2.03 Receipt Of Equipment

When you receive the equipment, check it against the invoice to make sure it is complete and inspect the equipment for possible damage due to shipping. If there is any damage, notify the carrier immediately to file a claim. Furnish complete information concerning damage claims or shipping errors to the location in your area listed in the inside back cover of this manual.

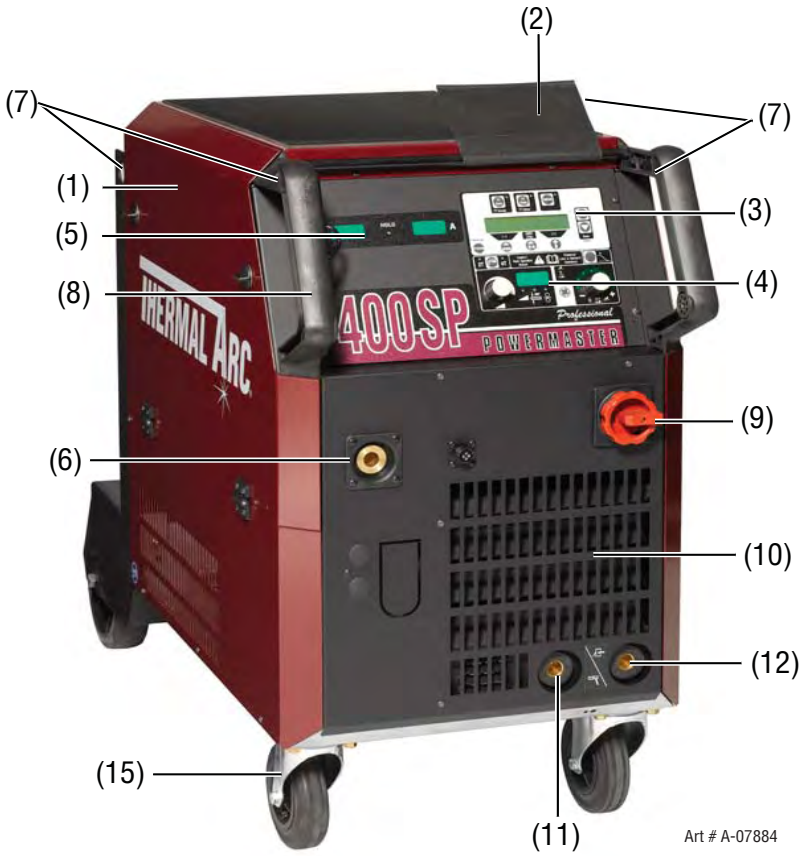
Include all equipment identification numbers as described above along with a full description of the parts in error.

Move the equipment to the installation site before un-crating the unit. Use care to avoid damaging the equipment when using bars, hammers, etc., to uncrate the unit.

2.04 Machine Components (500SP, 400SP, and SP4000W)

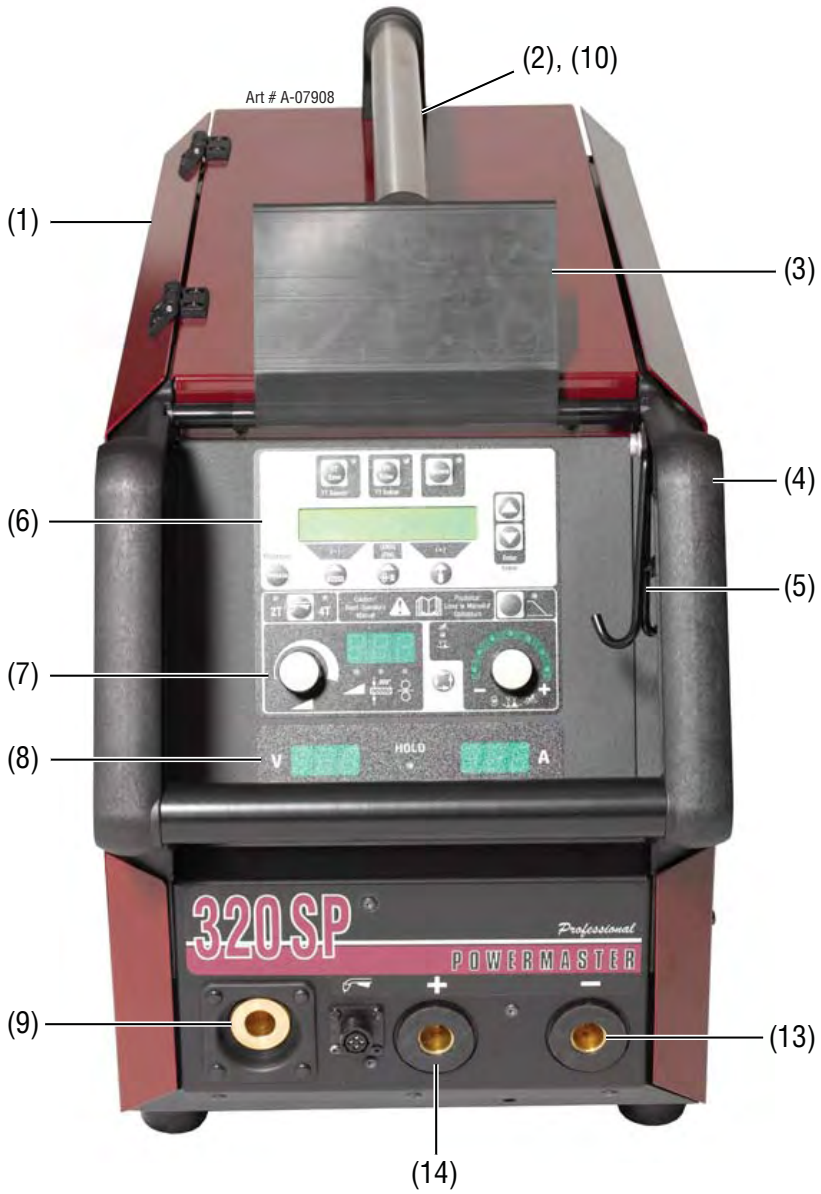
1. External Wire Feeder (N/A with compact models)
2. Protective Cover, Operation Panel
3. Secondary Control Operating Panel
4. Primary Control Operating Panel
5. Preview and actual welding current and voltage
6. MIG Torch Connection
7. Red = Hot coolant return
8. Blue = Cool coolant to torch
9. Lifting Points (refer to Section 2.07)
10. Handle
11. Mains On/Off Switch
12. Coolant Tank Cap
13. Air intake
14. Wheeling Gear
15. Positive Connection Socket for Work Lead
16. Negative Connection Socket for Work Lead
17. Gas Cylinder Tray
18. Work Clamp (not shown)
19. MIG Torch (not shown)

2.05 Machine Components (400SP Compact Model)



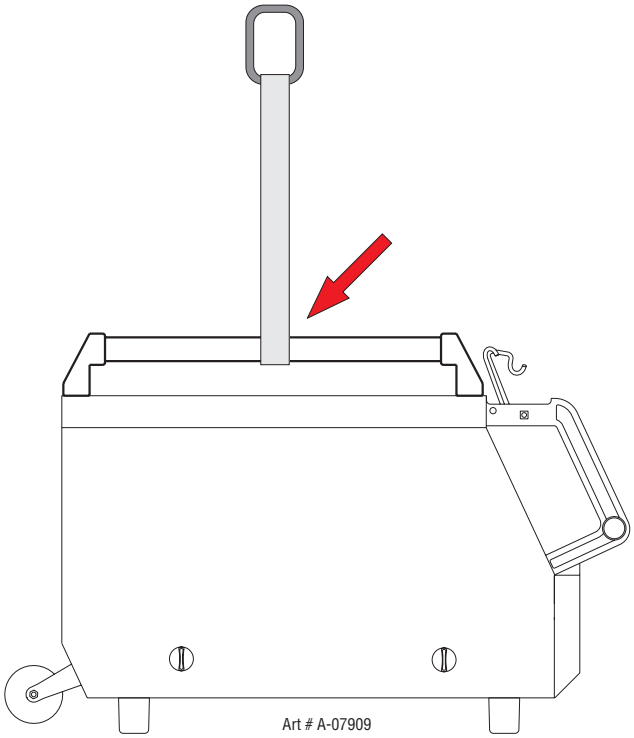
1. Wire Feeder Door Panel
2. Protective Cover, Operation Panel
3. Secondary Control Operating Panel
4. Primary Control Operating Panel
5. Preview and actual welding current and voltage
6. MIG Torch Connection
7. Lifting Points (refer to Section 2.07)
8. Handle
9. Mains On/Off Switch
10. Air intake
11. Positive Connection Socket for Work Lead
12. Negative Connection Socket for Work Lead
13. Work Clamp (not shown)
14. MIG Torch (not shown)
15. Wheeling Gear

2.06 Machine Components (320SP Compact Model)

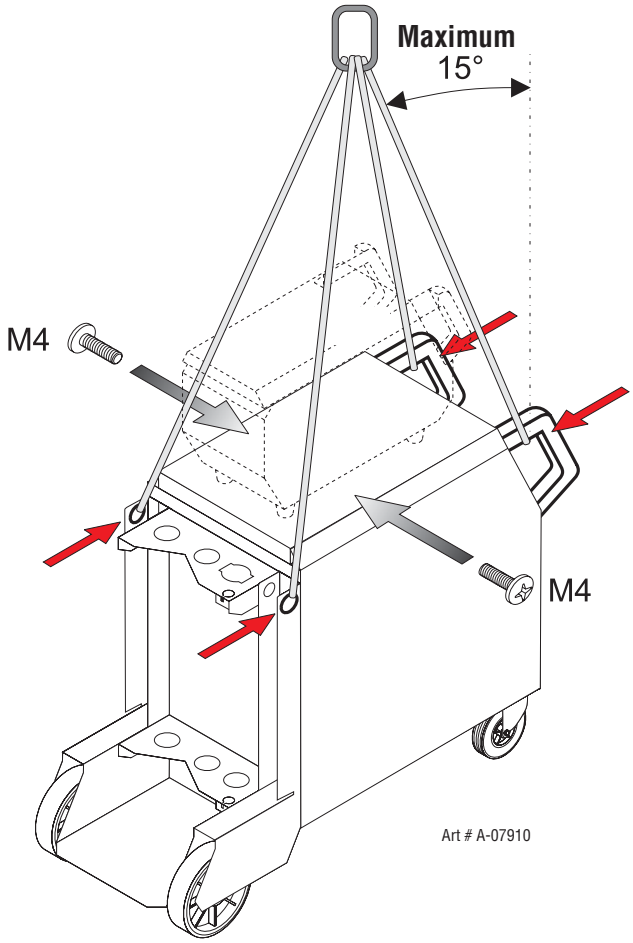


1. Wire Feeder Door Panel
2. Carrying Handle
3. Protective Cover, Operation Panel
4. Handle
5. Torch Holder
6. Secondary Control Operating Panel
7. Primary Control Operating Panel
8. Preview and actual welding current and voltage
9. MIG Torch Connection
10. Lifting Point (refer to Section 2.07)
11. Mains On/Off Switch (in rear)
12. Air intake (in rear)
13. Negative Connection Socket for Work Lead
14. Positive Connection Socket for Work Lead
13. Work Clamp (not shown)
14. MIG Torch (not shown)
15. Wheeling Gear (in rear)

2.07 Lifting Points



Lifting Point for 320SP and 400SP Compact



Lifting Points for 500SP and 400SP

2.08 Power Supply Specifications (part 1)

PowerMaster Power Source Part Numbers			320SP				400SP				500SP			
Compact Power Supply with Integrated Wirefeeder			W1000102				W1000304							
Remote Power Supply with Integrated Torch Water Cooling System							W1000202				W1000502			
Automation Power Supply with Integrated Torch Water Cooling System							W1000402				W1000602			
Summary Specifications														
Input Mains Voltage (50/60 Hz)		V	208	230	400	460	208	230	400	460	208	230	400	460
Mains Voltage Tolerance Range		%	+/- 10				+/- 10				+/- 10			
Max Recommended Circuit Breaker or Time-Delay Fuse	3 Phase	A	-	-	-	-	45	40	25	20	70	60	35	30
Max Recommended Standard Normal Operating Fuse	3 Phase	A	-	-	-	-	55	50	30	25	80	70	40	35
Max Recommended Circuit Breaker or Time-Delay Fuse	1 Phase	A	70	60	40	35	100	90	50	45	100	90	50	45
Max Recommended Standard Normal Operating Fuse	1 Phase	A	80	70	45	40	110	100	60	50	110	100	60	50
Power factor at Maximum Output		cos	0.99				0.99				0.99			
Maximum Open Circuit Voltage	OCV	V	79				79				79			
Voltage Range for GMAW-P, GMAW, FCAW, MIG	U 2min-U 2max	V	14.3 – 30				14.3 – 34				14.3 – 39			
Current Range for GMAW-P, GMAW, FCAW, MIG	I 2min-I 2max	A	5 – 320				5 – 400				5 – 500			
Current Range for SMAW (Stick)	I 2min-I 2max	A	10-300				10-380				10-480			
Enclosure Protection Class to EN 60 529			IP23				IP23				IP23			
Insulation Class			F				F				F			
Cooling Method			Fan Cooled				Fan Cooled				Fan Cooled			
Noise Emission		dB (A)	<70				<70				<70			

Electrical Specifications for GMAW-P / GMAW / FCAW / MIG with Three-Phase Input Power														
Welding Output			320SP				400SP				500SP			
Duty Cycle 100%	3 Phase	A	-				320				400			
Duty Cycle 60%	3 Phase	A	-				350				500			
Duty Cycle at Maximum Current	3 Phase	X	-				50%@400A, 34V				60%@500A, 39V			
Input Mains Power														
Input Mains Voltage (50/60 Hz)	3 Phase	V	-	-	-	-	208	230	400	460	208	230	400	460
Input Power S1 at 100% Duty Cycle	3 Phase	kVA	-	-	-	-	11	11	12	12	16	16	16	17
Input Power S1 at 60% Duty Cycle	3 Phase	kVA	-	-	-	-	13	13	14	14	24	23	23	24
Input Power S1 at Maximum Current	3 Phase	kVA	-	-	-	-	17	16	17	17	24	23	23	24
Generator Requirement with Three Phase	3 Phase	kVA	-				25				35			
Input Current I1 at 100% Duty Cycle	3 Phase	A	-	-	-	-	32	29	18	16	45	40	23	21
Input Current I1 at 60% Duty Cycle	3 Phase	A	-	-	-	-	37	33	20	17	66	59	34	30
Input Current I1 at Maximum Output	3 Phase	A	-	-	-	-	46	41	24	21	66	59	34	30

Electrical Specifications for GMAW-P / GMAW / FCAW / MIG with Single-Phase Input Power														
Welding Output			320SP				400SP				500SP			
Duty Cycle 100%	1 Phase	A	250				320				320			
Duty Cycle 60%	1 Phase	A	280				350				350			
Duty Cycle at Maximum Current	1 Phase	X	40%@320A, 30V				50%@400A, 34V				50%@400A, 34V			
Input Mains Power														
Input Mains Voltage (50/60 Hz)	1 Phase	V	208	230	400	460	208	230	400	460	208	230	400	460
Input Power S1 at 100% Duty Cycle	1 Phase	kVA	9	9	10	10	13	14	14	14	13	14	14	14
Input Power S1 at 60% Duty Cycle	1 Phase	kVA	11	11	12	12	15	16	16	16	15	16	16	16
Input Power S1 at Maximum Output	1 Phase	kVA	14	13	15	15	19	20	20	20	19	20	20	20
Generator Requirement with Single Phase	1 Phase	kVA	23				30				30			
Input Current I1 at 100% Duty Cycle	1 Phase	A	44	40	26	23	65	61	35	30	65	61	35	30
Input Current I1 at 60% Duty Cycle	1 Phase	A	52	47	31	26	74	68	40	35	74	68	40	35
Input Current I1 Maximum Output	1 Phase	A	70	58	38	32	92	85	50	43	92	85	50	43

2.09 Power Supply Specifications (part 2)

Electrical Specifications for SMAW / STICK with Three-Phase Input Power																
Welding Output			**320SP**				**400SP**				**500SP**					
Duty Cycle 100%	3 Phase	A	-				300				380					
Duty Cycle 60%	3 Phase	A	-				330				480					
Duty Cycle at Maximum Current	3 Phase	X	-				50%@380A, 35.2V				60%@480A, 39.2V					
Input Mains Power																
Input Mains Voltage (50/60 Hz)	3 Phase	V	-	-	-	-	208	230	400	460	208	230	400	460		
Input Power S1 at 100% Duty Cycle	3 Phase	kVA	-	-	-	-	10	10	11	11	16	16	17	17		
Input Power S1 at 60% Duty Cycle	3 Phase	kVA	-	-	-	-	12	12	12	12	23	22	22	23		
Input Power S1 at Maximum Output	3 Phase	kVA	-	-	-	-	16	16	16	17	23	22	22	23		
Generator Requirement with Three Phase	3 Phase	kVA	-				25				35					
Input Current I1 at 100% Duty Cycle	3 Phase	A	-	-	-	-	27	26	16	13	44	41	25	22		
Input Current I1 at 60% Duty Cycle	3 Phase	A	-	-	-	-	33	30	17	15	63	56	32	29		
Input Current I1 at Maximum Output	3 Phase	A	-	-	-	-	44	40	24	21	63	56	32	29		

Electrical Specifications for SMAW / STICK with Single-Phase Input Power																
Welding Output			**320SP**				**400SP**				**500SP**					
Duty Cycle 100%	1 Phase	A	230				300				300					
Duty Cycle 60%	1 Phase	A	260				330				330					
Duty Cycle at Maximum Current	1 Phase	X	40%@300A, 32V				50%@380A, 35.2V				50%@380A, 35.2V					
Input Mains Power																
Input Mains Voltage (50/60 Hz)	1 Phase	V	208	230	400	460	208	230	400	460	208	230	400	460		
Input Power S1 at 100% Duty Cycle	1 Phase	kVA	10	10	12	12	13	14	13	13	13	14	13	13		
Input Power S1 at 60% Duty Cycle	1 Phase	kVA	12	12	14	13	15	15	15	15	15	15	15	15		
Input Power S1 at Maximum Output	1 Phase	kVA	14	13	15	15	19	19	19	19	19	19	19	19		
Generator Requirement with Single Phase	1 Phase	kVA	22				30				30					
Input Current I1 at 100% Duty Cycle	1 Phase	A	49	45	29	25	64	59	34	29	64	59	34	29		
Input Current I1 at 60% Duty Cycle	1 Phase	A	57	52	34	28	73	66	38	33	73	66	38	33		
Input Current I1 at Maximum Output	1 Phase	A	67	57	38	32	90	83	48	41	90	83	48	41		

Torch Cooling System (Where Fitted)		**320SP**	**400SP**	**500SP**
Standard Coolant Flow Rate	gallon / min.	-	0.29	0.29
Maximum Coolant Pressure	Psi	-	50	50
Pump Type		-	Centrifugal Pump	Centrifugal Pump
Dimensions and Weights		**320SP**	**400SP**	**500SP**
Power Supply Dimension (DxWxH)	in	29.3x13.4x19.6	43.9x17.5x33.7	43.9x17.5x33.7
Power Supply Weight	lb	77	201	222

2.10 Wire Feeder Specifications

Wirefeeder Part Numbers		SP4000W	SP4000R
Wirefeeder suits water cooled torch		W3000102	–
Wirefeeder suits Automation Power Source		–	W3000302
Welding Output			
Weldable Wire Steel & Stainless Steel	Ø in	.023 – .045	.023 – 1/16
Weldable Wire Aluminum	Ø in	.035 - 1/16	.035 – 3/32
Wirefeed Speed	IPM	4 – 984	4 – 984
Wire feed unit	Rollers	4	4
Dimensions and weights			
Size of wire feed case (DxWxH)	in.	25.2x14x19.6	21.3x8.2x7
Weight of wire feed case	lb.	44.4	18.7

NOTE

Due to variations that can occur in manufactured products, claimed performance, voltages, ratings, all capacities, measurements, dimensions and weights quoted are approximate only. Achievable capacities and ratings in use and operation will depend upon correct installation, use, applications, maintenance and service.

2.11 Features and Benefits Common to all PowerMaster SP Systems

HARDWARE (Standard)

Inverter Design: Heavy duty, highly efficient, environmentally toughened 80KHz design with exceptional dynamic welding performance.

Flow Through Tunnel: Designed to circulate air around components that require cooling and not over critical circuitry. This reduces metallic dust ingression and improves reliability.

Intelligent Heat Sensing Fan: Operates only as needed to cool components and further reduce airborne contaminants from being pulled through the power source.

SmartLink Simple, multi-voltage design from 200 to 500V for maximum flexibility in a single power source.

Remote Control CAN-Bus Ports: Allow for easy data transfer and provide full function remote control capability.

4 Roll Drive Systems: All wire feeder drive systems are high precision, 4 roll systems manufactured to extremely tight tolerances for optimum feed-ability of both hard and soft wires. Refer to page 3-8.

Heavy Duty Running Gear: All running gear has been developed for manufacturing / production environments, built heavy-duty and designed to last.

Tweco® Guns and Accessories: Tweco® has a full line of PulseMaster standard and PulseMaster Smart Guns with advanced digital controls optimized for the PowerMaster SP range. Gun connections are Tweco® No. 4 and return leads are Tweco® MPC. Refer to page 3-10.

SOFTWARE (Standard)

SmartMig Links the wire feed speed, arc current and voltage to deliver the perfect welding parameters and eliminate the guesswork for achieving optimum performance. Refer to page 4-2 item 52.

TwinPulse Effortless TIG-like weld appearance up to seven times faster on aluminum and stainless steel than traditional TIG (GTAW).

HDP High Definition Pulse is expertly tailored, optimized wave designs for perfect, digital microprocessor controlled, pulse performance.

SmartLogic Built-in hardware and software protection against accidental incorrect input voltage selection.

JobTool JobTool™ is a library of 100 independent, user-defined, job save programs. You can save and recall welding procedures from a PulseMaster SmartGun or from the front panel at any time. Refer to page 4-3 item 62.

FTT Fresh Tip Treatment sharpens the wire at the end of the weld sequence ready for a perfect restart.

TipTronic Recalls up to 100 personalized jobs with perfect repeatability from the push of a button. Refer to page 4-2 item 45 and 47 and to page 4-6 section C 1-7.

Pre Programmed: Up to 100 optimized SmartMIG™, PulseMIG and TwinPulse™ programs are standard, delivering optimal performance and versatility.

Down Slope (Crater Fill Mode): The digitally adjustable parameters reduce arc energy down eliminating any craters that could cause defects.

#Subject to change without notification.

2.11 Features and Benefits Common to all PowerMaster SP Systems (con't)

PERFORMANCE (Standard)

Operating Platform: How would you like to use the machine? What is your primary parameter is it Inches per Minute or Amps? Would you rather just dial up the material thickness and let the machine do the rest? All can be accommodated.

One Touch Control: Delivers at your fingertips the perfect welding parameters by adjusting the total arc energy. Set material thickness then start welding.

Hot Start Ignition: The digitally adjustable start parameters combined with FTT™, creep feed speed and an amplified power level applied to the welding arc at the start of the weld bead ensures perfect fusion.

HARDWARE/SOFTWARE (Options)

HSP™ High Speed Pulse is specialized high speed wave design for maximum productivity.

Push / Pull Gun Capability: "Plug and Play" Python® interface.

#Subject to change without notification.

SECTION 3: INSTALLATION

NOTE

Please refer to Sections 3.04 Recommended Equipment Setup and SECTION 4: Control Panels for explanations of the controls.

WARNING

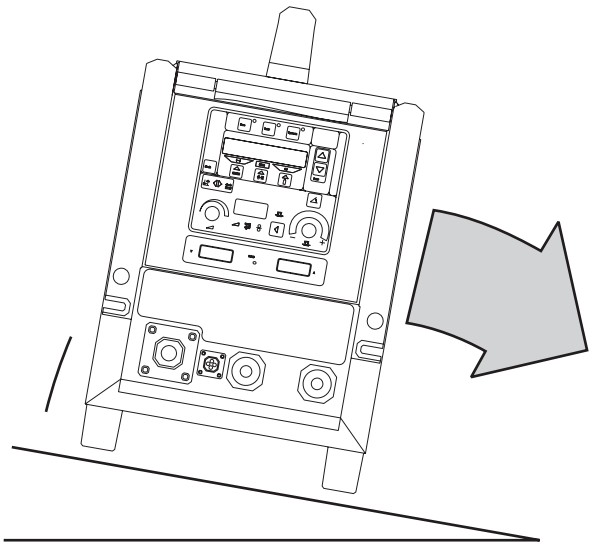
Thermal Arc advises that a suitable Mains Plug and cable be fitted to this equipment by a qualified electrical trades-person.

3.01 Location

Adequate air circulation is needed at all times in order to assure proper operation. Provide a minimum of 12 inches (305 mm) of free airspace on all sides of the unit. Make sure that the ventilator openings are not obstructed. Ventilation airflow is from rear to side.

3.02 Transportation and Positioning

Properly transporting and positioning the equipment is important for preventing injury. Move the equipment in an upright position and pick a flat welding surface.



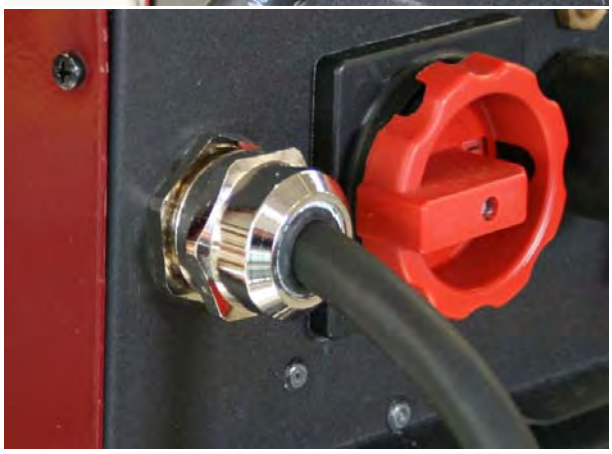
Art # A-08324_AA

WARNING

Injury to the operator may occur if the machine's maximum permissible angle of inclination is exceeded. The maximum permissible angle of inclination is 10°. Only transport or position the machine for welding on a flat and level surface.

3.03 Fitting the Mains Cable into the Cable Gland

Refer to the pictures below when connecting the mains cable to the cable gland.



Art # A-08325_AA

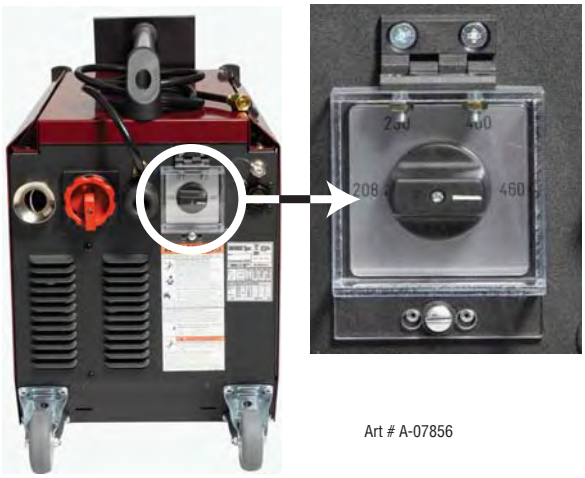
WARNING

The mains cable has to be assembled into the cable gland as shown in the picture. The electrical technician has to make sure that the cable gland is adjusted to the external diameter of the mains cable and the mains cable is securely fastened in the cable gland according to IEC 60974-1.

3.04 Voltage Change-over

For proper operation and to prevent damage to the machine, the Voltage Input Select Switch must be set according to the incoming AC line voltage.

If this switch is not set to the position that matches the input line voltage, the Smart Logic will inhibit the welding power source from turning on. The Voltage Input Select Switch is located on the rear panel.



Art # A-07856

To set the Voltage Input Select Switch:

1. Rotate the locking screw 90 degrees.
2. Lift up the switch cover and set the switch to the incoming AC line voltage.
3. Secure the switch cover.

WARNING

Do not alter the position of the Voltage Input Select Switch when the ON/OFF Switch is in the ON position as this will cause two internal auxiliary fuses to rupture. These fuses will have to be replaced before the machine can operate.

WARNING

ELECTRIC SHOCK CAN KILL.

Open the main wall disconnect switch or breaker, before removing any covers or access panels on the welding machine. Live voltage is still present even with the front panel control switch OFF. Wait at least 10 full minutes after power has been removed before removing any covers or access panels to allow adequate time for internal capacitors to discharge.

3.05 Connecting 3-Phase Input Power to 400SP or 500SP

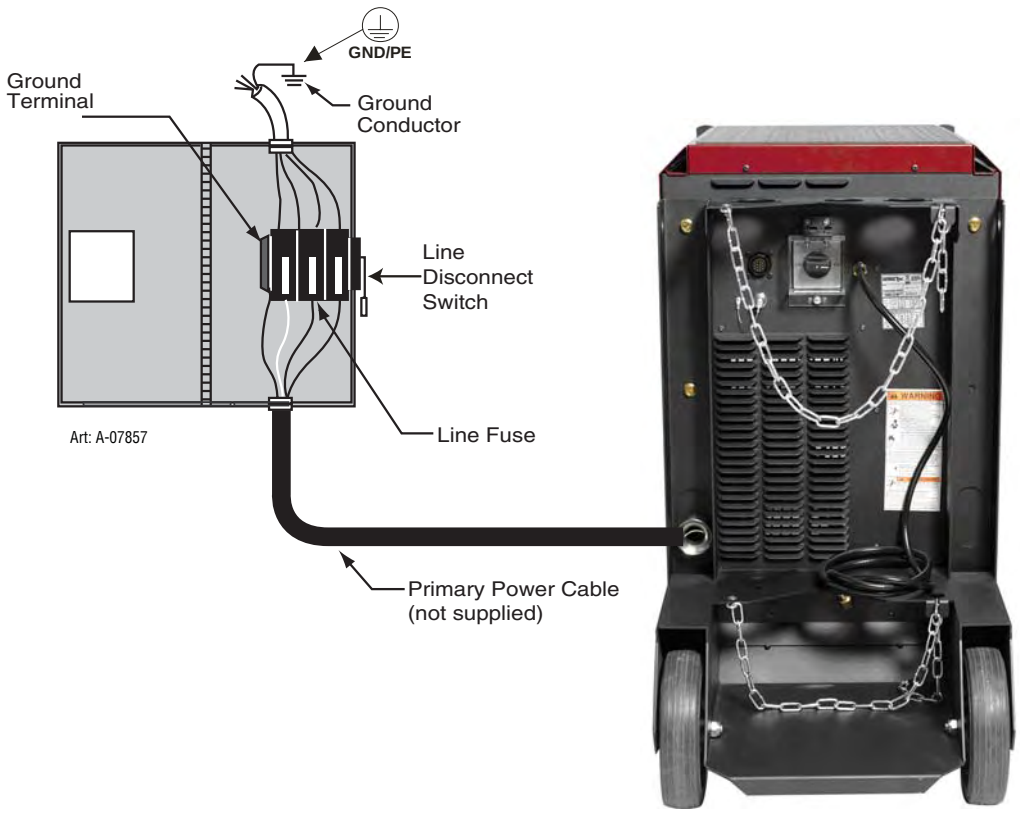
WARNINGS

Installation must meet all National and Local Codes - have only qualified persons make this installation.

Disconnect and lockout/tagout input power before connecting input conductors from unit.

Always connect green or green/yellow conductor to supply grounding terminal first, and never to a line terminal. Make input power connections to the welding power source first.

		Three-Phase 400SP				Three-Phase 500SP			
Input Mains Voltage (50/60 Hz)	V	208	230	400	460	208	230	400	460
Max Recommended Circuit Breaker or Time-Delay Fuse	A	45	40	25	20	70	60	35	30
Max Recommended Standard Normal Operating Fuse	A	55	50	30	25	80	70	40	35
Min Input Conductor Size	AWG	8	8	12	14	4	6	10	10
Min Input Conductor Size	AWG	8	8	12	14	6	8	10	10
Suggested Input Cord Type		Carolprene® Jacketed Type SOOW 90°C 600 Volt UL/CSA Portable Cord							



WARNING

Never connect the safety ground screw to one of the three line phases. This would represent a serious electrical shock hazard. The wiring to this machine should be performed by a qualified person only.

A. Input Power Conductors (Customer Supplied Cord)

Select size of conductors using table. Conductors must comply with national, state, and local electrical codes. If applicable, use lugs of proper amperage capacity and correct hole size.

B. Welding Power Source Input Power Connections

Remove the side panel next to the strain relief.

Route conductors (cord) through strain relief and tighten screws.

Connect input conductors as shown in illustration.

Connect green or green/yellow grounding conductor to welding power supply grounding terminal first.

Then connect input conductors L1, L2, and L3 to welding power supply line terminals.

Reinstall side panel onto welding power supply.

C. Turn the Line Disconnect Switch off

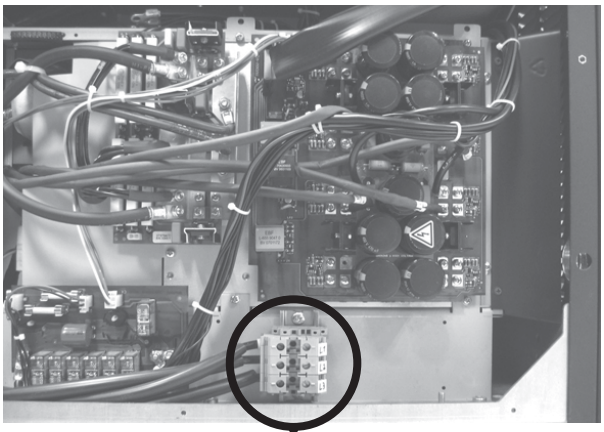
D. Connect the green or green/yellow-grounding conductor to the Line Disconnect Switch ground terminal first.

E. Connect input conductors L1, L2, and L3 to the Line Disconnect Switch terminals.

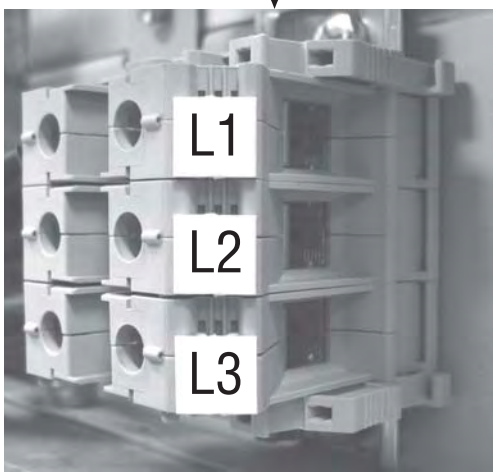
F. Select type and size of over-current protection using table (fused Line Disconnect Switch shown).

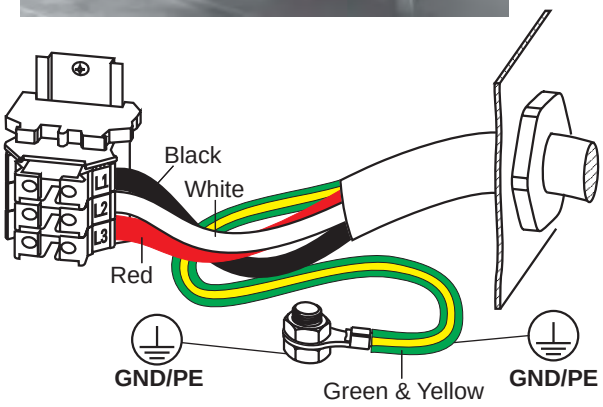
G. Close and secure door on Line Disconnect Switch.

H. Remove lockout/tagout device, and place switch in the On position.



Art # A-07858





3.06 Connecting Single-Phase Input Power to 320SP or 400SP or 500SP

WARNINGS

Installation must meet all National and Local Codes - have only qualified persons make this installation.

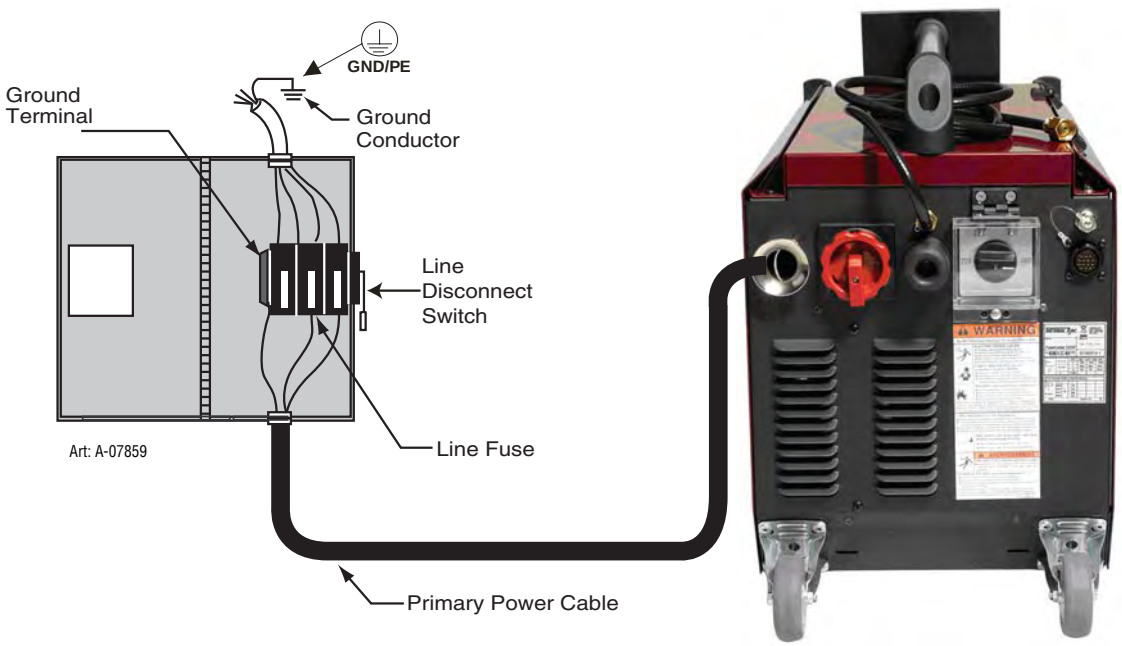
Disconnect and lockout/tagout input power before connecting input conductors from unit.

Always connect green or green/yellow conductor to supply grounding terminal first, and never to a line terminal.

Make input power connections to the welding power source first.

		Single-Phase			
		320SP			
Input Mains Voltage (50/60 Hz)	V	208	230	400	460
Max Recommended Circuit Breaker or Time-Delay Fuse	A	70	60	40	35
Max Recommended Standard Normal Operating Fuse	A	90	70	45	40
Min Input Conductor Size	AWG	6	6	10	12
Min Input Conductor Size	AWG	8	8	10	12
Suggested Input Cord Type		Carolprene® Jacketed Type SOOW 90°C 600 Volt UL/CSA Portable Cord			

		Single-Phase				Single-Phase			
		400SP				500SP			
Input Mains Voltage (50/60 Hz)	V	208	230	400	460	208	230	400	460
Max Recommended Circuit Breaker or Time-Delay Fuse	A	100	90	50	45	100	90	50	45
Max Recommended Standard Normal Operating Fuse	A	110	100	60	55	110	100	60	55
Min Input Conductor Size	AWG	4	4	8	10	4	4	8	10
Min Input Conductor Size	AWG	6	6	8	10	6	6	8	10
Suggested Input Cord Type		Carolprene® Jacketed Type SOOW 90°C 600 Volt UL/CSA Portable Cord							



WARNING

Never connect the safety ground screw to one of the three line phases. This would represent a serious electrical shock hazard. The wiring to this machine should be performed by a qualified person only.

A. Input Power Conductors (Customer Supplied Cord)

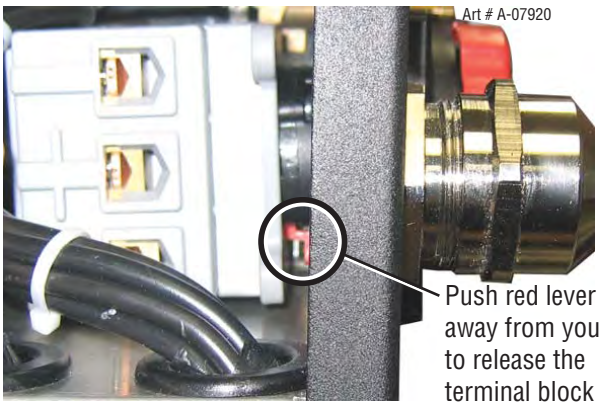
Select size of conductors using table. Conductors must comply with national, state, and local electrical codes. If applicable, use lugs of proper amperage capacity and correct hole size.

B. Welding Power Source Input Power Connections

Remove the side panel next to the strain relief.

Route conductors (cord) through strain relief and tighten the compression fitting.

On the 320SP, disconnect the terminal block from the switch shaft by pushing the small red lever away from you (see below).



Connect input conductors as shown in illustration.

Connect green or green/yellow grounding conductor to welding power supply grounding terminal first.

Then connect input conductors T1 and T2 to welding power supply line terminals.

On the 320SP, push the terminal block back on the switch shaft and pull the red level toward you.

Reinstall side panel onto welding power supply.

C. Turn the Line Disconnect Switch off

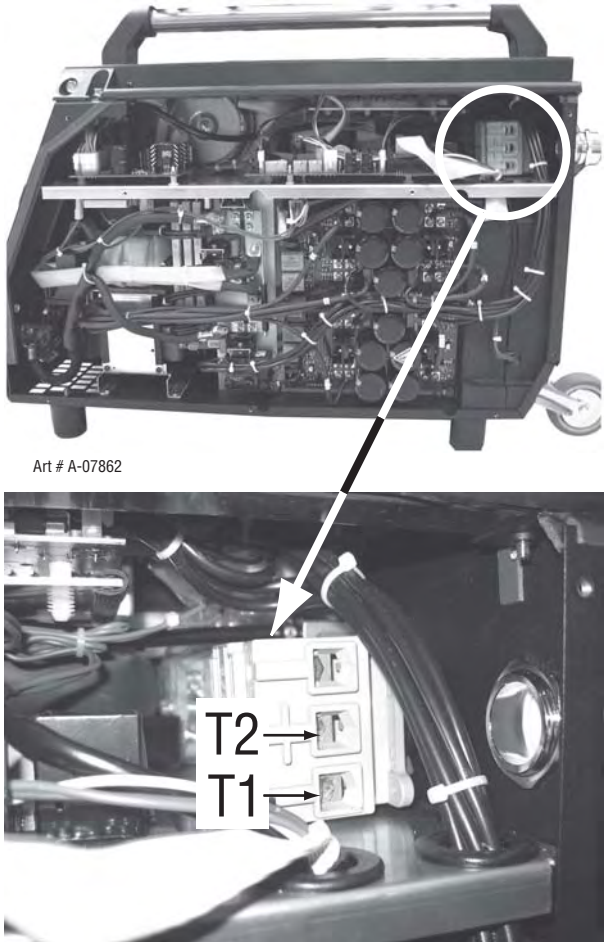
D. Connect the green or green/yellow-grounding conductor to the Line Disconnect Switch ground terminal first.

E. Connect input conductors T1 and T2 to the Line Disconnect Switch terminals.

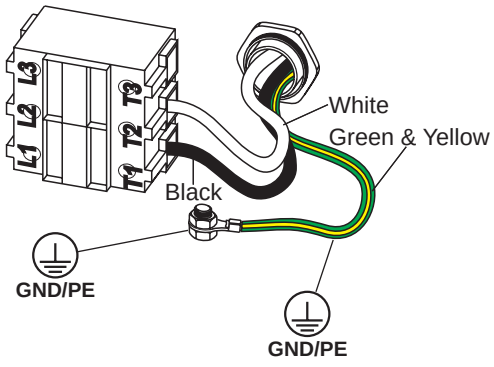
F. Select type and size of over-current protection using table (fused Line Disconnect Switch shown).

G. Close and secure door on Line Disconnect Switch.

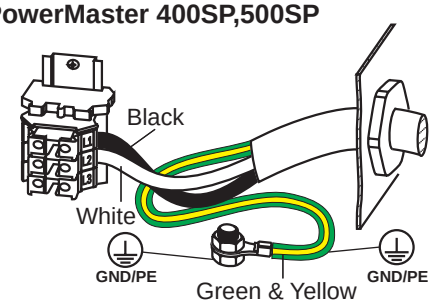
H. Remove lockout/tagout device, and place switch in the On position.



1-Phase Input Power Connection PowerMaster 320SP



1-Phase Input Power Connection PowerMaster 400SP,500SP



3.07 Quick Start Set Up

NOTE:

Please refer to Sections 3.04 Recommended Equipment Setup and SECTION 4: Control Panels for explanations of the controls.

WARNING

Thermal Arc advises that a suitable Mains Plug be fitted to this equipment by a qualified electrical trades-person.

A. Where equipped, place the gas cylinder on the power supply cylinder tray and secure with the two safety chains. If unit is not equipped with this option, then ensure that the gas cylinder is secured to a building pillar, wall bracket or otherwise securely fixed in an upright position.

B. Remove screw cap from gas cylinder, if fitted, and open gas cylinder valve briefly to remove contaminants.

C. Connect gas regulator to gas cylinder.

D. Connect gas hose from power supply to gas regulator and open gas cylinder valve.

E. Connect input power, refer to previous WARNING and the Connecting Input Power Section.

F. Connect work lead to Negative connection (–) and attach Work clamp to workpiece.

G. Fit the correct size feed rollers to wire feeder then fit the selected welding wire and set the pressure levers to position 2.

H. Connect torch (central socket, coolant connections red-blue) and mount contact tip to fit welding wire selected.

I. Insert welding wire.

J. Turn on main switch.

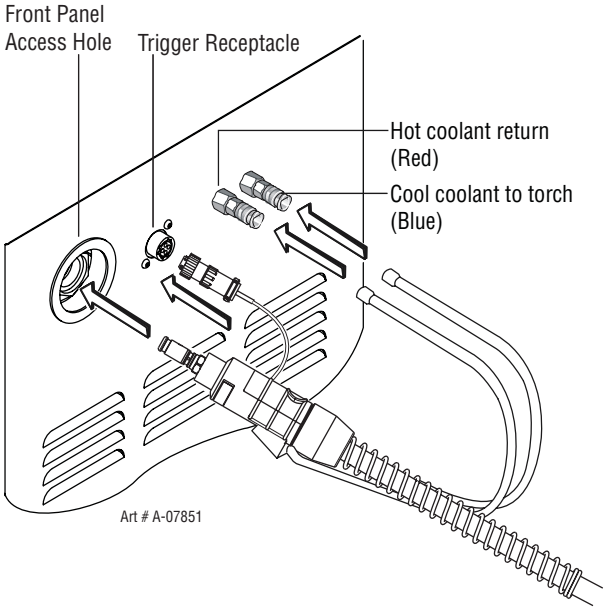
K. Press push-button and push-button (gas type) (solenoid valve is activated) and adjust gas amount on the gas regulator.

L. Keep the wire inch switch pressed until the welding wire protrudes approximately 3/8 in. (10 mm) out of the MIG torch nozzle.

3.08 Recommended Setup for MIG

A. Torch Connection

1. Open the door panel to the machine by turning the release knobs and pulling the cover outward and up.
2. Route the gun cable through the access hole in the front panel.
3. Locate the thumbscrew on the gun adapter inside the unit. Loosen the thumbscrew and insert the gun cable end into the gun adapter as far as it will go. Tighten the thumbscrew.
4. Align the keyways of the gun switch connector with the trigger receptacle next to the gun cable and plug them together. Secure by turning the locking ring to the right (clockwise).
5. If a coolant cooling system is installed, connect the coolant hoses of the torch with the coolant sockets on the front panel. Be sure to connect the red fittings together and the blue fittings together.



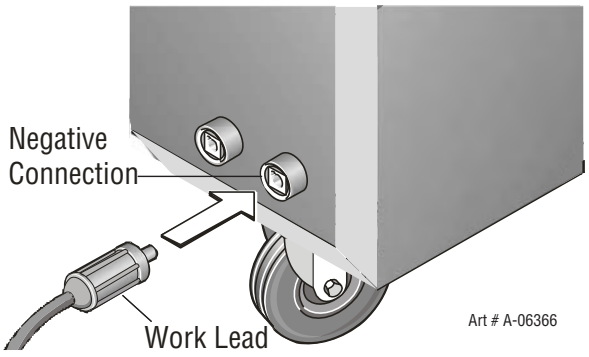
NOTE

When disconnecting gun switch leads from the machine, loosen the locking ring and grab the connectors and pull. Do not pull on the wires.

6. To remove the gun, reverse these directions.

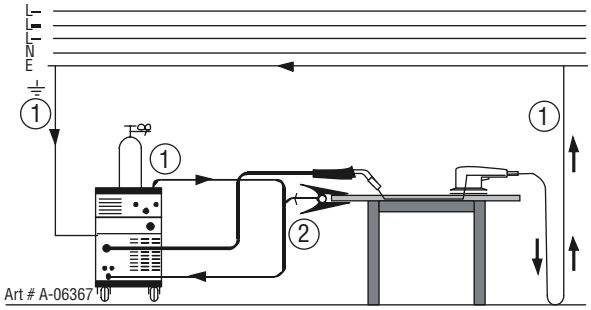
B. How To Connect The Work lead

Connect the Work Lead to the Negative Connection and fasten it by turning the connector to the right. Connect the Work Clamp to the workpiece or the welding table.



C. Where to connect the Work Clamp

Fasten the Work clamp (shown as #2 below), near the welding location; this avoids stray current flow through mains earthing system.



Connect the Work Clamp tightly to the welding bench or to the workpiece.

WARNING

Do not place the Work clamp on the welding power supply or gas cylinder as welding current may be conducted via the mains earth and will burn it out.

D. How To Connect To The Input Power

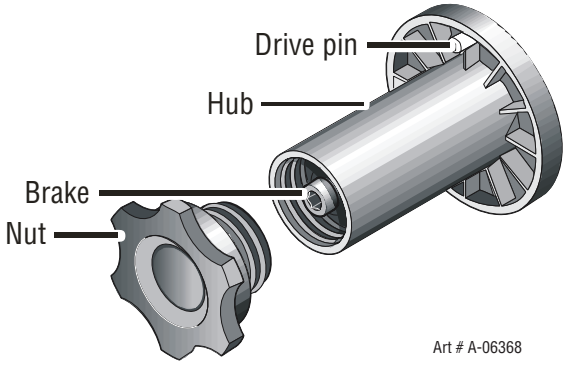
Refer to Connecting Input Power Section.

E. How To Install The Wire Spool

Open the wire feed compartment lid on the power supply or wire feed case and unscrew the nut from the wire support coil hub.

Place wire spool on the hub and ensure that the drive pin engages the mating hole in the wire spool.

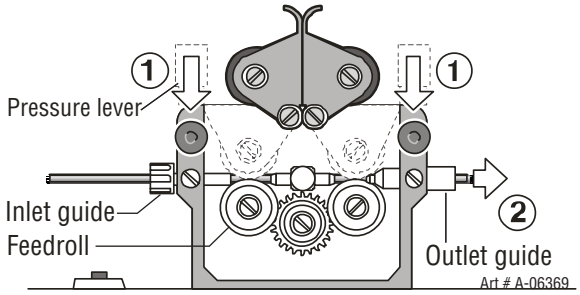
Press then release the inch switch to adjust the brake, the wire spool should not continue to run.



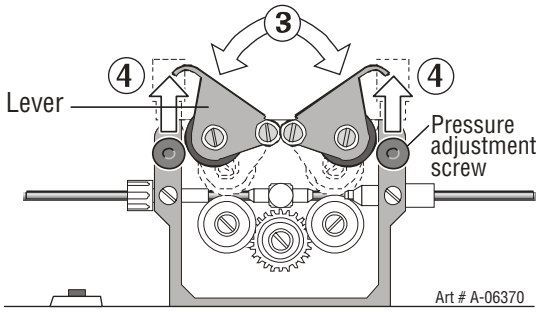
F. Insertion Of The Wire Electrode

Screw out the contact tip in the MIG torch handset. Open the wire feed compartment lid on the power supply or wire feed case.

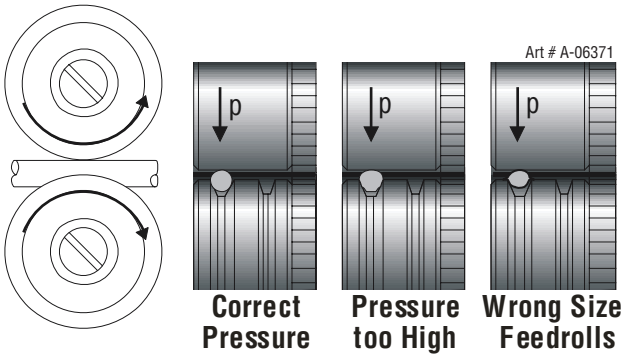
The diameter of the wire should correspond to the diameter of the feedrolls. The wire size is on the face of the feedrolls. Open the pressure lever and thread the wire through the inlet guide and the outlet guide.



Close the lever and fasten the pressure rollers.



Switch on power supply at main switch **(item #11 - see page 2-2)**, stretch torch cable out straight and press the inch switch button ⍈ in the wire feed compartment. Adjust the pressure at the pressure adjustment screws so the wire feed rolls drive the wire consistently without slipping. The wire should not be deformed.



Adjust the pressure adjustment knob next to the inlet guide to a lower pressure less than the pressure adjustment knob next to the outlet guide. This will ensure that the wire will be located correctly in the wire feed unit.

Press the inch switch button ⍈ until the wire appears approximately 3/4 in. (20 mm) out of the torch neck.

Screw in the contact tip corresponding to the wire diameter and cut off any wire sticking out.

G. How To Connect The Gas Cylinder

If the Wheeling Kit option has been installed, position a gas cylinder on the rear tray and lock securely to the Power Source cylinder bracket with the chains provided. If this arrangement is not used then ensure that the gas cylinder is secured to a building pillar, wall bracket or otherwise securely fixed in an upright position.

Open the gas valve once to blow out possible dirt particles.

Connect the gas regulator to the gas cylinder valve.

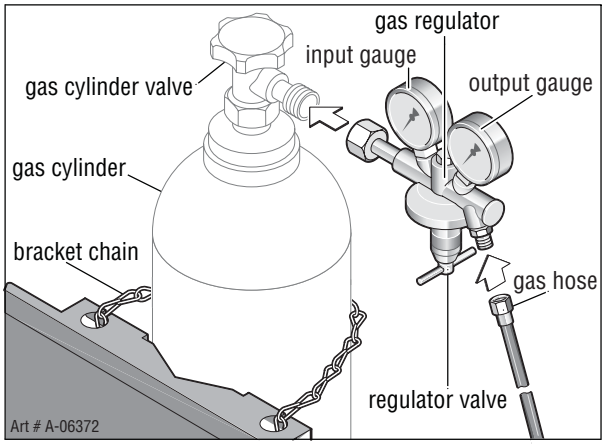
Connect the gas hose to the gas regulator.

Open the gas cylinder valve and adjust the gas flow on the gas regulator while pressing the torch trigger switch.

The quantity will be shown at the flowmeter.

This should be approximately:

Wire Size (in)	Gas Flow (CFH)
.023	13
.030	17
.035	19
.040	21
.045	25
3/64	34



H. How To Refill The Cooling Fluid

Only use original MIG/TIG coolant for refill. It provides protection against frost down to 4°F (-20°C). If using other coolants, the coolant pump could be damaged. Coolant circulation has to be checked at regular intervals. Reliable coolant return flow is essential to ensure the coolant is not lost and the coolant cooled MIG torch is not damaged. Check the level of the coolant every day before operating. The coolant must be visible when the tank cap is removed.

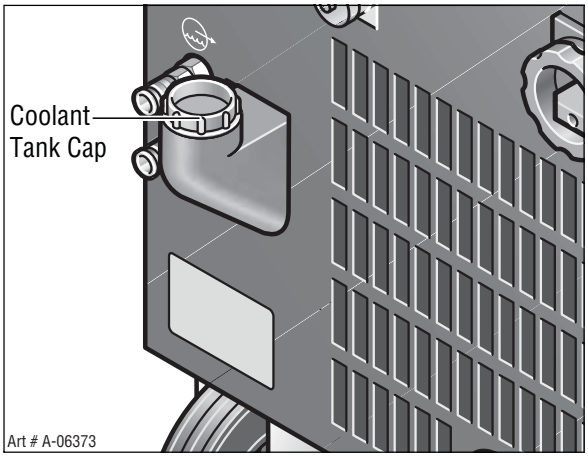
CAUTION

Remove the pin from the breather hole in the cap of the coolant tank as leaving the pin in the cap may cause a coolant flow error.

MIG/TIG Coolant 1 Quart (1 L) Part No. W4001402

MIG/TIG Coolant 1 Gallon (5 L) Part No. W4001400

MIG/TIG Coolant 5 Gallon (20 L) Part No. W4001401



I. How To Configure The Power Supply For Aluminum Welding

Change the feedrolls to U groove for aluminum wire (refer to the Options and Accessories list in the Appendix).

Change the torch liner to a nylon or teflon liner (refer to the Options and Accessories list in the Appendix and to the next section "3.07 Installing a New Wire Conduit").

Use the correct size outlet guide to suit the wire diameter.

.030 & .035 in. - Steel tube with red lining

.045 & 3/64 in. - Use steel tube with black lining

1/16 in. - Use clear teflon tube

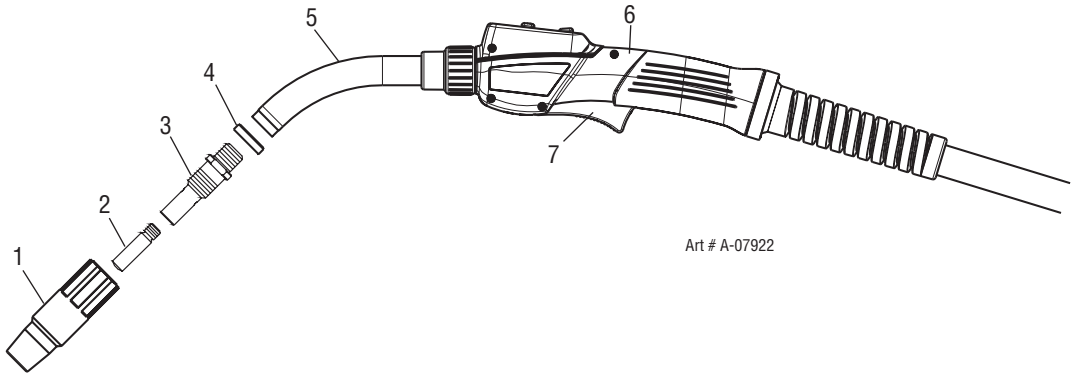
Fasten the torch and insert the wire electrode.

NOTE

The parts required for the torch depends on the type torch and wire diameter. Please refer to the torch spare parts list.

3.09 TWECO PULSEMASTER PMA5512 500 AMP Weld Gun

The TWECO Pulsemaster PMA5512 500 AMP gun fitted to the PowerMaster offers robust construction, unparalleled reliability and easy replacement of consumable parts. The TWECO Pulsemaster gun has an operating capacity in excess of the capacity of the PowerMaster and can be expected to give trouble free service.



TWECO Pulsemaster PMA5512 500 AMP Weld Gun

Original Parts Installed			
Item	Description	Part No.	Qty
1	HEAVY DUTY NOZZLE	HD24LP-62-A	1
2	CONTACT TIP	16RZ-XX-A	1
3	HEAVY DUTY GAS DIFFUSER	MS5416SW-F	1
4	MACHINED NOZZLE INSULATOR	66J-3A	1
5	CONDUCTOR TUBE	PMA65-45S-F	1
6	HANDLE ASSY	N/A	1
7	TRIGGER ASSEMBLY	PM95-F	1

TWECO Pulsemaster MIG guns may be fitted to many different types of MIG welding Power Supplies so that your whole shop can be converted to TWECO Pulsemaster. Not only will this give greater reliability (and hence greater productivity) but it will reduce stockholding of consumable parts. See your Thermal Arc distributor for details.

3.10 Installing A New Wire Conduit

1. Be sure the MIG gun cable is arranged in a straight line, free from twists, when installing or removing a wire conduit. Remove the old conduit by first removing the MIG gun nozzle, contact tip, insulator and gas diffuser. Then loosen Allen screws in the conductor tube and connector plug and pull the old wire conduit out of the cable assembly from the connector plug end.
2. To install a new conduit, first inspect the o-ring gas seal on the conduit for cuts or damage. Start from the connector plug end of the assembly and begin pushing the conduit through the connector plug, cable assembly and into the gun. If the conduit should lodge along the way, gently whip or work the cable assembly to aid forward movement.

   When the conduit stop meets the end of the connector plug and the new raw end extends through the end of the conductor tube on the welding gun, tighten the Allen screw in the connector plug onto the conduit to prevent its backward movement.

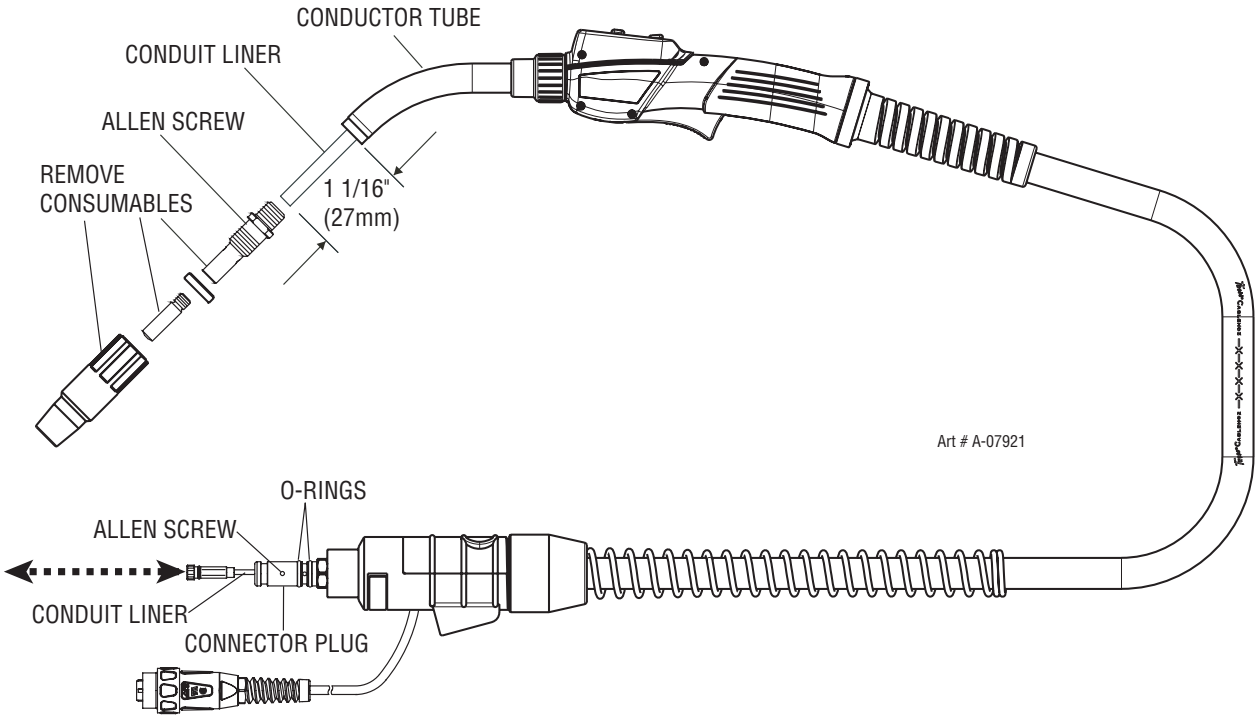
NOTE

When the conduit is fully inserted into the cable assembly and the conduit stop is firmly against the Connector Plug, the "raw end" of the conduit will protrude out of the open end of the gun conductor tube. Trim the conduit as shown below. The trimmed end which seats in the Gas Diffuser must be filed and reamed smooth on the inside and outside radii so wire feed will not be obstructed.

3. Replace Gas Diffuser, Contact Tip, Insulator and Nozzle.
4. Tighten the Allen screw in the conductor tube.

CAUTION

Do not over tighten the conductor tube screw as this action will result in the distortion of the conduit and will lead to wire feedability problems.



SECTION 4:
OPERATION

4.01 General Safety Precautions

Read and understand the safety instructions at the beginning of this manual prior to operating this machine.

WARNING:

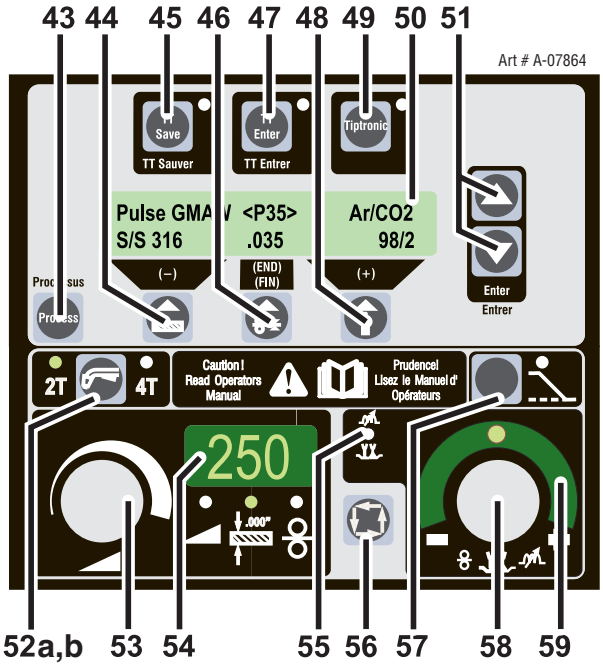
Be sure to put on proper protective clothing and eye safeguards (welding coat, apron, gloves, and welding helmet, with proper lenses installed). See Safety Instructions and Warnings chapter included in this manual. Neglect of these precautions may result in personal injury.

WARNING:

Make all connections to the power source including electrode and work cables, as well as remote control cables, with the power source turned off. These connections could be electrically live with the power switch ON.

4.02 Welding Controls

This section explains the displays and buttons in the Secondary Control Panel and Primary Control Panel **(items # 3 and 4 - see page 2-2)**.



(43) "Process" push-button

For switching between the operation processes.

ManualGMAW — Conventional GMAW with separate Voltage and Wirespeed controls

SmartGMAW — Non-pulse GMAW with one knob (53) control

PulseGMAW — Pulse GMAW with one knob (53) control

TwinPulse — Twin pulse GMAW with one knob (53) control

SMAW/STICK — Stick electrode welding

(44) "Material" push-button

For selection of the wire material to be welded. The push-button is also used for the "Decremental" (-) function, e. g., to reduce the value of a secondary parameter.

(45) "TT Save" push-button TipTronic

For saving user-defined, frequently used welding jobs.

(46) "Welding wire diameter" push-button

For diameter selection of the wire to be welded. The push-button is also used for the "End" function, with which you can move back to the previous menu level.

(47) "TT Enter" push-button TipTronic

For acknowledgment when saving a welding job.

(48) "Gas type" push-button

For selection of the gas to be used. The push-button is also used for the "increment" (+) function, e. g., to increase the value of a secondary parameter.

(49) TipTronic push-button

For switching the Tiptronic process on or off.

(50) Multifunction display

For indication of all parameter values and messages.

(51) ▲ and ▼ push-buttons (Enter)

For switching between the individual secondary parameters. Pressing both push-buttons at the same time is used for acknowledgment (Enter).

(52a) "2 stroke (2T) / 4 stroke (4T)" push-button

For switching between 2T and 4T (Latch) operation process. A lit LED indicates the currently selected operating process.

(52b) "Spot Welding Mode" push-button

Activate the Spot Welding Mode by pressing and holding the 2T/4T button for 2 seconds, at which point the 2T and 4T LEDs will both be lit. The "spot welding time" parameter can then be adjusted in the main display.

(53) "Smart Power" control knob SmartMig

Sets welding current or material thickness or wire speed in SmartGMAW, Pulse MIG, TwinPulse process. OR

"Arc Voltage" control knob Sets welding arc voltage in ManualGMAW process.

(54) "Digital multifunction" display

Displays the primary parameters such as welding current, material thickness (in .001), wire feed speed (in inches/min) or arc length trim.

(55) “Primary parameter” indicator lights

These lights show which primary parameter is currently displayed in the multifunction display **(54)**.

(56) “Primary parameter” push-button

For switching between welding current, material thickness, wire feed speed and arc length, as indicated in the digital multifunction display **(54)**.

(57) “Downslope” push-button

Switches the downslope function on or off. A lit LED next to the push-button indicates that the downslope is on.

(58) “Arc length” control knob

To adjust the arc length in SmartGMAW, PulseGMAW, TwinPulse process,

OR

"Wire speed/Inductance" control knob. To adjust the wire speed or Inductance in Manual MIG process.

(59) “Arc length” LED indication

Indicates the degree of the trim in SmartGMAW, Pulse MIG, TwinPulse process.

OR

”Wire speed” LED indication Indicates the wire speed in ManualGMAW process.

When the uppermost center LED is lit, the programmed arc length/wire speed remains unchanged; “0” is indicated in the multifunction display **(54)**. Turn the rotary control knob **(58)** left to shorten the arc length/ wire speed; turn the rotary control knob **(58)** right to lengthen the arc length/wire speed.

Art # A-06376

(60) Smart Torch display

Indicates the welding current or arc length trim; material thickness or arc length trim; wire feed speed or arc length trim (Linked to the digital multifunction display **(54)**).

In TipTronic process, the current job set and the current job number are displayed.

(61) Smart torch rocker

Changes the welding current, material thickness, arc length to the arc length (depending on which value is being displayed on the digital multifunction display **(54)**).

In TipTronic process, the rocker can be used to switch between the active jobs or job sets.

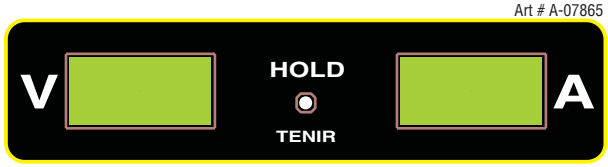
(62) Smart torch push-button JobTool

Has the same function as the “Primary parameter” push-button **(56)** on the *Control Panel*. In TipTronic process this push-button can be used to switch between job selection and job-set selection.

Current / voltage display

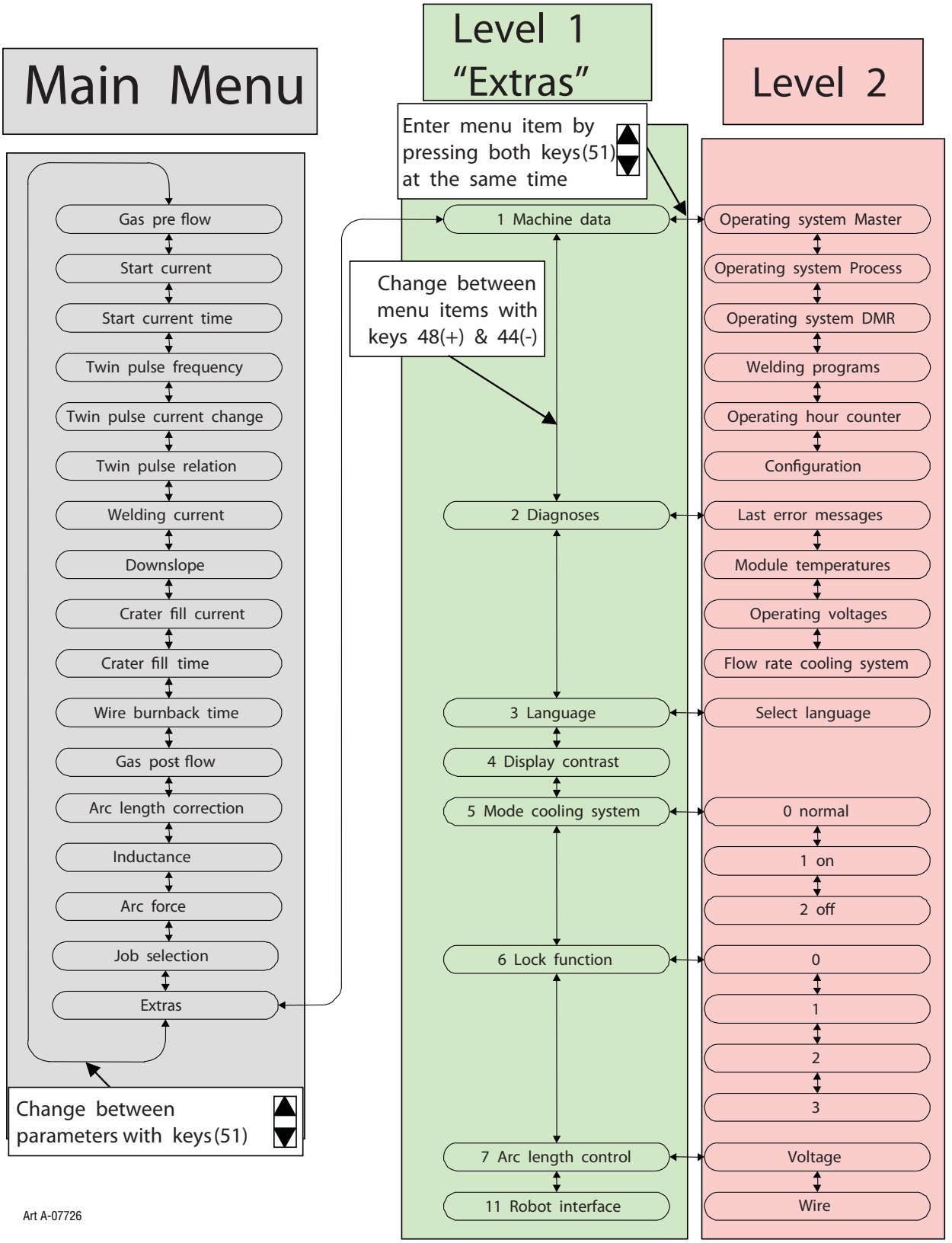
The actual welding voltage and welding current values are indicated during welding. After the welding procedure, the “Hold” LED illuminates and the last welding voltage and welding current values are indicated. When the operator changes certain welding adjustments (e. g. thickness, program, job), the “Hold” LED goes out and the preview values for current and voltage are displayed.

Art # A-07865



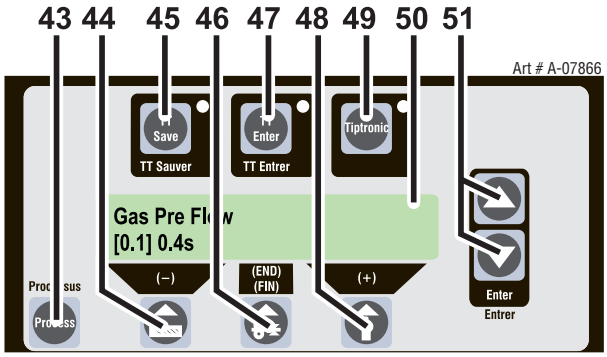
4.03 Menu Structure

Main Menu	Level 1 “Extras”	Level 2	Remark
Gas pre-flow			0 – 10 sec.; not in SMAW/STICK electrode process
Start current			20 % – 200 % of the welding current
Start current time			0 – 10 sec.; not in 4-stroke (4T) mode
Twin pulse frequency			0,5 – 5 Hz; only in TwinPulse mode
Twin pulse current change			5 – 50 % of the welding current; only in TwinPulse process
Twin pulse relation			20 % – 80 %; only in TwinPulse process
Welding current			Adjustment range depends on the selected material-wire-gas combination
Downslope			10 – 990 A/sec.; not in SMAW/STICK process, only when downslope = on
Crater fill current			10 % – 200 % of the welding current; not in SMAW/STICK process, only when slope = on or in 4 (4T) stroke
Crater fill time			0 – 10 sec.; not in SMAW/STICK process, only for slope = on
Wire burnback time			20 % – 300 % of the programmed value; not in SMAW/STICK process
Gas post-flow			20 % – 200 % of the programmed value; not in SMAW/STICK process
Arc length correction			60 % – 140 % of the programmed value
Inductor effect			20 % – 200 % of the programmed value; only in ManualGMAW process (short arc)
Arc dynamic arc force			0 % – 100 % of the programmed value; only in SMAW/STICK process
Job selection, indication of set and job name			Set and job name are indicated only in Tiptronic mode upon actuation of the „TT Enter“ push-button **(47)** or the „Tiptronic“ push-button (**49)**
	Edit mode for set and job name		Move the cursor with the ▼ and ▲ push-buttons **(51)**; change the character with the pushbuttons (**48)** (+) and (**44)** (-)
Extras	1 Machine data	Operating system Master	Version number, operating system Master
		Operating system Process	Version number, operating system process
		Operating system DMRs	Version number, motor assembly
		Welding program version	Version number, welding programs
		Operating hour counter	Indication of the welding duration in h, min, sec
		Configuration	Machine type and the recognized power module (with max. current) are indicated alternately
	2 Diagnosis	Last error message	Indication of the last three error messages from the error memory (0 = last error, 2 = oldest error)
		Module temperatures	Temperatures of the power modules in °C
		Operating voltages	Indication of the operating voltages (15 V / 24 V) of the assembly DPMAPRO
		Flow rate, cooling unit	Indication of the coolant flow rate in l/min
	3 Language		Selection of the menu language
	4 Display contrast		Contrast setting of the LCD display
	5 Mode cooling system	0 normal	cooling unit switches on, as soon as an arc is ignited
		1 on	cooling unit runs constantly
		2 off	cooling unit is deactivated
	6 Lock function	0	All welding controls can be adjusted by user
		1	Only Tiptronic on/off and job selection can be adjusted by user
		2	Tiptronic on/off, job selection free
		3	All welding controls locked except menu selection, gas and pump test
	7 Arc length control	Voltage	correct arc length with rotary pulse encoder **(58)**
		Wire	correct wire speed with rotary pulse encoder **(58)**
	8 Robot interface		Menu item is only visible when the machine is equipped


Main Menu
Level 1 "Extras"
Level 2
Enter menu item by pressing both keys(51) at the same time
Change between menu items with keys 48(+) & 44(-)
Change between parameters with keys(51)
Gas pre flow
Start current
Start current time
Twin pulse frequency
Twin pulse current change
Twin pulse relation
Welding current
Downslope
Crater fill current
Crater fill time
Wire burnback time
Gas post flow
Arc length correction
Inductance
Arc force
Job selection
Extras
1 Machine data
2 Diagnoses
3 Language
4 Display contrast
5 Mode cooling system
6 Lock function
7 Arc length control
11 Robot interface
Operating system Master
Operating system Process
Operating system DMR
Welding programs
Operating hour counter
Configuration
Last error messages
Module temperatures
Operating voltages
Flow rate cooling system
Select language
0 normal
1 on
2 off
0
1
2
3
Voltage
Wire

Art A-07726

A. Secondary Parameters (Menu Main Level)



With ▲ and ▼ **(51)** push-buttons you can switch to the secondary parameters. The currently selected parameter is indicated in the display **(50)**. The Gas Pre Flow [0.1] value is pre-loaded at the Factory but the user has increased it to 0.4s using (48) push-button.

Push-button **(44)** (-) is used to reduce the indicated parameter and push-button **(48)** (+) is used to increase the value of the indicated parameter. Pressing the push-button **(46)** (END) saves the parameter and the system switches back to the material-wire-gas combination display.

B. Extras menu

In addition to the secondary parameters, the Extras menu item is also available; it offers the following functions:

Push-buttons **(44)** (-) and **(48)** (+) are used to switch between the menu items. The different entries of the menu items are called up by pressing the ▲ and ▼ push-buttons **(51)** at the same time. Switching between the individual entries is also possible here with the push-buttons **(44)** (-) and **(48)** (+). To return, press push-button **(46)** (END).

C. TipTronic

The Tiptronic function provides you with 100 independent jobs (10 job set with 10 jobs each). A job stores all the settings and corrections on the operating panel.

The best way to use the Tiptronic function is to assign job numbers to frequently recurring welding tasks or save the settings which individual welders use specifically for “their” jobs.

1. Save/Programming jobs:

   a. Determine the optimal welding values.

   b. Press the “TT Save” button **(45)** (Save LED flashes).

   c. Select the target job number with the push-buttons **(44)** (-) and **(48)** (+) or with the smart torch rocker, and confirm with the “TT Enter” push-button **(47)** (if you do not press Enter, the Save LED goes out after 10 seconds after the last keystroke and the save operation is aborted).

   d. The Save and Enter LEDs flash briefly to confirm that programming is terminated.

2. Selecting jobs:

   a. Switch the Tiptronic function on by pressing “Tiptronic” **(49)** (associated LED comes on).

   b. Select the job number with the smart torch rocker (alternatively the job number can be selected with the push-buttons **(44)** (-) and **(48)** (+)).

   c. To exit the Tiptronic process, press “Tiptronic” **(49)** (Tiptronic LED goes out). The parameters are reset to the values that existed before you switched on the Tiptronic process.

3. Setting a job inactive:

   a. Switch the Tiptronic function on by pressing “Tiptronic” **(49)** (associated LED comes on).

   b. Select job number with the smart torch rocker **(61)** or with the push-buttons **(44)** (-) and **(48)** (+) (an active job is indicated in the smart torch display **(60)** and in digital multifunction display **(54)** with a decimal point between the job set and the job number).

   c. Hold the Enter push-button **(47)** pressed for two seconds (the decimal point in the smart torch display **60** and in the digital display **(54)** goes out).

4. Setting a job active:

   a. Switch the Tiptronic function on by pressing “Tiptronic” **(49)** (associated LED comes on).

   b. Select the job number with the push-buttons **(44)** (-) and **(48)** (+) (with an inactive job, the decimal point between job set and job number is missing).

   c. Hold the “TT Enter” push-button **(47)** pressed for two seconds (the decimal point between the job set and the job number lights up).

5. Re-saving/Reprogramming jobs:

a. Switch the Tiptronic function on by pressing “Tiptronic” **(49)** and select a job (see Selecting Jobs).

b. Change the settings as required.

c. Press the “TT Save” button **(45)** (Save LED flashes).

d. Press “TT Enter” button **(47)** to confirm.

e. The Save and Enter LEDs flash briefly to confirm that programming is terminated.

6. Copying jobs:

a. Switch the Tiptronic function on by pressing “Tiptronic” **(49)** and select a job for copying (see Selecting Jobs).

b. Press the “TT Save” button **(45)** (Save LED flashes).

c. Select the target job number with the push-buttons **(44)** (-) and **(48)** (+) and confirm with the “TT Enter” push-button **(47)** (if the Enter push-button is not actuated, the Save LED goes out 10 seconds after the last push-button actuation and the saving procedure is cancelled). If the target job number has not been occupied with a job yet, it is indicated by the display flashing.

d. The Save and Enter LEDs flash briefly to confirm that programming is terminated.

The user-defined job texts are also copied onto the new target job number.

7. Assigning descriptive text to a job:

Text can be assigned to each job in order to identify it more clearly.

a. Switch on the Tiptronic function with the “Tiptronic” push-button **(49)**.

b. Select the job number with the push-buttons **(44)** (-) and **(48)** (+).

c. Press the ▲ and ▼ push-buttons **(51)** at the same time (a flashing cursor appears in the display **(50)**) in order to get into the edit mode.

d. The cursor is moved with the ▲ and ▼ push-buttons **(51)**. At the end of the line, the cursor jumps to the respective next line.

e. Select a character (number, letter or special character) with push-buttons **(44)** (-) and **(48)** (+).

f. The edit mode is ended by pressing push-button **(46)** (END) or by pressing the ▲ and ▼ push-buttons **(51)** at the same time.

If you press the “Tiptronic” push-button **(49)** in edit mode (Tiptronic is switched off), then the text entries will not be saved.

Texts can be programmed both for the job set (upper line in display **(50)**) as well as for the job (bottom line in display **(50)**).

4.04 Special functions

A. Gas test

Pressing the ▲ push-button **(51)** and the “Gas type” push-button **(48)** at the same time activates the gas test function. The solenoid valve of the system is activated and the gas flow rate can be checked / adjusted. The function remains active for 30 seconds and is then ended automatically. By pushing the “Gas type” push-button **(48)** again, the gas test can be terminated.

B. Pump test (where fitted)

Pressing the ▲ push-button **(51)** and the “Material” push-button **(44)** at the same time activates the pump test function. The coolant pump is switched on and runs for approximately one minute. By pushing the “Material” push-button **(44)**, the pump test can be terminated.

C. Resetting Adjustments

Pressing the ▲ push-button **(51)** and the “TT Enter” push-button **(47)** at the same time resets all secondary parameters to the Factory set values. When the Tiptronic process is active, the settings of the current job are reset. All adjustment in the Extras menu (language, display contrast, etc.) remain unchanged.

D. Code lock function

The lock function in menu Extras is secured with a code lock. A three-digit code must be entered before the lock function can be changed. Only after the correct code is entered, the lock function can be altered. After leaving the menu, a new code number can be set or the old code number is acknowledged. Code “000” is the default (factory setting) number.

Procedure:

1. Switch to menu Extras, lock function
2. Press button **(44)** (-) or **(48)** (+) question “change parameter ?” is displayed
3. Acknowledge with button ▲ **(51)**
4. Set three-digit code number with button **(44)** (-),**(48)** (+) or encoder **(53)**
5. Acknowledge the code number with button **(51)**
6. Set desired lock function number with buttons **(44)** (-) or **(48)** (+)
7. Leave menu with button **(46)** (END)
8. If requested, set a new code number with buttons **(44)** (-) ,**(48)** (+) or encoder **(53)**
9. Acknowledge the code number with button ▲ **(51)**

4.05 Smart GMAW, Pulse GMAW & TwinPulse Programs

Material		Shield Gas	Wire size	Program Number	Smart GMAW Current Range	Pulse GMAW Current Range	TwinPulse Current Range
Type	Name	Ar / CO2 / O2 / He	in.		min - max	min - max	min - max
Mild Steel ER70S-x	M/ Steel	75 / 25 / 0 / 0	.030	1	**40-288**	**N/A**	**N/A**
	M/ Steel	75 / 25 / 0 / 0	.035	2	**52-332**	**N/A**	**N/A**
	M/ Steel	75 / 25 / 0 / 0	.045	3	**64-436**	**N/A**	**N/A**
	M/ Steel	75 / 25 / 0 / 0	.052	4	**72-468**	**N/A**	**N/A**
	M/ Steel	92 / 8 / 0 / 0	.030	5	**48-292**	**24-292**	**24-292**
	M/ Steel	92 / 8 / 0 / 0	.035	6	**52-360**	**28-360**	**28-360**
	M/ Steel	92 / 8 / 0 / 0	.045	7	**68-440**	**32-448**	**32-448**
	M/ Steel	92 / 8 / 0 / 0	.052	8	**72-468**	**48-476**	**48-476**
	M/ Steel	92 / 8 / 0 / 0	1/16	9	**100-500**	**N/A**	**N/A**
Flux Cored ER70C-xx	FC Metal	75 / 25 / 0 / 0	.045	13	**76-388**	**N/A**	**N/A**
	FC Metal	75 / 25 / 0 / 0	.052	14	**84-440**	**N/A**	**N/A**
	FC Metal	75 / 25 / 0 / 0	1/16	15	**96-488**	**N/A**	**N/A**
Flux Cored ER71-T1	FC E71- T1	75 / 25 / 0 / 0	.045	16	**96-340**	**60-360**	**60-360**
	FC E71- T1	75 / 25 / 0 / 0	1/16	17	**144-480**	**120-460**	**120-460**
Stainless Steel ER308/ER309	S/S 308/309	81 / 1 / 0 / 18	.030	18	**48-280**	**24-284**	**24-284**
	S/S 308/309	81 / 1 / 0 / 18	.035	19	**52-320**	**28-320**	**28-320**
	S/S 308/309	81 / 1 / 0 / 18	.045	20	**60-444**	**32-440**	**32-440**
	S/S 308/309	98 / 2 / 0 / 0	.030	21	**48-280**	**24-280**	**24-280**
	S/S 308/309	98 / 2 / 0 / 0	.035	22	**52-320**	**28-320**	**28-320**
	S/S 308/309	98 / 2 / 0 / 0	.045	23	**60-432**	**32-428**	**32-428**
Stainless Steel ER316	S/S 316	81 / 1 / 0 / 18	.030	30	**48-280**	**24-280**	**24-280**
	S/S 316	81 / 1 / 0 / 18	.035	31	**52-320**	**28-320**	**28-320**
	S/S 316	81 / 1 / 0 / 18	.045	32	**60-436**	**32-432**	**32-432**
	S/S 316	98 / 2 / 0 / 0	.030	33	**48-280**	**24-280**	**24-280**
	S/S 316	98 / 2 / 0 / 0	.035	34	**52-320**	**28-320**	**28-320**
	S/S 316	98 / 2 / 0 / 0	.045	35	**60-428**	**32-420**	**32-420**
Aluminum ER4043	Al 4043	100 / 0 / 0 / 0	.035	36	**48-268**	**20-260**	**20-260**
	Al 4043	100 / 0 / 0 / 0	3/64	38	**64-348**	**24-348**	**24-348**
	Al 4043	100 / 0 / 0 / 0	1/16	39	**80-388**	**32-388**	**32-388**
	Al 4043	75 / 0 / 0 / 25	3/64	40	**68-352**	**24-352**	**24-352**
	Al 4043	75 / 0 / 0 / 25	1/16	41	**80-388**	**32-380**	**32-380**
Aluminum ER5356	Al 5356	100 / 0 / 0 / 0	.035	42	**64-228**	**24-232**	**24-232**
	Al 5356	100 / 0 / 0 / 0	3/64	44	**88-340**	**28-328**	**28-328**
	Al 5356	100 / 0 / 0 / 0	1/16	45	**100-388**	**36-380**	**36-380**
	Al 5356	75 / 0 / 0 / 25	3/64	46	**88-340**	**28-328**	**28-328**
	Al 5356	75 / 0 / 0 / 25	1/16	47	**92-388**	**36-384**	**36-384**
Aluminum ER5183	Al 5183	100 / 0 / 0 / 0	.035	48	**64-228**	**24-228**	**24-228**
	Al 5183	100 / 0 / 0 / 0	3/64	50	**88-332**	**28-320**	**28-320**
	Al 5183	100 / 0 / 0 / 0	1/16	51	**96-380**	**32-372**	**32-372**
	Al 5183	75 / 0 / 0 / 25	3/64	52	**88-340**	**28-328**	**28-328**
	Al 5183	75 / 0 / 0 / 25	1/16	53	**92-380**	**32-372**	**32-372**
Silicone Bronze	Si Bronze	100 / 0 / 0 / 0	.035	56	**48-280**	**24-288**	**24-288**
	Si Bronze	100 / 0 / 0 / 0	.045	57	**64-348**	**28-352**	**28-352**

4.06 Welding Setting Selection Guide

Wire Gas Combinations

Material Name	Shield Gas	Wire Size	320SP Synergic Smart MIG	320SP Pulse &Twin Pulse	400SP Synergic Smart MIG	400SP Pulse &Twin Pulse	500SP Synergic Smart MIG	500SP Pulse &Twin Pulse
Mild Steel ER70-S6	75Ar/ 25CO_2	.030" (0.8mm)	✓					
		.035" (0.9mm)	✓		✓		✓	
		.045" (1.1mm)	✓		✓		✓	
		.052" (1.4mm)			✓		✓	
	90Ar/ 10CO_2 or 92Ar/ 8CO_2	.030" (0.8mm)	✓	✓	✓	✓	✓	✓
		.035" (0.9mm)	✓	✓	✓	✓	✓	✓
		.045" (1.1mm)	✓	✓	✓	✓	✓	✓
		.052" (1.4mm)			✓	✓	✓	✓
		.062" (1.6mm)			✓		✓	
Flux Cored E71-T1	75Ar/ 25CO_2	.045" (1.1mm)	✓	✓	✓	✓	✓	✓
		.062" (1.6mm)	✓	✓	✓	✓	✓	✓
Flux Cored E70C-6M	75Ar/ 25CO_2	.045" (1.1mm)	✓		✓		✓	
		.052" (1.4mm)			✓		✓	
		.062" (1.6mm)			✓		✓	
Stainless Steel 308-309	81Ar/ 18He/ 1CO_2	.030" (0.8mm)	✓	✓	✓	✓	✓	✓
		.035" (0.9mm)	✓	✓	✓	✓	✓	✓
		.045" (1.1mm)	✓	✓	✓	✓	✓	✓
	98Ar/ 2CO_2	.030" (0.8mm)	✓	✓	✓	✓	✓	✓
		.035" (0.9mm)	✓	✓	✓	✓	✓	✓
		.045" (1.1mm)	✓	✓	✓	✓	✓	✓
Stainless Steel 316	81Ar/ 18He/ 1CO_2	.030" (0.8mm)	✓	✓	✓	✓	✓	✓
		.035" (0.9mm)	✓	✓	✓	✓	✓	✓
		.045" (1.1mm)	✓	✓	✓	✓	✓	✓
	98Ar/ 2CO_2	.030" (0.8mm)	✓	✓	✓	✓	✓	✓
		.035" (0.9mm)	✓	✓	✓	✓	✓	✓
		.045" (1.1mm)	✓	✓	✓	✓	✓	✓
Aluminum 4043	Argon	.035" (0.9mm)	✓	✓	✓	✓	✓	✓
		.045" (1.1mm)	✓	✓	✓	✓	✓	✓
		.047" (1.2mm)	✓	✓	✓	✓	✓	✓
		.062" (1.6mm)			✓	✓	✓	✓
	75Ar/ 25He	.047" (1.2mm)	✓	✓	✓	✓	✓	✓
		.062" (1.6mm)			✓	✓	✓	✓
Aluminum 5356	Argon	.035" (0.9mm)	✓	✓	✓	✓	✓	✓
		.045" (1.1mm)	✓	✓	✓	✓	✓	✓
		.047" (1.2mm)	✓	✓	✓	✓	✓	✓
		.062" (1.6mm)	✓	✓	✓	✓	✓	✓
	75Ar/ 25He	.047" (1.2mm)	✓	✓	✓	✓	✓	✓
		.062" (1.6mm)			✓	✓	✓	✓
Aluminum 5183	Argon	.035" (0.9mm)	✓	✓	✓	✓	✓	✓
		.045" (1.1mm)	✓	✓	✓	✓	✓	✓
		.047" (1.2mm)	✓	✓	✓	✓	✓	✓
		.062" (1.6mm)	✓	✓	✓	✓	✓	✓
	75Ar/ 25He	.045" (1.1mm)	✓	✓	✓	✓	✓	✓
		.047" (1.2mm)	✓	✓	✓	✓	✓	✓
		.062" (1.6mm)			✓	✓	✓	✓
Silicon Bronze	Argon	.035" (0.9mm)	✓	✓	✓	✓	✓	✓
		.045" (1.1mm)	✓	✓	✓	✓	✓	✓

Art # A-07907

Base Material Thickness Guide

Decimal Thickness (Thous)	Fraction Thickness (Inches)	Gauge Steel	Decimal Thickness (mm)
024		24	0.61
030		22	0.76
031	1/32		0.79
036		20	0.91
038			0.97
040			1.02
047	3/64		1.19
048		18	1.21
060		16	1.52
063	1/16		1.59
075		14	1.91
078	5/64		1.98
094	3/32		2.38
105		12	2.66
109	7/64		2.78
125	1/8		3.18
135		10	3.42
141	9/64		3.57
156	5/32		3.97
162		8	4.11
172	11/64		4.37
188	3/16		4.76
203	13/64		5.16
219	7/32		5.56
234	15/64		5.95
250	1/4		6.35
266	17/64		6.75
281	9/32		7.14
297	19/64		7.54
313	5/16		7.94
328	21/64		8.33
344	11/32		8.73
359	23/64		9.13
375	3/8		9.53
391	25/64		9.92
406	13/32		10.32
422	27/64		10.72
438	7/16		11.11
453	29/64		11.51
469	15/32		11.91
484	31/64		12.30
500	1/2		12.70
516	33/64		13.10
532	17/32		13.50
547	35/64		13.89
563	9/16		14.29
578	37/64		14.68
594	19/32		15.08
609	39/64		15.48
625	5/8		15.88
641	41/64		16.27
656	21/32		16.67
672	43/64		17.07
688	11/16		17.46
703	45/64		17.86
719	23/32		18.26
734	47/64		18.65
750	3/4		19.05
766	49/64		19.45
781	25/32		19.84
797	51/64		20.24
813	13/16		20.64
828	53/64		21.03
844	27/32		21.43
859	55/64		21.83
875	7/8		22.23
891	57/64		22.62
906	29/32		23.02
922	59/64		23.42
938	15/16		23.81
953	61/64		24.21
969	31/32		24.61
984	63/64		25.00

* Refer to Warranty Schedule

Three Steps To GMAW (MIG) Welding

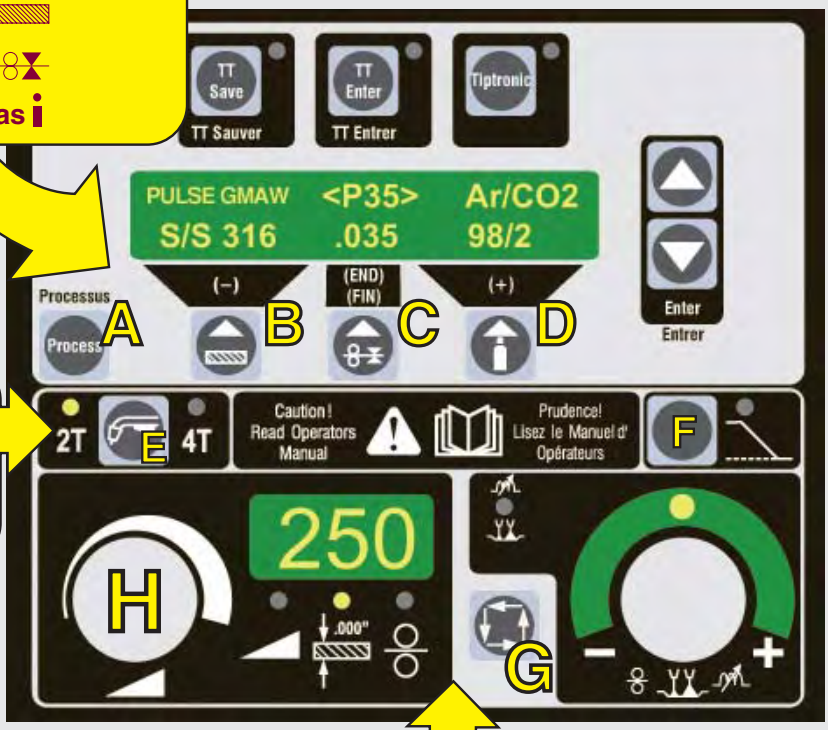
1.Set Variables

A) Select Process : MANUAL GMAW
SMART GMAW
PULSE GMAW
TWIN PULSE

B) Select Wire Type

C) Select Wire Size

D) Select Shielding Gas



2.Set Function

E) Set Trigger to 2T or 4T.
4T= Latch

F) Set Crater fill on or off.

3.Set Thickness

G) Set LED to .000"

H) Set material thickness
Refer to Base Material
Thickness Guide

Now you are ready to weld

Art # A-07907

SECTION 5:
MANUAL GMAW WELDING

5.01 Types of Weld Transfer Modes

A. Dip transfer mode (short circuit arc)

This type of arc is especially suitable for thin materials and positional welding due to a relative cool welding pool welded with very short arc, low arc voltage and low current. The surface tension of the welding poll helps to draw the drop into the bath and to reignite the arc. This cycle is repeated again and again so the short circuit and the arcing period are constantly alternating.

NOTE

The transition from the short circuit to spray arc depends on the wire diameter and the gas mixture.

B. Transitional arc

The transitional arc is especially suitable for medium thickness sheet metals and for vertical-down welding. The transfer of the electrode to the workpiece takes place partly in short circuit and in free flight. Due to fewer short circuits, the welding pool is hotter than at the short circuit arc. Welding with transitional arc provides higher electrode melt rate and is more economic than welding at short circuit arc.

C. Long arc

Long arcs are typically at a higher ampere range under carbon dioxide and gases with a high CO2 content. It is not particularly suitable for positional welding. In this type of arc large drops are formed which falls into the welding pool mainly by force of gravity. This results in occasionally short circuits occurring, which increases the current at the moment of the short circuit and high spatter levels when the arc is reignited.

D. Spray arc

The spray arc is not suitable for positional welding, due to the extremely liquid nature of the welding pool. The spraying arc forms by welding at the higher range of ampere using inert gas or mixtures with high argon content. The most typical characteristic of the spray arc is the transfer of extremely fine molten metal droplets across the arc.

E. Working range at GMAW welding

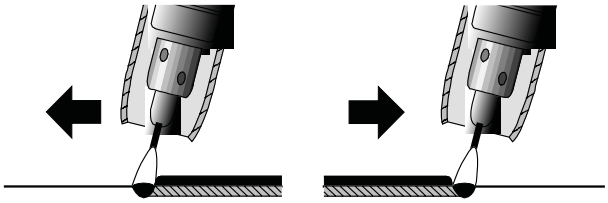
Wire diameter	Long arc / Spray arc		Transitional arc		Short circuit arc	
inches	A	V	A	V	A	V
.030	140… 180	23… 28	110… 150	18… 22	50… 130	14… 18
.035	180… 250	24… 30	130… 200	18… 24	70… 160	16… 19
.045 or 3/64	220… 320	25… 32	170… 250	19… 26	120… 200	17… 20
1/16	260… 320	26… 34	200… 300	22… 28	150… 200	18… 21
Favorable welding characteristics are only possible if voltage and current are correctly adjusted. CO2requires an arc voltage approximately 3 V higher than gas mixtures with a high argon content.						

5.02 Holding and Manipulating the Torch

NOTE

Metal shielded gas welding can be welded in all positions: horizontal, vertical-down, vertical-up, overhead and in horizontal-vertical position.

When horizontal welding, hold the torch vertical to the workpiece (neutral torch position) or up to 30° "pushing" the torch. For best depth of penetration and shielding gas coverage hold the torch in the neutral position. Please note that if the torch is tilted too far, it is possible that air will be sucked into the shielded gas and may result in porosity. For vertical or overhead welding a slight pushing motion is required. Vertical down welding is most used for thin materials, hold the torch at the neutral or slightly "dragging" position. Some experience is required as the welding pool could run ahead of the arc and cause weld defects. There is a danger of lacks of fusion with thicker material due to the welding pool being very liquid from high voltage.



Welding direction pushing the weld — Art # A-06380 — Welding direction dragging the weld

Avoid extreme side to side movements as it can cause the weld pool to dam up in front of the arc. This can cause lacks of fusion due to the welding pool flowing ahead of the welding arc. The side to side motion should only be used as wide as is necessary to reach both sides of the joint. If the joint is too wide you should weld two parallel weld beads. When vertical-up welding, the side to side motion should follow the shape of an open triangle.

A. Length of the arc

Welding with a longer arc reduces the penetration, the welding bead is wide and flat with increased spattering. The welding material is transferred with slightly larger drops than welding with a shorter arc. A longer arc is useful for welding a fillet weld to form a flat or concave seam. Welding with a shorter arc (at the same amperage) increases the penetration, the welding bead is narrow and high with reduced spattering. The welding material is transferred with smaller droplets.

Art # A-06381

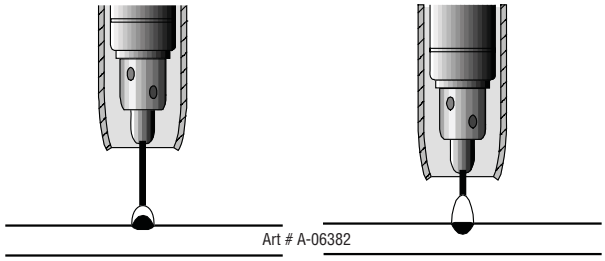
Long Arc — Short Arc

B. Length of the wire electrode

The distance between the torch and the workpiece should be 10 – 12 times the diameter of the wire. Altering the distance of the torch will influence the electrode stick out.

A longer electrode stick out reduces the amperage and the penetration.

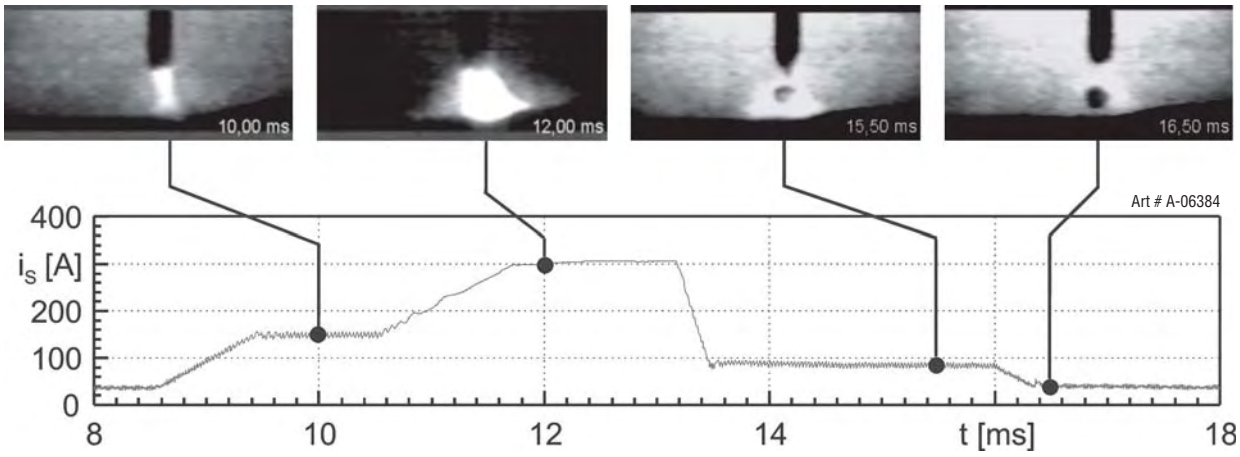
A shorter electrode stick out increases the amperage if the wire-feed speed remains the same.



Art # A-06382

Long electrode stick out — Short electrode stick out

C. Material Transfer



Benefits:

- Controlled, short-circuit-proof material transfer without spatter
- Low thermal transfer due to low primary current

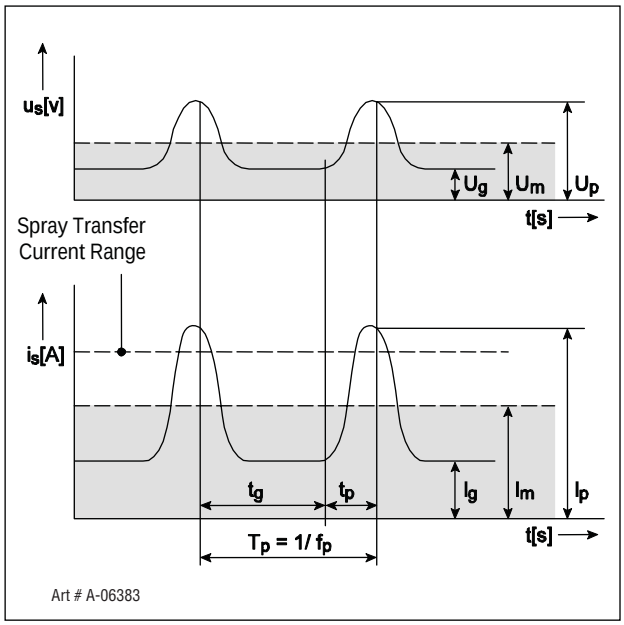
Disadvantages:

- Only shielding gases with low CO2 content can be used

5.03 Basics of Pulsed Arc Welding

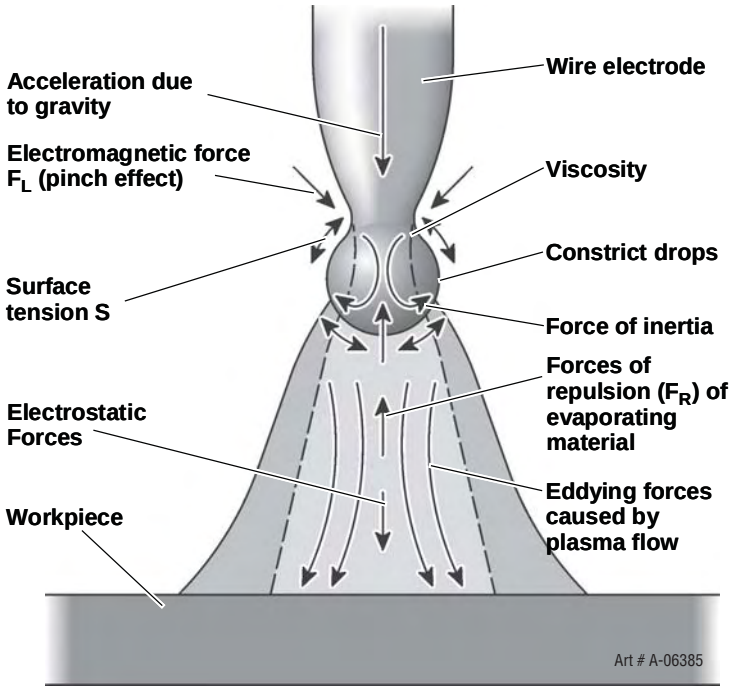
A. Current and voltage pulses

Material transfer is achieved by current and voltage pulses controlled at the same rate as the pulse frequency. The arc power is changed by the ratio between background and pulses current, the pulse duty cycle and the pulse frequency.



B. Forces acting during material transfer

A number of forces come into play which influences the resulting molten metal drop formation and separation.



NOTE

The main force components for separating the drops are electromagnetic force (pinch effect).

5.04 Pulsed Arc Welding Parameters

A. Pulse period t_P

The pulse period for separating the droplet is between 1.5 and 3.0 ms depending on wire diameter and the pulse current setting I_P.

If the pulse period is too long, material transfer only takes place during the pulse phase.

Arc formation and drop rate can be affected by additional pulse stages.

B. Pulse voltage U_P and pulse current I_P

Since welding with pulsed arc is based on the temporary utilization of the pinch effect, the drop-separating pulse current must always be large enough to exceed critical current intensity depending on wire diameter, wire material and shielding gas composition, etc. If this value is not achieved, material transfer takes place completely or partially in the short circuit with possible spatter.

C. Wire feed speed v_D and pulse frequency f_P

The main condition for a controlled material transfer with one drop per pulse is to set a defined drop volume. The volume of the melted drop must then be identical with the volume of the wire electrode fed in each pulse period. The necessary wire feed speed v_D results from the product of pulse frequency fP and the wire length “L” melted in each pulse period. From this relationship you see that a change in wire feed speed requires a linear change in pulse frequency. A rise in electrode melt rate by increasing wire feed speed needs a higher pulse frequency. The objective drop diameter should be about .045" (1.2mm) with a wire diameter of .045" (1.2mm).

D. Primary current

Arc length ionization must be maintained during the primary current phase, whose period results from the selected frequency and pulse period. This requires currents ranging between 25 and 80 A depending on wire diameter, material and material thickness. The primary current can also be used to affect the arc and material transfer. At a constant ratio of wire feed speed and pulse frequency, the arc length can be changed by varying the primary current and the associated voltage. Reducing the primary current causes a shorter arc. This can be used to counteract arc deflection with fillet welds or at high welding rates.

The time of drop separation can be affected by varying the ratio of primary current to pulse current. Normally the objective is to separate the drop just after the current pulse in the primary current phase (in the third pulse current phase). This can be achieved by increasing the primary current and reducing the pulse current at the same time. Remember that excessively high primary current will melt the free wire end too quickly. This will form very large drops which can lead to spatter during the transition to the welding pool.

E. Pulse MIG applications

The main application for pulse MIG is for precision MIG welding of aluminum, stainless steel, steel and other weldable materials.

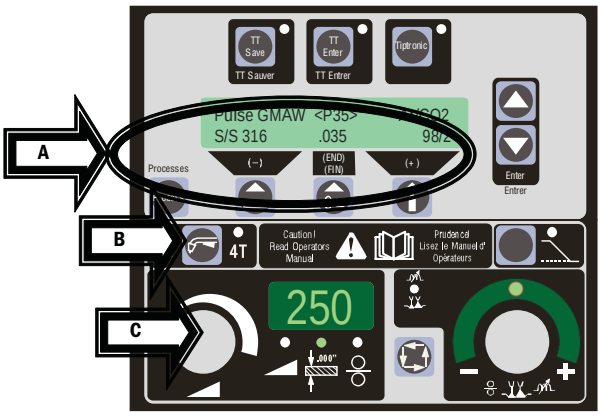
- Spray transfer welding permitted at lower-than-normal average weld currents.
- No spatter or undercut in the majority of welding applications.
- Precise control of welding power, to assure bead shape and root penetration rivaling TIG welding.
- High energy arc produced, that virtually eliminates the risk of lack of fusion.
- Improved arc control for out-of-position welding and more effective welding of thin materials, with all the advantages of spray transfer.
- Optimized pulse programs for gas/wire combinations
- TwinPulse® capabilities.
- Exceptional out-of-position welding for nonferrous materials, including aluminum.
- Effortless TIG-like weld appearance on aluminum and stainless steel
- Deeper weld penetration
- Accurate penetration on sheet metal
- Superior welding characteristics on hard-facing and high alloy steels
- The ability to use larger-than-normal diameter wires on thin base material, providing a cost saving on wire
- Spray arc welding vertical up, giving smoother welds, better control and deeper penetration
- Improved edge wetting in PulseGMAW process

At the lower end of the performance range the pulsed arc cannot fully replace the dip transfer. The reason is the continuous arc that occurs in the primary current phase. This phenomenon does not exist with the short-circuiting arc. An exception to this is when welding aluminum and aluminum alloys. Normally, these materials can only be reliably welded using a pulsed arc. In the upper performance range, the pulsed arc is preferable to the sprayer arc, in particular for welding aluminum materials and high-alloy steels.

5.05 Smart, Pulse or TwinPulse GMAW Welding

The following instructions explain how to set up for SmartGMAW or PulseGMAW or TwinPulse welding.

Art # A-07867



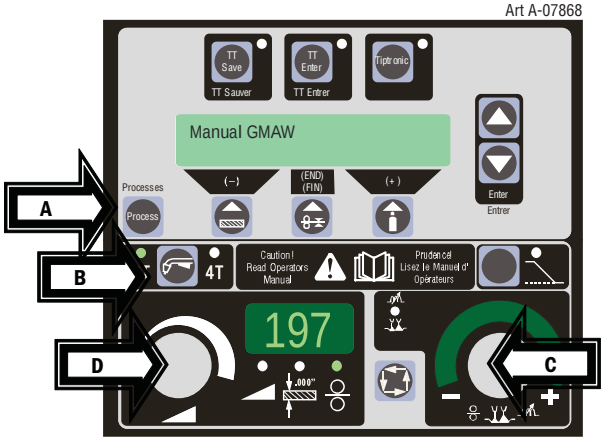
Art # A-07871

A Set	*Process*	Processes / Process: SmartGMAW = One knob control non-pulse welding; PulseGMAW = One knob control pulse welding; TwinPulse = One knob control twin pulse welding
	Wire type	Eg. Stainless Steel 316
	Wire size	Eg. .035 in diameter
	Shielding gas	Eg. 98% Argon / 2% CO2
	Thickness	Press button to select material thickness
B Set	*Torch trigger operation*	2T = Normal Operation 4T = Trigger Latch
C Set	*Base material thickness*	Use left hand knob to dial up base material thickness Eg. 250 = 0.250" (1/4")

5.06 Conventional Manual GMAW/ FCAW Welding

The following instructions explain how to set up for conventional manual GMAW welding.

Art A-07868



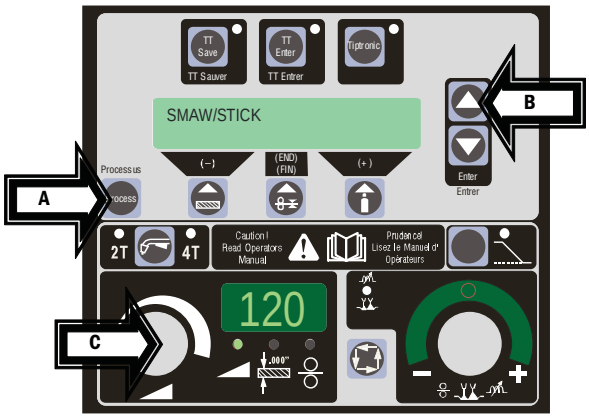
Art # A-07870

A Set	Process	Processes / Process: To Manual GMAW
B Set	Torch trigger operation	2T = Normal Operation OR 4T = Trigger Latch
C Adjust	Wirefeed speed knob to the desired IPM	
D Adjust	Arc voltage knob to the desire arc voltage	

5.07 SMAW/STICK Welding

The following instructions explain how to set up for SMAW/STICK welding.

Art # A-07869



Art # A-07872

A Set	*Process*	Processes / Process — To SMAW/STICK
B Press	*Button*	To activate SMAW mode
C Set	*Weld current*	120 — To the suggested weld current. Refer to electrode manufacturer

SECTION 6:
BASIC SERVICE

6.01 Maintenance

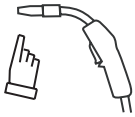
Warning!
Disconnect input power before maintaining.

Maintain more often if used under severe conditions

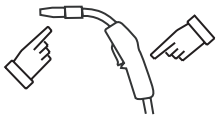
Each Use

Visual check of regulator and pressure

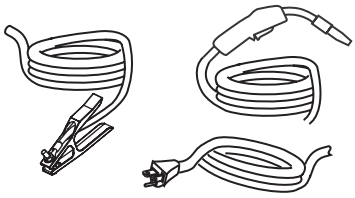
Visual check of torch electrode and shield cup



Weekly



Visually inspect the torch body and consumables

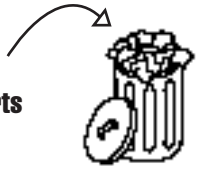


Visually inspect the cables and leads. Replace as needed

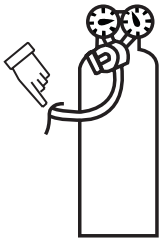
Visually inspect the Wire feed mechanisms

3 Months

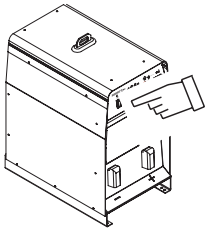
Replace all broken parts



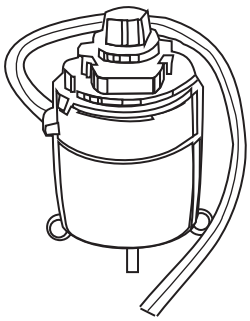
Gas and air lines



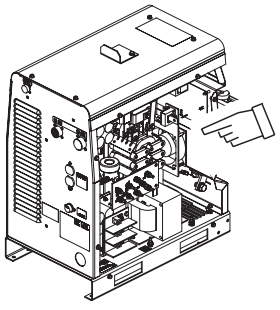
Clean exterior of power supply



6 Months



Visually check and Carefully clean the interior



Art # A-07725

NOTE

For units with integrated coolers, check the fluid levels and refill as needed. Check torch connections for leaks and then check for return flow of coolant to the reservoir.

6.02 System Troubleshooting Guide

Symptom	Cause	Remedy
Torch too hot	Insufficient coolant through flow due to pollution in coolant	Flush the coolant hoses of the torch in opposite direction
	Contact tip is not tight or the wrong size for the wire used	Check it
No function when torch button is pressed	Nut of the torch hose is not tight	Tighten it
	No connection of the control cable in the torch hose	Check and change if necessary
	Overload of the unit and thermal protection operates	Allow unit to cool down at no load
Irregular wire feeding or wire welds to the contact tip	Wire electrode is tight at the spool	Check and change if necessary
	Burr at the wire beginning	Cut burr from end of wire
Irregular wire feeding or no wire feeding	Wrong contact pressure at the wire-feed rolls	Adjust it as described in the manual
	Torch defective	Check and change if necessary
	No intermediate guide or is dirty	Install or clean the intermediate guide
	Bad quality of welding wire	Check and change if necessary
	Rust formation on the welding wire	Check and change if necessary
	Torch liner is dirty inside	Disconnect the torch from the machine, unscrew the contact tip and clean the liner with compressed air
	Torch liner is defective	Check and change if necessary
	Motor brake adjusted too strong	Adjust as described in the manual
Unit switches off	Duty cycle overloaded	Allow the machine to cool down
	Poor cooing of internal unit parts	Check the air in and outlet
Cooler, hoses or pump are damaged	Frozen systems due to low concentration of recommended coolant in re-circulator	Contact the nearest service facility
Arc or short circuit between contact tip and gas nozzle	Spatter built up inside the gas nozzle	Remove it with special pliers
Unstable arc	Wrong diameter contact tip or worn out	Change contact tip
The *Control Panel* is completely blank	Primary power phase missing	Check the unit at another power outlet. Check power cable and mains fuses/circuit breakers
No shielded gas	Gas cylinder empty	Replace it
	Defective torch	Check and replace it
	Gas regulator dirty or defective	Check and replace it
	Valve of gas cylinder defective	Replace the gas cylinder
Shielded gas switches not off	Valve of gas cylinder dirty or does not close	Remove torch and gas regulator and clean it with compressed air
Not enough shielded gas	Incorrect setting of shielded gas	Adjust as described in the manual
	Dirty gas regulator	Check valve
	Torch, gas hose blocked or not air-tight	Check and change if necessary
	Shielded gas is blown away from draft	Avoid draft
Decreased welding performance	One of the three phase input power is missing	Check the unit at another power outlet. Check power cable and mains fuses/circuit breakers
	Poor Work lead connection	Ensure good electrical contact between Work clamp and workpiece
	Work lead not plugged in right	Fasten work lead by turning the plug to the right
	Defect torch	Repair or replace it
Hot plug of work lead	Plug was not tightened by turning to the right	Check
Higher wire wear out at wire-feeding unit	Wire rolls do not fit the wire diameter	Install correct wire rolls
	Wrong contact pressure at wire feeder	Adjust as described in the manual

6.03 Welding Process Troubleshooting Guide

Symptom	Cause	Remedy
Poor edge wetting on stainless steel welds	Gas mixture in the cylinder has separated due to lack of use	Place protective cap used for storage and transport on cylinder then carefully disconnect the cylinder from the welder and lay it down on the floor. Carefully roll it back and forth to re-mix the gas
	Wire is contaminated with oil or the wire quality is uncertain	Contact wire manuafacturer / supplier. Keep the wire covered
	Work piece is contaminated with grease or oil	Degrease with mineral spirits, etc to remove contaminates
	Poor current transfer to the wire at the contact tip	Use a copper or brass jump liner in the conductor tube to improve current transfer to the wire
Stanless steel weld has a dark burnt finish	Arc length control (58) has been adjusted too high	Reduce arc length, control (58)
Dirty aluminum welds	Inadequate gas coverage	Increase gas flow by 10% and check again. Shield arc from drafts. Hold nozzle closer to the work. Replace the damaged nozzle to center contact tip in nozzle
	Wire is contaminated with oil	Contact wire manuafacturer / supplier. Keep the wire covered
	Work piece is contaminated with grease or oil	Degrease with mineral spirits, etc to remove contaminates
	Poor current transfer to the wire at the contact tip	Use a copper or brass jump liner in the conductor tube to improve current transfer to the wire
Weld performance is very poor or high spatter levels	Incorrect wire / gas combination selected	Set the correct gas / wire combination
Poor weld starts	Improper work lead connection	Reconnect work lead
	Contact tip is worn with an oval shape hole or contact tip is black	Replace contact tip
	Contact tip is loose	Tighten contact tip
Varying arc length when welding	Material build-up in torch liner	Replace torch liner
	Contact tip is worn or damaged	Replace contact tip

SECTION 7:
ADVANCED SERVICE

7.01 Safety Precautions

Requirement

WARNING: 

Use and maintenance of welding and cutting machines can be dangerous. Follow the safety precautions in Section 1 of this manual to avoid injuries. Welding and cutting machines must be used by properly trained personnel. Please review the safety precautions and regulations on a regular basis to avoid accidents while working with this machine.

WARNING: 

Only qualified workers who are knowledgable and have been trained to work safely with test instruments and equipment on energized circuits shall be permitted to perform testing work on electrical circuits or equipment where there is danger of injury from accidental contact with energized parts or improper use of the test instruments and equipment.

CAUTION: 

Use only original spare parts. Immediately replace any components that are not in perfect condition.

Norms

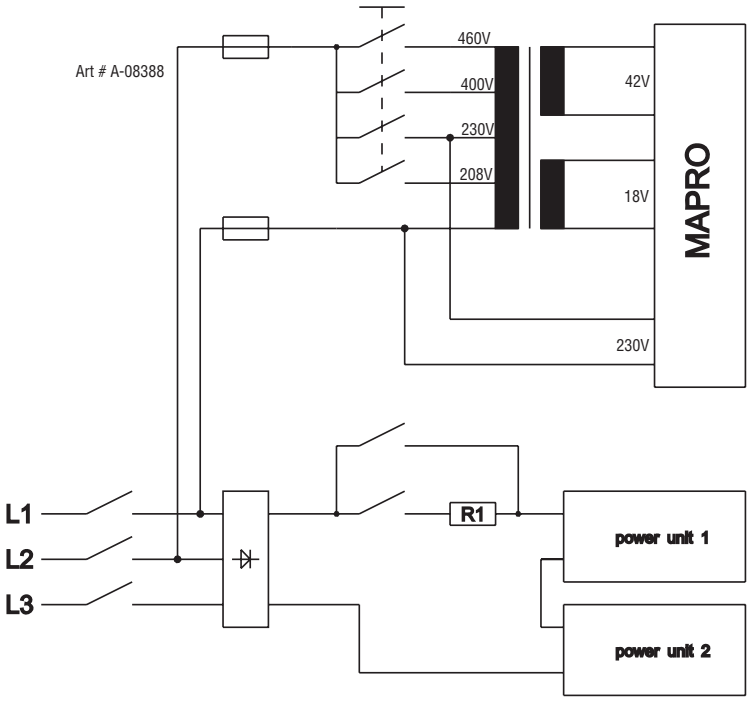
CAUTION: 

Please follow the current safety regulations corresponding to your country.

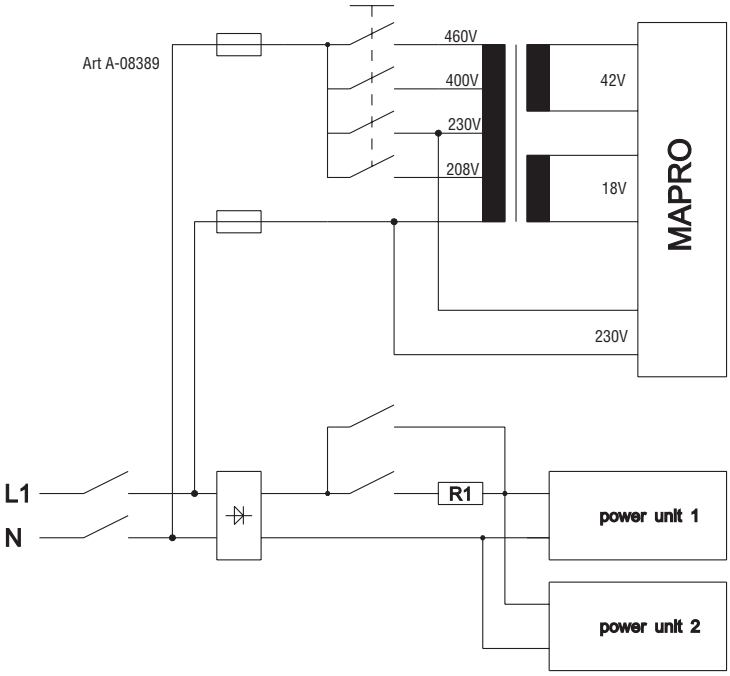
7.02 Multivoltage Principle

Setting the input switch

When switch setting 208V and 230V, the power units are connected parallel. When switch setting 400V and 460V, the power units are connected in series. This applies to either single or 3-phase operation.

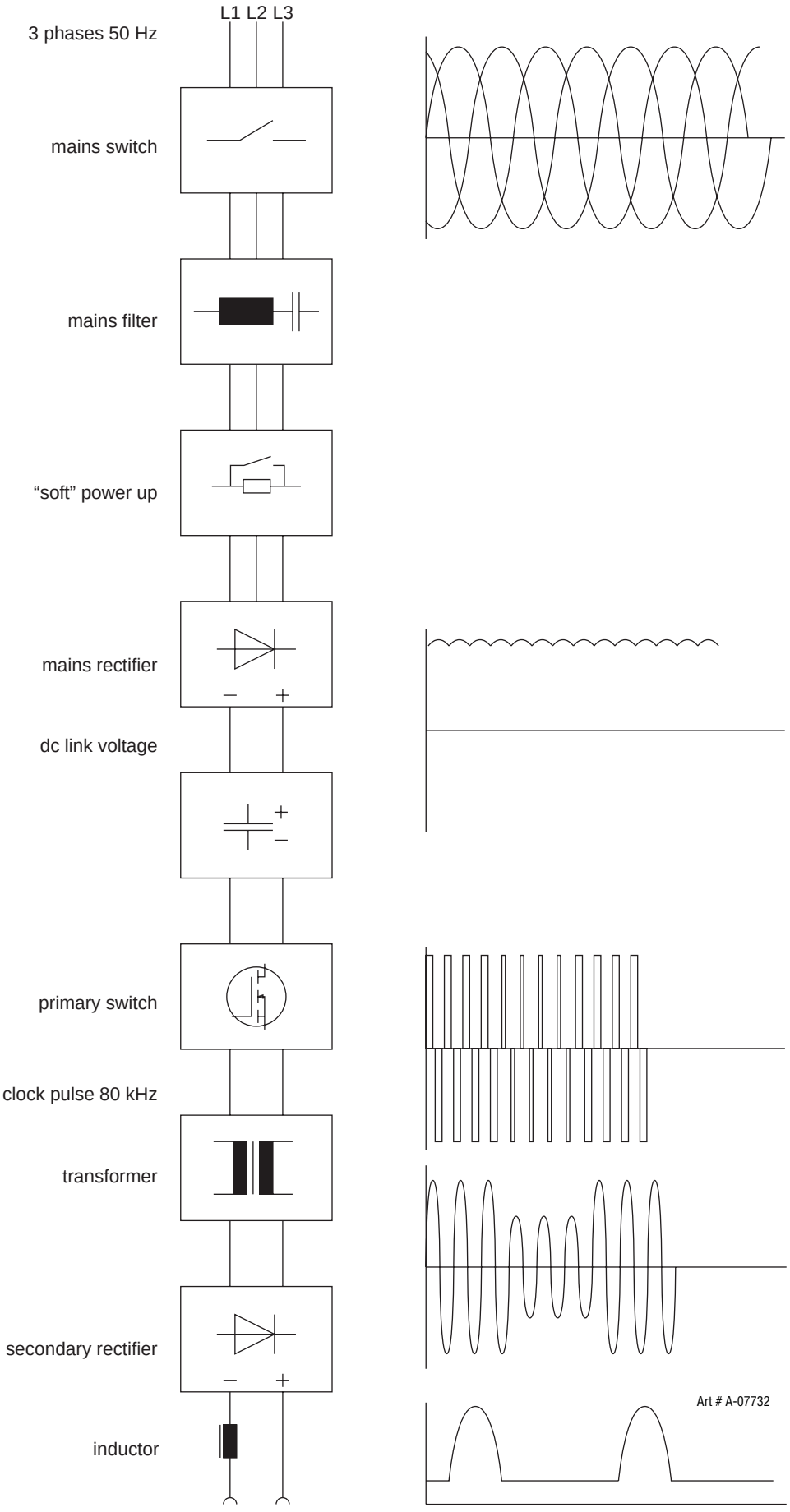


Three Phase Input Switch Diagram



Single Phase Input Switch Diagram

7.03 Inverter Principle



7.04 Common Logic Functions

Component	Function	Cause
fan (power unit)	on	power module temperature over 40°C
	off	power module temperature below 40°C
fan (cooling system)	on	after detection “welding current on“
	off	after welding process, two minutes post-cooling time
pump	on	after detection “welding current on“
	off	after welding process, two minutes post-cooling time

7.05 Gas Test

1. Press the buttons  (arrow up) and  "gas type" (+) at the same time
2. The gas valve is activated for 30 seconds.
3. A countdown is shown in the display
4. Press button "gas type" (+) again to end the test manually

7.06 Pump Test

1. Press the buttons  (arrow up) and  "material type" (-) at the same time
2. The cooling pump is activated for one minute
3. A countdown is shown in the display
4. Press button "material type" (-) again to end the test manually

7.07 Reset Adjustments

1. Press the buttons  (arrow up) and 

"TT Enter" at the same time
2. All secondary parameters are reset to their default values
3. If Tiptronic is active, the settings of the current job are reset to their programmed values
4. All adjustments of the Extras menu remain unchanged

7.08 Master Reset

1. Press the buttons  (arrow up) and 

"Process" together for about five seconds.
2. The display shows "Master Reset"
3. The machine is reset completely to factory settings

CAUTION :

All Tiptronic jobs will be deleted !!!

7.09 Torque Setting(s)

All power semi conductors and mounting screws should be tightened with a torque wrench to 1.5 Nm.

7.10 Error Codes and Troubleshooting Guide

In case of a malfunction, an error code is indicated on the digital multifunction display **(54)** and the corresponding error description appears on the LCD display **(50)**. As long as an error code is indicated, welding operation is not possible.

Code	Description	Cause	Remedy
E01	thermal overload	thermal sensor of power unit measures too high of a temperature (>80°C)	let machine cool down in standby (*1) check temperature sensor (short circuit)
E02	mains overvoltage	mains voltage too high (24V supply > 36V)	check mains voltage and control transformer (*2)
E03	secondary overcurrent	welding current is too high	check current sensor and its wiring
E04	air cooling error	Temp. sensor of the power unit detects that the unit heats up too fast	check fans and it's wiring
E05	cooling system error	flowrate of the cooling liquid is too low (< 0,3 l/min or .8 GPM) pump is not working	check connectors of flow-meter, level of cooling liquid and flowrate (*3) check fuse SI7 (2,5A) on pc-board MV-MAPRO
E06	secondary overvoltage	Master detects output voltage is too high (>100V)	check wiring from output sockets to MV-MAPRO check MVDRV and MOSFETs exchange MAPRO
E07	EEPROM checksum error	no welding program stored or error during reading from memory	transfer welding programs to machine again, exchange MV-MAPRO if error still persists
E08	wire feed / tacho	power consumption of wire feed motor too high no tacho signal no CAN-Bus connection between MAPRO & DMR	blow out torch package with compressed air check wire feed unit check wiring of wire feed motor and pc-board DMR
E09	error v/a measuring	measuring difference between Master and Process	check wiring of pc-board LSW, pc-board DP-EMV and pc-board DP-UFI-BO
E11	remote-control conn.	short circuit between remote control cables	check remote control and wiring of remote control socket
E12	Communication Process	Process is not responding to Master	switch the machine off and on again optionally exchange pc-board DP-MAPRO
E13	Temp. sensor error	Temp. sensor is defective	check resistor value and wiring of the sensor
E14	Op. voltages error	supply voltage is too low (24V supply < 17V)	check mains voltage and control transformer (*2)
E16	Overcurrent protection1	power consumption of power unit 1 is too high	check MOSFETs and pc-board MVDRV
E17	Op. voltage 18V error	18 V from control transformer missing	check mains supply and control transformer
E18	overload protection	safety shutdown to protect electrical components temp. sensor is disconnected	let machine cool down in standby check temp. sensor
E19	Power module error	Charge-up time for capacitors >1 second	check mains input check MVPWRUP board and it's wiring check MOSFETs and MVDRV
E20	Overvoltage sec.	Process reports a too high output voltage or no voltage	check wiring of the output sockets to MAPRO check MOSFETs and MVDRV exchange MV-MAPRO
E21	Output voltage/current	external current/voltage or measure-difference between Master and Process	exchange pc-board MV-MAPRO check MOSFETs and MVDRV
E22	Mains undervoltage 1	power unit 1 reports mains voltage too low	check mains voltage and mains rectifier
E23	Mains overvoltage	power unit reports mains voltage too high	check mains voltage
E24	Overcurrent protection2	power consumption of power unit 2 is too high	check MOSFETs and pc-board MVDRV
E25	Power module detection	DIP-switch on pc-board MVDRV is set wrong	check DIP-switch on pc-board MVDRV
E26	Error voltage symmetry	dc-link voltage difference (>50V) between power units	check MOSFETs and MVDRV
E27	no program (DSP)	wrong material-wire-gas combination welding programs faulty or not available	select other material-wire-gas combination transfer welding programs to machine again
E30	Op. voltage 15V error	supply voltage is too low	exchange MV-MAPRO
E31	Communication error	Master is not responding to Process	switch the machine off and on again optionally exchange pc-board MV-MAPRO
	"?" is shown in the display	Display board doesn't get any data from MV-MAPRO	check the flat ribbon cable of the DS20BF check interpass hose (only machines with separate wire feeder) and it's connectors check pc-boards DMR and MV-MAPRO

*1 check module temperatures in menu Extras, Diagnosis > Module temperatures

*2 check supply voltages in menu Extras, Diagnosis > Operating voltages

*3 check the flow rate in menu Extras, Diagnosis > Flow rate cooling system

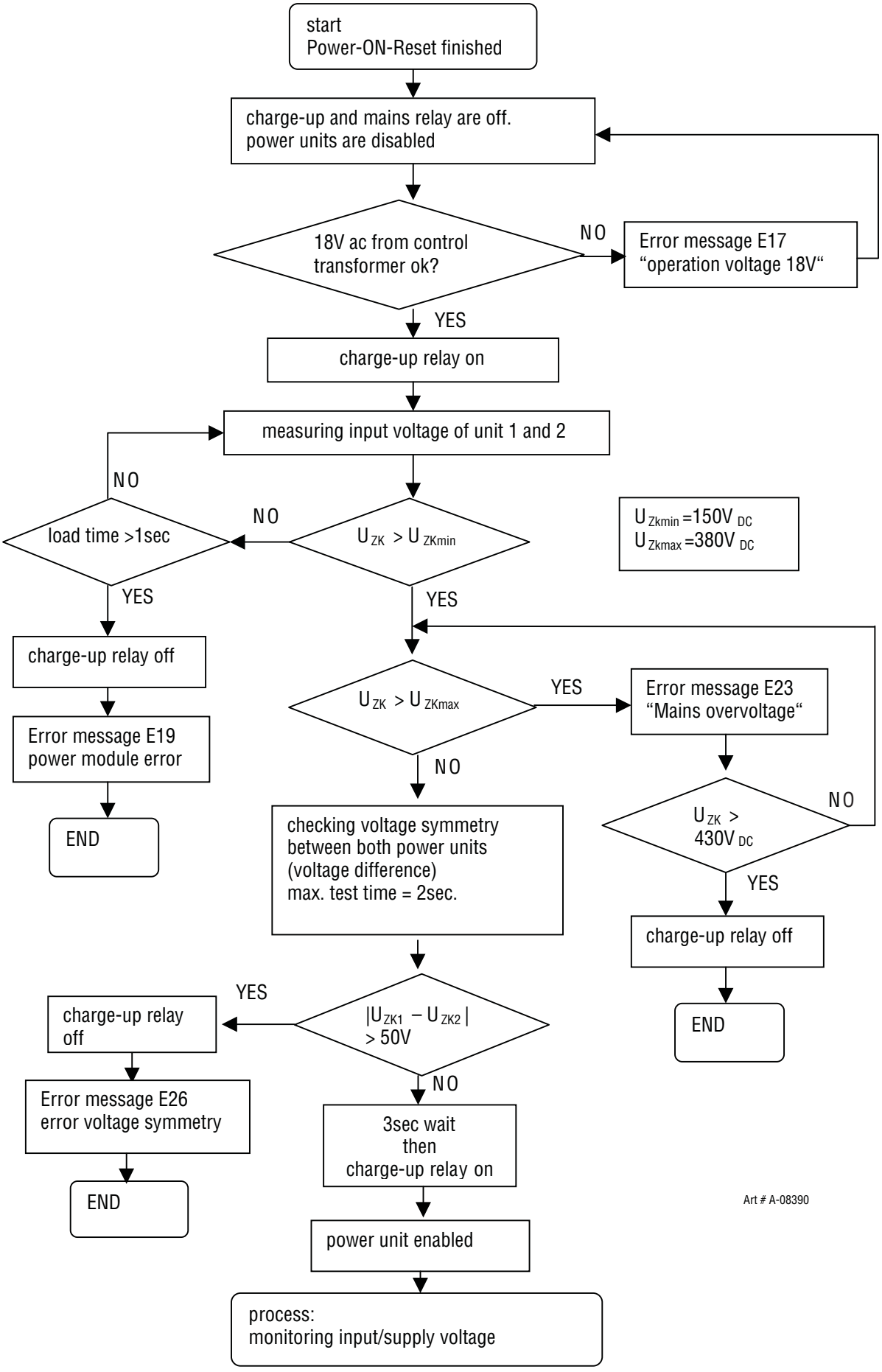
7.11 Overview of Mains Voltage Limits

mains (3 phase)	voltage limit for E14	voltage limit for E23
460V	322V	520V
400V	280V	500V
230V	163V	276V
208V	147V	274V

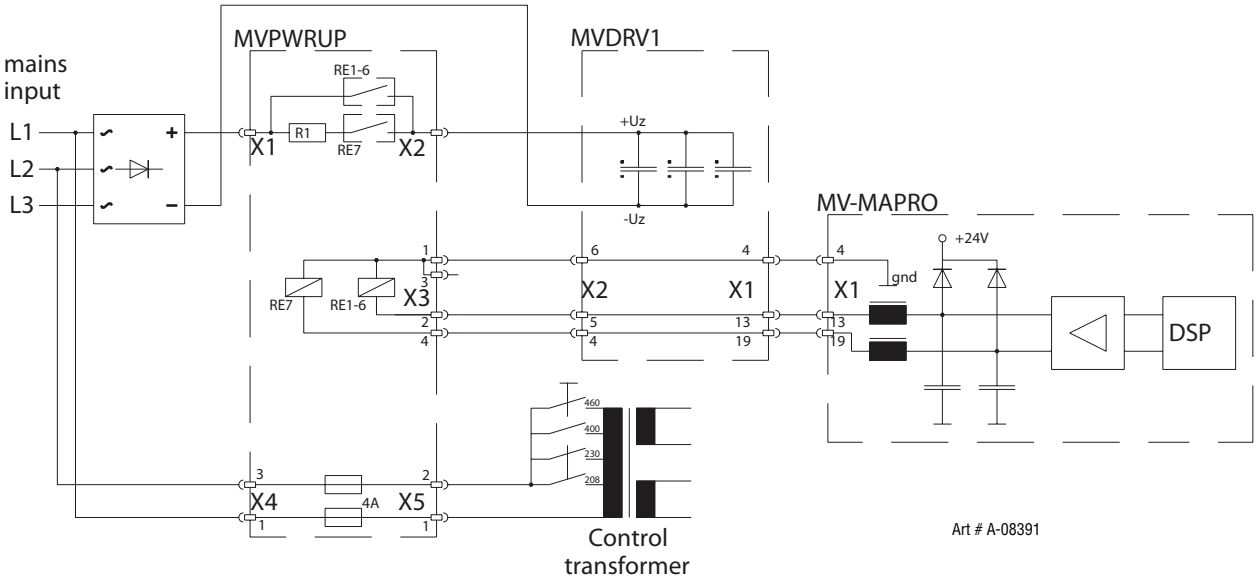
7.12 Flowchart: Soft Power-Up Cycle At Switch On

NOTE

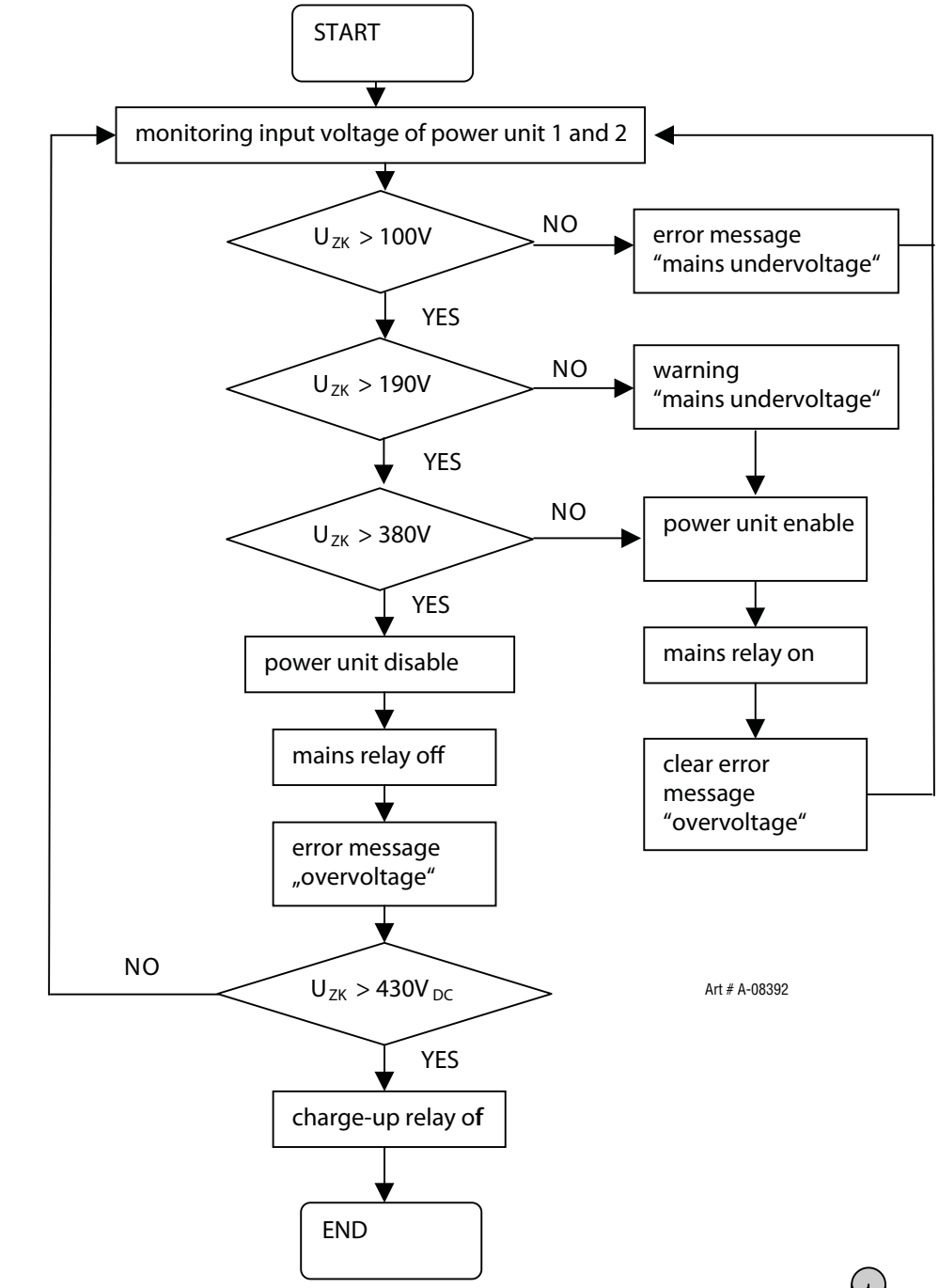
U_{ZK} is the bus voltage after the rectifier



7.13 Power-Up Schematic



7.14 Flowchart: Voltage Monitoring

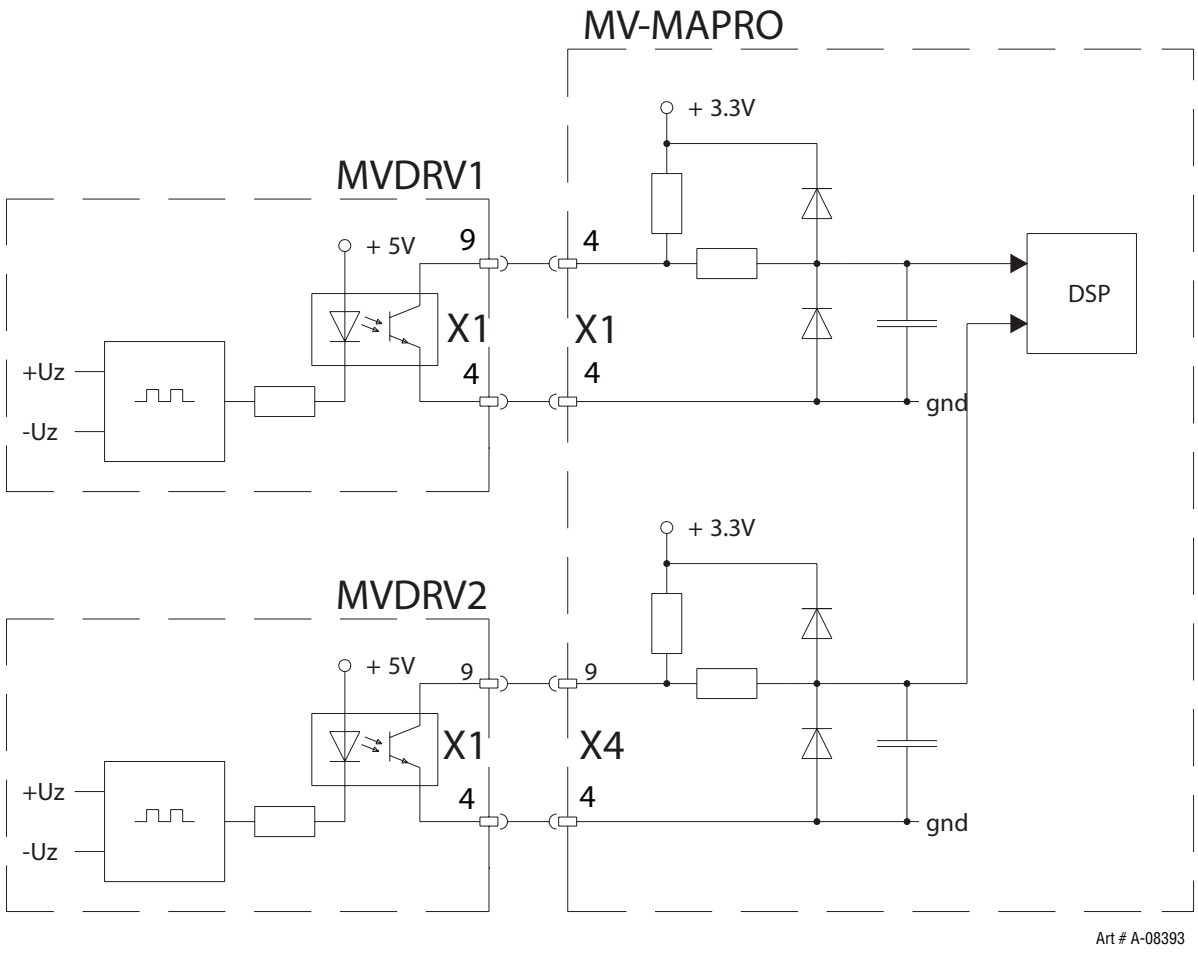


The machine remains in this condition.
By turning off the charge-up relay, the input voltage decreases and the power unit is safe from overvoltage.
A reset is only possible by switching the machine off and on at the mains switch.

7.15 Monitoring Bus Voltage

The bus voltage is monitored by the Process (DSP).

The MVDRV is transmitting a certain frequency to the Process (DSP), depending on the bus voltage level. The higher the bus voltage, the higher the frequency. If the bus voltage is too low or too high, the Process (DSP) stops the machine, showing E22 (mains under-voltage) or E23 (mains overvoltage).



7.16 DP-MAPRO PC Board

The DP-MAPRO PC board provides the welding sequence and manages the process control of the machine. (MAPRO = MAster-PROcess)

Functions

- Logic functions of the welding process
- generating and monitoring supply voltages
- driving power-up-relays
- driving power unit/units
- monitoring control and operating elements (DS20BF, remote control, torch buttons)
- driving fans
- driving cooling pump
- monitoring flowmeter
- monitoring mains- and output voltage
- generating signal "welding current on"
- managing communications between PC and machine
- managing and storage of all welding parameters
- CAN-bus

Normal MAPRO LED Displays:

LED	State	Designation
1 (green)		status CPLD
2 (red)	off	Digital Signal Processor (DSP) ok
3 (green)	on	supply voltage 3,3V DC ok
4 (red)	off	micro controller ok
5 (green)	flashing	DSP is working
6 (green)	flashing	micro controller is working

Malfunction MAPRO LED Displays:

LED	State	Designation
1 (green)		status CPLD
2 (red)	on	DSP is not working
3 (green)	off	supply voltage 3,3V DC is missing check 18V AC of control transformer X2/1 and X2/2
4 (red)	on	micro controller is not working
5 (green)	never on	DSP is not working
6 (green)	never on	micro controller is not working

CAUTION

if the LEDs are indicating a malfunction which can not be relieved by switching the machine off and on again, it is recommended that the PC board DP-MAPRO is exchanged.

Fuses on DP-MAPRO PC Board

fuse	value [A]	Safeguarding
Si 6	1	fans (power unit)
Si 7	2,5	cooling pump

7.17 MAPRO Connector Descriptions & Measuring Points

connector	pin	designation	signal
X1		**interface primary power unit 1**	
X1	1	supply primary control DFW1	
X1	2	supply primary control DFW2	
X1	3	supply primary control	+15V DC
X1	4	gnd for primary control	GND
X1	5	inverter PWM-low 1	
X1	6	inverter PWM-high 1	
X1	7	gnd for secondary control	GND
X1	8	signal primary shut down 1	
X1	9	signal dc-link voltage 1	
X1	10	signal dc-link voltage 2	
X1	11	analog coding power unit 1	
X1	12	temp.sensor primary heatsink 1	
X1	13	power relay	+24V DC
X1	14	supply current sensor	+15V DC
X1	15	current sensor value MVDRV	
X1	16	supply current sensor	-15V DC
X1	17	inverter PWM-low 2	
X1	18	inverter PWM-high 2	
X1	19	charge-up relay	+24V DC
X1	20		
X2		**connector control transformer**	
X2	1	supply 18V AC	18V AC
X2	2	supply 18V AC	18V AC
X2	3	supply 42V AC	42V AC
X2	4	supply 42V AC	42V AC
X3		**connector DS-E**	
X3	1	gnd for supply	GND
X3	2	supply	+24V DC
X3	3	clock	
X3	4	supply from control transformer (fused)	42V AC
X3	5	supply from control transformer (not fused)	42V AC
X3	6	data	
X3	7	strobe	
X3	8	n.c.	
X3	9	n.c.	
X3	10	n.c.	
X4		**interface primary power unit 2**	
X4	1	supply primary control DFW1	
X4	2	supply primary control DFW2	
X4	3	supply primary control	+15V DC
X4	4	gnd for primary control	GND
X4	5	inverter PWM-low 1	
X4	6	inverter PWM-high 1	
X4	7	gnd for secondary control	GND
X4	8	signal primary shut down 2	
X4	9	signal dc-link voltage 1	
X4	10	signal dc-link voltage 2	
X4	11	analog coding power unit 2	
X4	12	temp.sensor primary heatsink 2	
X4	13	power relay	
X4	14	supply current sensor	+15V DC
X4	15	current sensor value MVDRV	
X4	16	supply current sensor	-15V DC
X4	17	inverter PWM-low 2	
X4	18	inverter PWM-high 2	
X4	19	charge-up relay	+24V DC
X4	20		

X5		connector interpass hose	
X5	1	gnd	GND
X5	2	gnd	GND
X5	3	CAN high	
X5	4	CAN low	
X5	5	supply motor +	+70V DC
X5	6	supply motor -	
X5	7	separate wire feeder active	
X5	8	supply	+24V DC

X6		supply fan/pump	
X6	1	230V AC from control transformer	230V AC
X6	2	n.c.	
X6	3	230V AC from control transformer	230V AC
X6	1	only at 320SP : 42V AC from control transformer	42V AC
X6	3	only at 320SP : 42V AC from control transformer	42V AC
X7		connector fan group 1	
X7	1	supply fan	230V AC
X7	2	supply fan	230V AC
X8		CAN interface 1	
X8	1	supply CAN -	
X8	2	supply CAN +	+15V DC
X8	3	CAN low	
X8	4	CAN high	
X8	5	n.c.	
X8	6	n.c.	
X9		connector flowrate sensor	
X9	1	supply flowrate sensor	+15V DC
X9	2	output flowrate sensor	
X9	3	gnd for supply	GND
X9	4	identification “monitoring off“	
X10		connector gas valve (only at TIG option)	
X10	1	supply gas valve	+24V DC
X10	2	supply gas valve	
X11		connector front panel	
X11	1	gnd	GND
X11	2	CAN low	
X11	3	CAN high	
X11	4	n.c.	
X11	5	supply	+5V DC
X11	6	n.c.	
X11	7	n.c.	
X11	8	n.c.	
X11	9	n.c.	
X11	10	gnd	GND

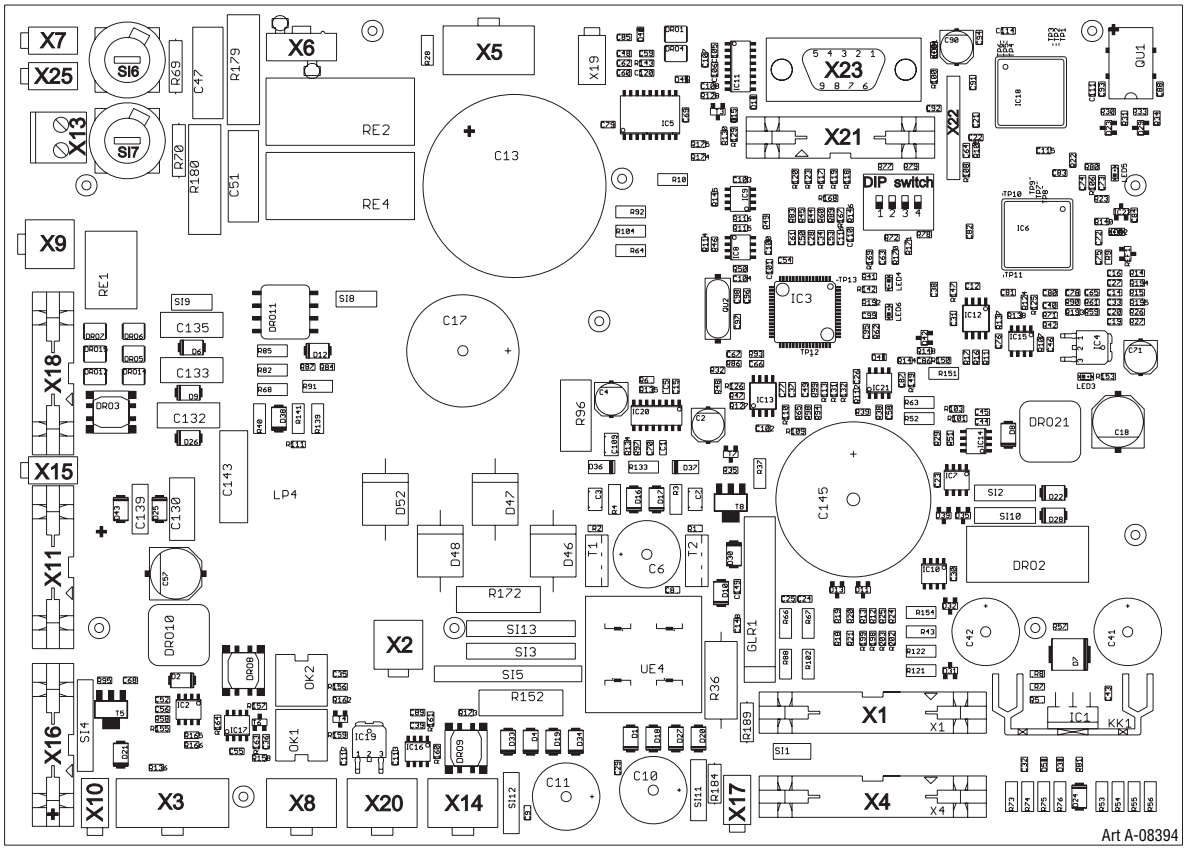
X13		**connector pump / cooling unit**	
X13	1	supply pump	230V AC
X13	2	supply pump	230V AC
X13	1	only 320SP : supply cooling unit	42V AC
X13	2	only 320SP : supply cooling unit	42V AC
X14		**CAN Interface 2**	
X14	1	supply CAN -	
X14	2	supply CAN +	+15V DC
X14	3	CAN low	
X14	4	CAN high	
X14	5	n.c.	
X14	6	n.c.	
X15		**connector TIG torch button**	
X15	1	remote start	
X15	2	gnd for remote start	
X16		**connector VA display**	
X16	1	gnd	GND
X16	2	n.c.	
X16	3	n.c.	
X16	4	data	
X16	5	supply	+5V DC
X16	6	load	
X16	7	clock	
X16	8	n.c.	
X16	9	n.c.	
X16	10	gnd	GND

X17		**connector welding voltage**	
X17	1	arc voltage	
X17	2	gnd for arc voltage	GND
X18		**connector remote control interface**	
X18	1	remote start	
X18	2	gnd for remote start	GND
X18	3	remote plus	+15V DC
X18	4	remote in	
X18	5	remote gnd	GND
X18	6	identification control voltage	
X18	7	gnd	GND
X18	8	identification 2 stroke	
X18	9	contact “welding current on“	
X18	10	contact “welding current on“	
X19		**connector gas test button**	
X19	1	gnd	GND
X19	2	gas test	

X20		**CAN Interface 3**	
X20	1	supply CAN -	
X20	2	supply CAN +	+15V DC
X20	3	CAN low	
X20	4	CAN high	
X20	5	n.c.	
X20	6	n.c.	

X21	**connector JTAG-Interface**		
X21	1	TMS	
X21	2	TRST/	
X21	3	TDI	
X21	4	gnd	GND
X21	5	supply	+5V DC
X21	6	n.c.	
X21	7	JT TDO	
X21	8	gnd	GND
X21	9	JT TCK	
X21	10	gnd	GND
X21	11	JT TCK	
X21	12	gnd	GND
X21	13	JT_EMU0	
X21	14	JT_EMU1	
X22	**connector JTAG-Interface**		
X22	1	supply	+3,3V DC
X22	2	TDO	
X22	3	TDI	
X22	4	n.c.	
X22	5	n.c.	
X22	6	TMS	
X22	7	gnd	GND
X22	8	TCK	
X23	**connector serial interface**		
X23	1	n.c.	
X23	2	TX	
X23	3	RX	
X23	4	DTR	
X23	5	gnd	GND
X23	6	n.c.	
X23	7	RTS	
X23	8	n.c.	
X23	9	n.c.	
X25		**connector fan group 2**	
X25	1	supply fan	230V AC
X25	2	supply fan	230V AC

7.18 MV-MAPRO Diagram



DIP Switch Settings

If the machine is to be programmed via the serial port, the DIP switches 1-3 has to be set to "ON". In normal operation they has to be set to "OFF".

If the PC board is used in a 320SP, the DIP switch 4 has to be set to "ON". For the use in a 400SP or 500SP, DIP switch 4 has to be set to "OFF".

DIP switch	ON	OFF
1	mode serial programming	mode normal operation
2	mode serial programming	mode normal operation
3	mode serial programming	mode normal operation
4	configuration 320SP	configuration 400SP, 500SP

7.19 DMR PC Board

The DMR PC board is the wire feed motor control of the machine.

Functions

- control and monitoring wire feed motor
- driving solenoid valve
- control and monitoring of operating elements (DS20BF, remote control, torch buttons)
- monitoring wire insert button
- supply PP90R PC board (Push-Pull)

Normal DMR LED Displays:

LED	state	designation
1 (red)	off	microcontroller ok
2 (green)	on	supply voltage 5V ok

Malfunction DMR LED Displays:

LED	state	designation
1 (red)	is lit weak	microcontroller not programmed
	flashes	malfunction CAN bus
2 (green)	off	supply voltage 5V not ok

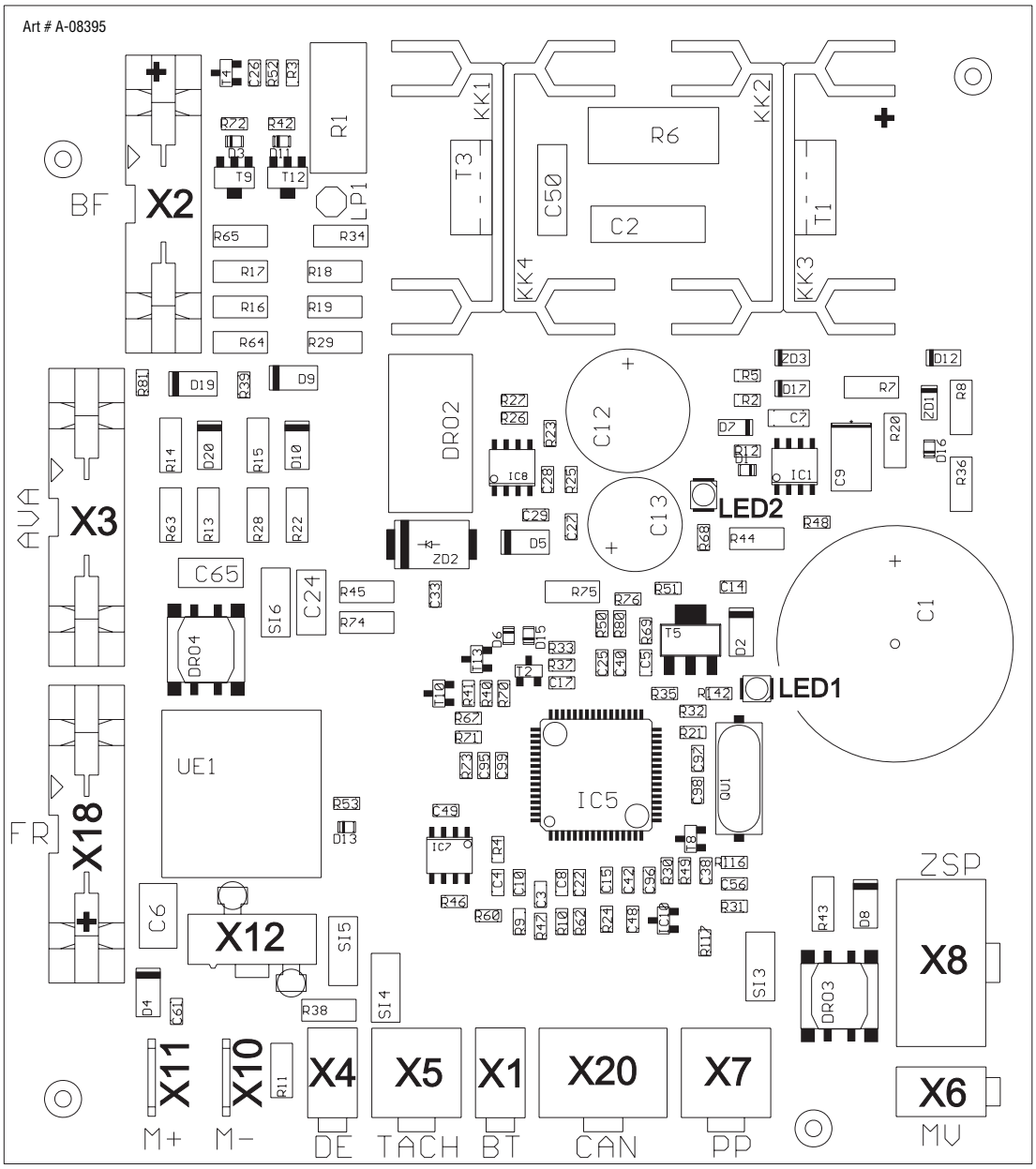
7.20 DMR Connector Descriptions & Measuring Points

connector	pin	designation	signal
X1		**connector torch button**	
X1	1	torch button	
X1	2	torch button	
X2		**connector front panel**	
X2	1	gnd	GND
X2	2	CAN low	
X2	3	CAN high	
X2	4	n.c.	
X2	5	supply	+5V DC
X2	6	n.c.	
X2	7	n.c.	
X2	8	n.c.	
X2	9	n.c.	
X2	10	gnd	GND
X3		**connector VA display**	
X3	1	gnd	GND
X3	2	n.c.	
X3	3	n.c.	
X3	4	data	
X3	5	supply	+5V DC
X3	6	load	
X3	7	clock	
X3	8	flash mode	
X3	9	programming voltage	+24V DC
X3	10	gnd	GND
X4		**connector wire insert button**	
X4	1	gnd	GND
X4	2	wire insert button	
X5		**connector tacho**	
X5	1	supply	+5V DC
X5	2	tacho signal	
X5	3	gnd	GND
X5	4	tacho on	

X6		connector gas valve	
X6	1	supply gas valve	+24V DC
X6	2	signal gas valve	

X7		connector Push-Pull	
X7	1	supply Push-Pull relais	+24V DC
X7	2	supply Push-Pull motor	+70V DC
X7	3	signal Push-Pull relais	
X7	4	gnd	GND
X8		**connector interpass hose**	
X8	1	gnd	GND
X8	2	gnd	GND
X8	3	CAN high	
X8	4	CAN low	
X8	5	supply motor	+70V DC
X8	6	supply motor	
X8	7	wire feeder case active	
X8	8	supply	+24V DC
X10/X11		**connector Motor**	
X10		wire feed motor -	
X11		wire feed motor +	
X12		**connector welding voltage**	
X12	1	torch button (X1/1)	
X12	2	welding voltage +	
X12	3	torch button (X1/2)	
X18		**connector remote control socket**	
X18	1	remote start	
X18	2	gnd for remote start	GND
X18	3	n.c.	
X18	4	n.c.	
X18	5	n.c.	GND
X18	6	n.c.	
X18	7	gnd	GND
X18	8	n.c.	
X18	9	supply	+24V DC
X18	10	signal “welding current on“	

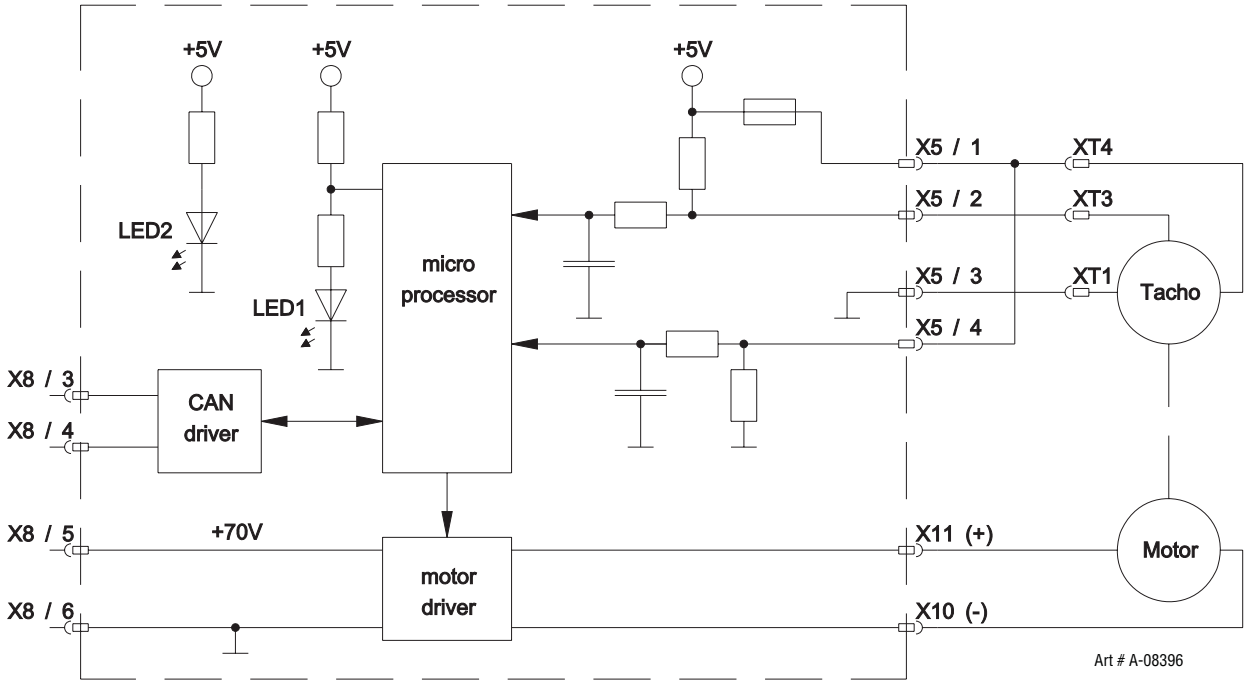
7.21 DMR Diagram



7.22 DMR Schematic

The DMR communicates with the MV-MAPRO via the CAN bus. The microprocessor drives the wire feed motor and monitors the tacho signal of the motor. The monitoring of the tacho signal is enabled via pin 4 of connector X5 (hard-wired in the cable harness). The tacho is supplied with 5V on X5 pin 1 and the digital output signal of the tacho is present at X5 pin 2. The microprocessor also monitors the current consumption of the motor. If the motor draws too much current (for example if the wire feed unit is mechanically blocked), the machine will stop and display E08 (error wire feed / tacho).

Another reason for E08 (error wire feed / tacho) is that the CAN bus is blocked or interfered (no data can be sent or received).



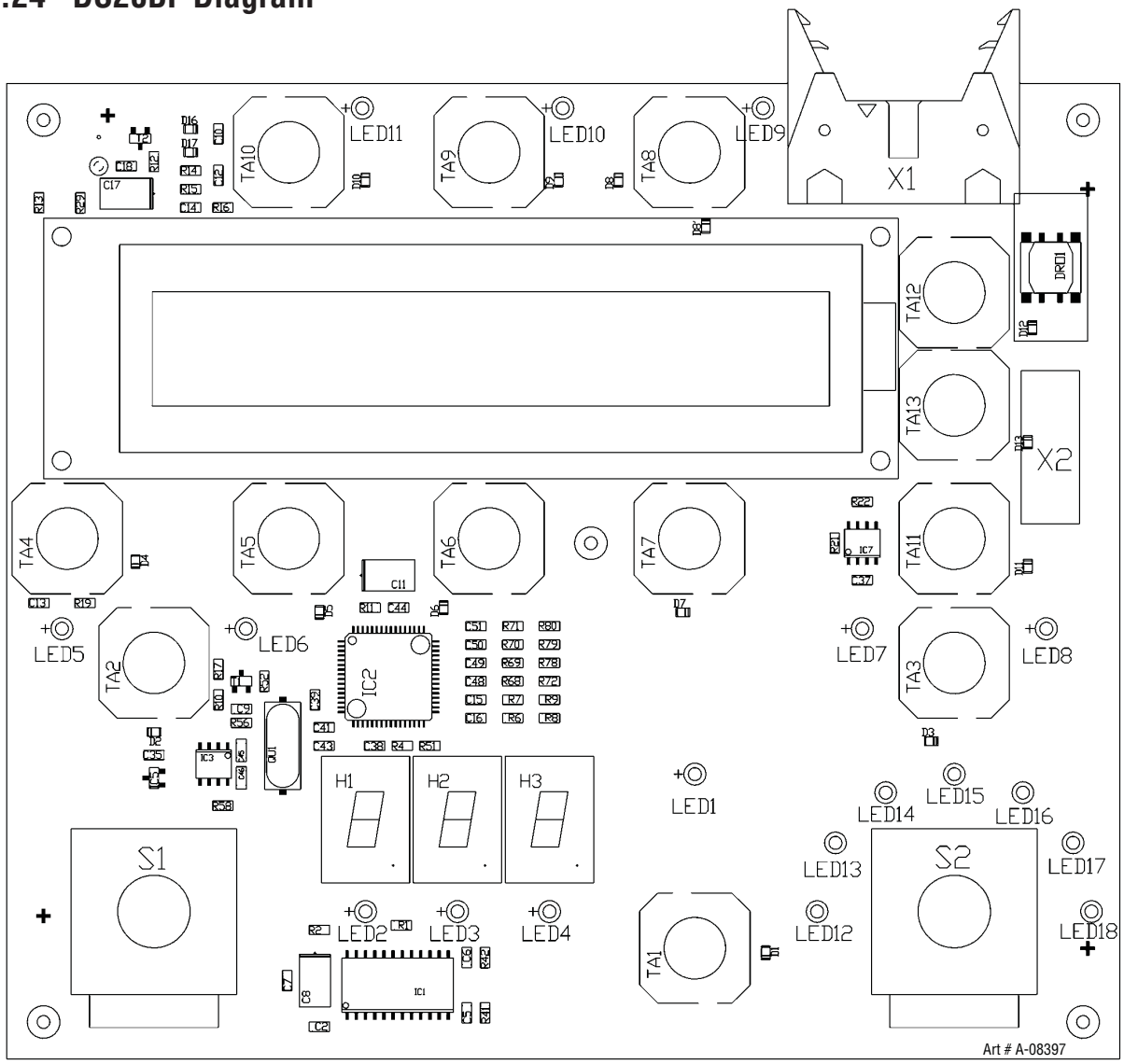
7.23 DS20BF PC Board

The DS20BF PC board is the front panel with all buttons, rotary impulse encoder and all displays.

Functions

- operating/setup the machine
- display of all welding parameters
- display error messages
- display machine parameters (version operating system, actual values etc.)

7.24 DS20BF Diagram



7.25 DS20BF Display Test

The display has a internal function test. To execute the test press the buttons (arrow down) and “Process“ at the same time. Now the LCD-Display shows "Display Test" and the version number of the display operating system. Press any button to start the first test, where all LEDs and the LCD-Display are turned on and off alternately. The LCD-Display shows "LEDs on, Backlight off".

Press any button to go to the next test. In this test all buttons are checked, by pressing all 12 buttons one after another. After that the rotary impulse encoders are checked. The LCD-Display shows a cursor which can be moved by the rotary impulse encoders. At first the cursor has to be moved to the right with the left rotary impulse encoder then to the left. After that the cursor has to be moved to the right and left with the right rotary impulse encoder.

Then the test is completed and the LCD-Display shows “End of Tests“. The machine goes back into normal mode, which was displayed before the display test was executed

7.26 MVDRV / MVMDRV PC Board

The MVDRV PC board manages the primary drive level of the 400SP and 500SP power units.

The MVMDRV PC board manages the primary drive level of the 320SP power unit.

Functions

- encoding power unit
- connection temperature sensor of heat sink
- connection current sensor
- monitoring DC link voltage and supply voltage
- pass through signal power-up relays.

Encoding Power Unit

DIP S1-1	DIP S1-2	setting	machine type
off	off	240 A	400SP
off	on	270 A	320SP
on	off	300 A	500SP
on	on	reserved	

Normal MVDRV LED Displays:

LED	State	Designation
1 (green)	on	supply high side ok
2 (green)	on	supply low side ok
3 (red)	on / off	drive level high side
4 (red)	on / off	drive level low side

Malfunction MVDRV LED Displays:

LED	state	reason
1 (green)	off	supply high side not ok
2 (green)	off	supply low side not ok
3 (red)		drive level high side
4 (red)		drive level low side

Normal MVMRV LED Displays:

LED	State	Designation
1 (green)	on	supply high side1 ok
2 (green)	on	supply low side1 ok
3 (green)	on / off	drive level high side1
4 (green)	on / off	drive level low side1
5 (green)	on / off	drive level low side2
6 (green)	on / off	drive level high side2
7 (green)	on	supply high side2 ok
8 (green)	on	supply low side2 ok

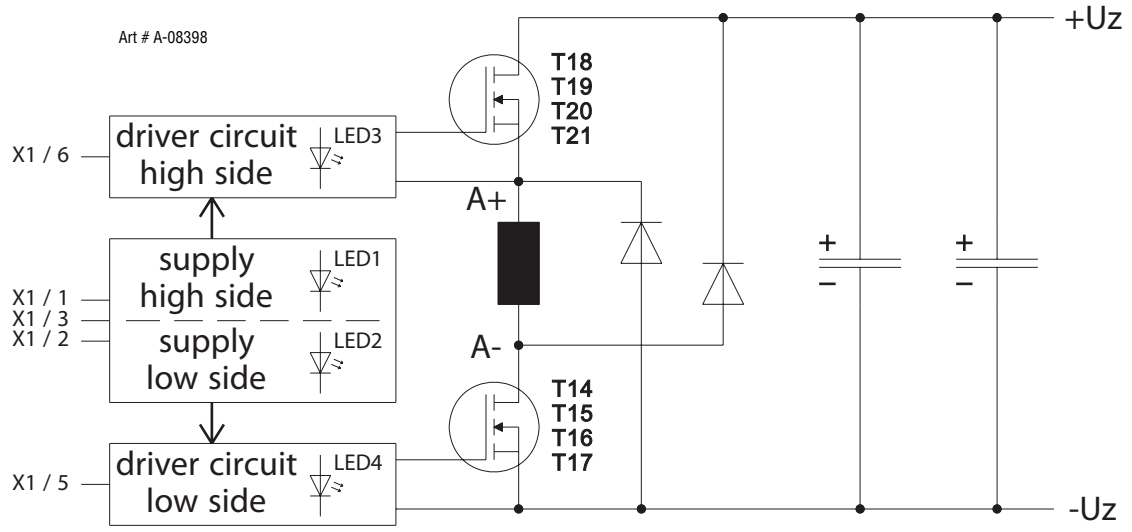
Malfunction MVMDRV LED Displays:

LED	state	reason
1 (green)	off	supply high side1 not ok
2 (green)	off	supply low side1 not ok
3 (green)		drive level high side1
4 (green)		drive level low side1
5 (green)		drive level low side2
6 (green)		drive level high side2
7 (green)	off	supply high side2 not ok
8 (green)	off	supply low side2 not ok

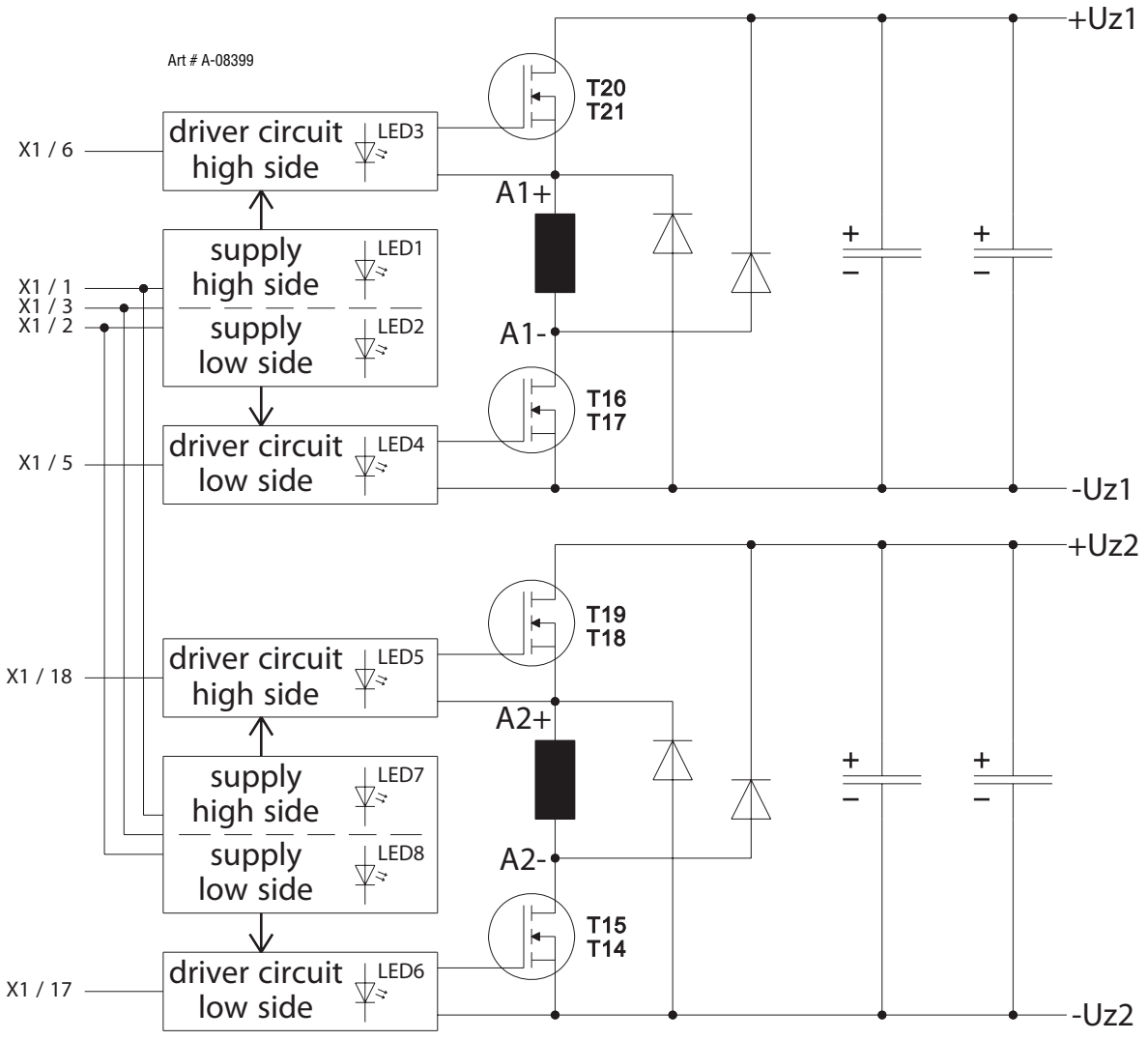
7.27 MVMRV / MVMDRV Connector Descriptions & Measuring Points

Connector	Pin	Designation	Signal
X1	**interface primary power unit 1**		
X1	1	supply primary control DFW1	
X1	2	supply primary control DFW2	
X1	3	supply primary control	+15V DC
X1	4	gnd for primary control	gnd
X1	5	inverter PWM-low 1	
X1	6	inverter PWM-high 1	
X1	7	gnd for secondary control	gnd
X1	8	signal primary shut down 1	
X1	9	signal DC-link voltage UZ1	
X1	10	signal DC-link voltage UZ2	
X1	11	analog coding power unit	
X1	12	temp.sensor primary heatsink	
X1	13	power relay	+24V DC
X1	14	supply current sensor	+15V DC
X1	15	current sensor value MVDRV	
X1	16	supply current sensor	-15V DC
X1	17	inverter PWM-low 2	
X1	18	inverter PWM-high 2	
X1	19	charge-up relay	+24V DC
X1	20		
X2	**connector LSW / PRWUP**		
X2	1	supply current sensor	+15V DC
X2	2	current sensor value MVDRV	
X2	3	supply current sensor	-15V DC
X2	4	charge-up relay	+24V DC
X2	5	power relay	+24V DC
X2	6	gnd	gnd
X3	**connector temp.sensor**		
X3	1	gnd	gnd
X3	2	temp.sensor	10k? at 25°C (about +2V DC)

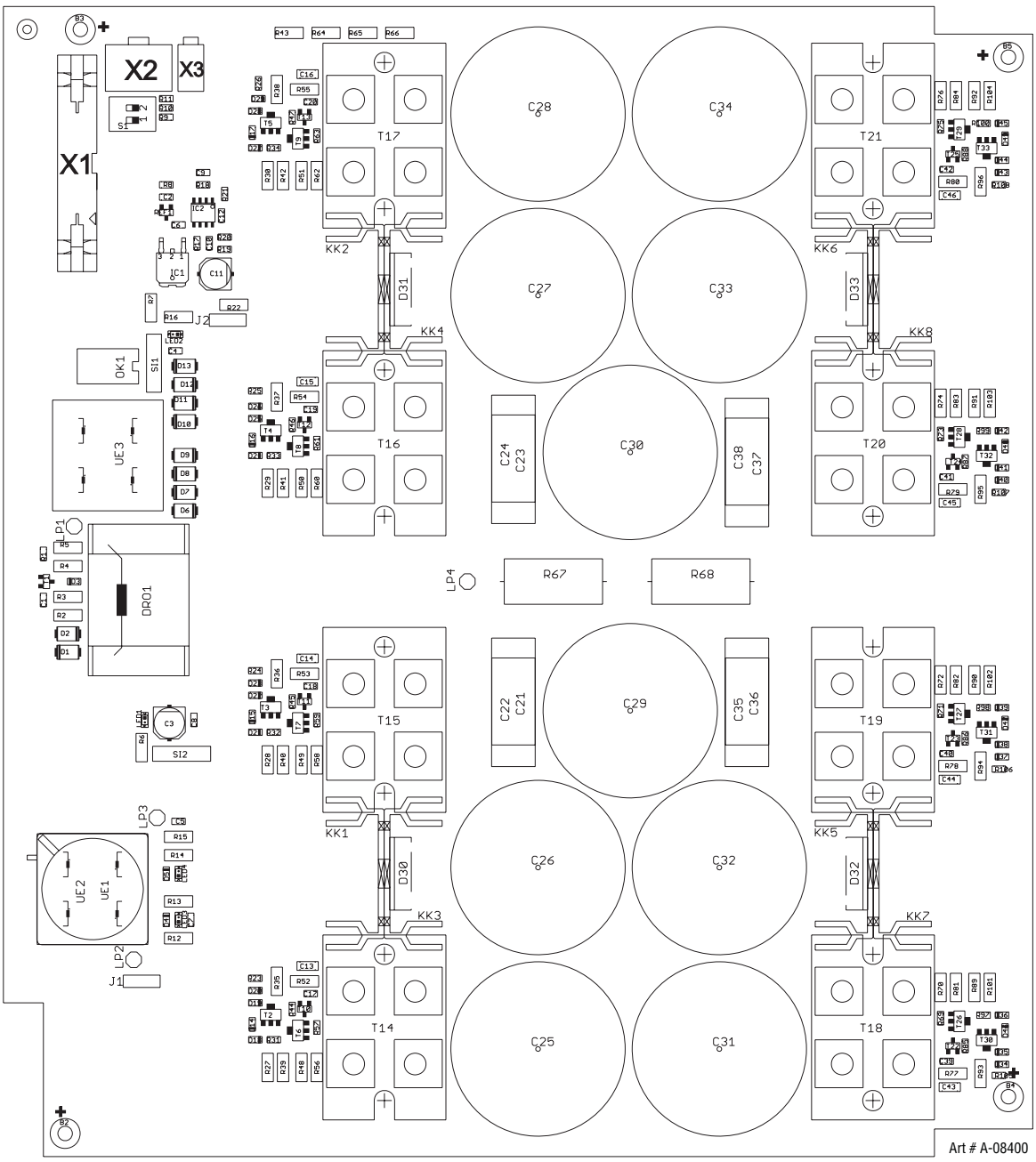
7.28 MVDRV Schematic



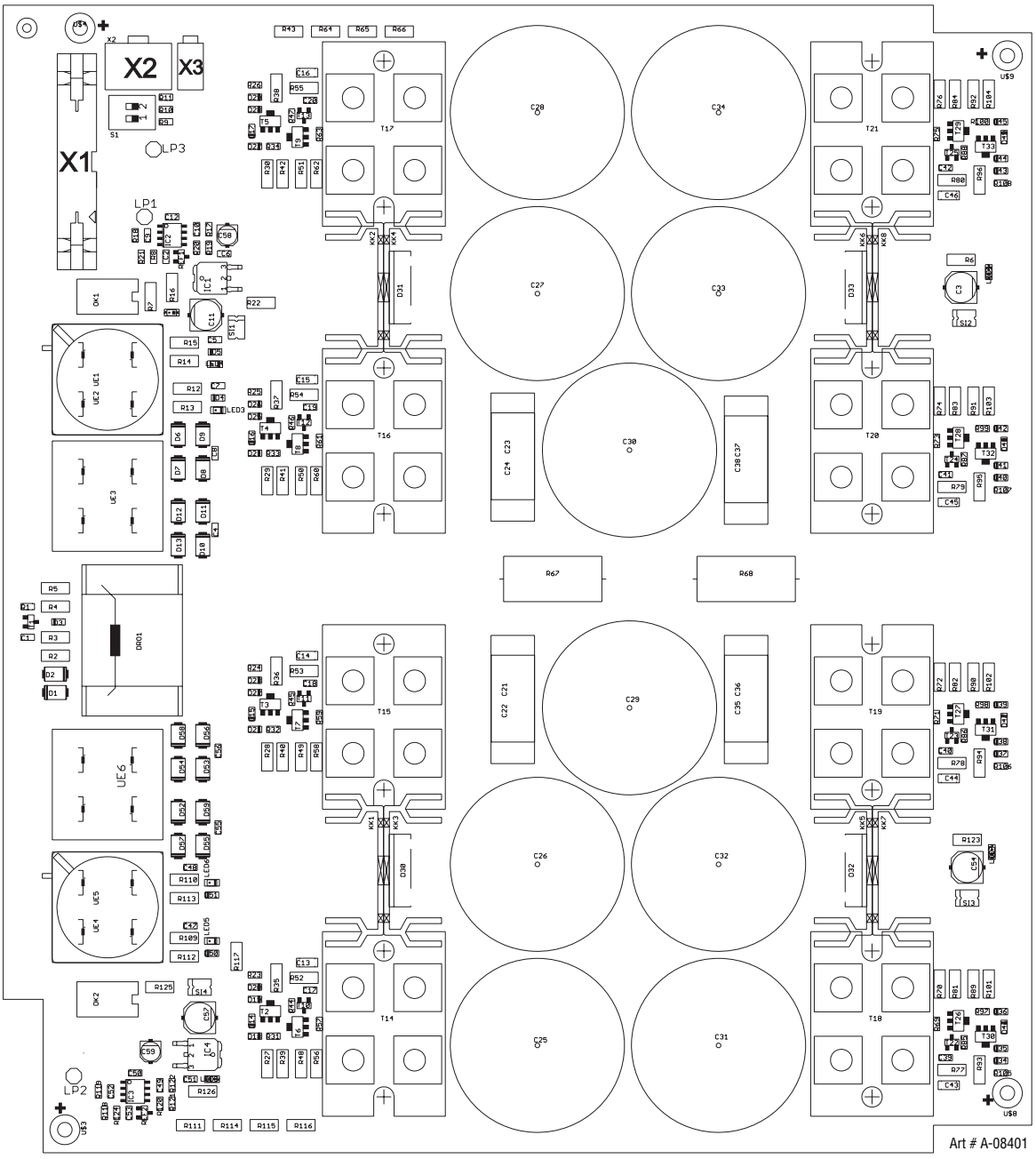
7.29 MVMDRV Schematic



7.30 MVDRV Diagram



7.31 MVMDRV Diagram



7.32 MVPWRUP PC Board

The MVPWRUP PC board is the power up board of the 320SP, 400SP and 500SP.

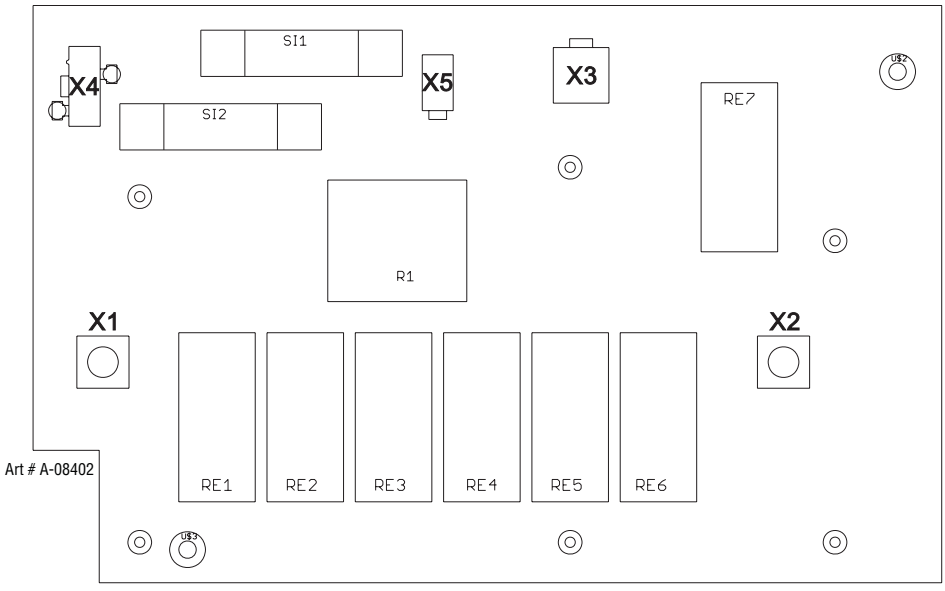
Functions

- reducing start-up peak current for capacitors
- supply and safeguarding of control transformer

7.33 MVPWRUP Connector Descriptions & Measuring Points

Connector	Pin	Designation	Signal
X1		**DC link voltage input**	
X2		**DC link voltage output**	
X3		**connector relays**	
X3	1, 3	supply relays	+24V DC
X3	2	drive level power relays	
X3	4	drive level charge up relay	
X4		**mains input**	
X4	1	phase L1	400V AC
X4	3	phase L2	400V AC
X5		**connector control transformer**	
X5	1	supply control transformer (phase L1)	400V AC
X5	2	supply control transformer (phase L2)	400V AC

7.34 MVPWRUP Diagram



Si1 and Si2 fuses protect the control transformer. 4A slow blow each

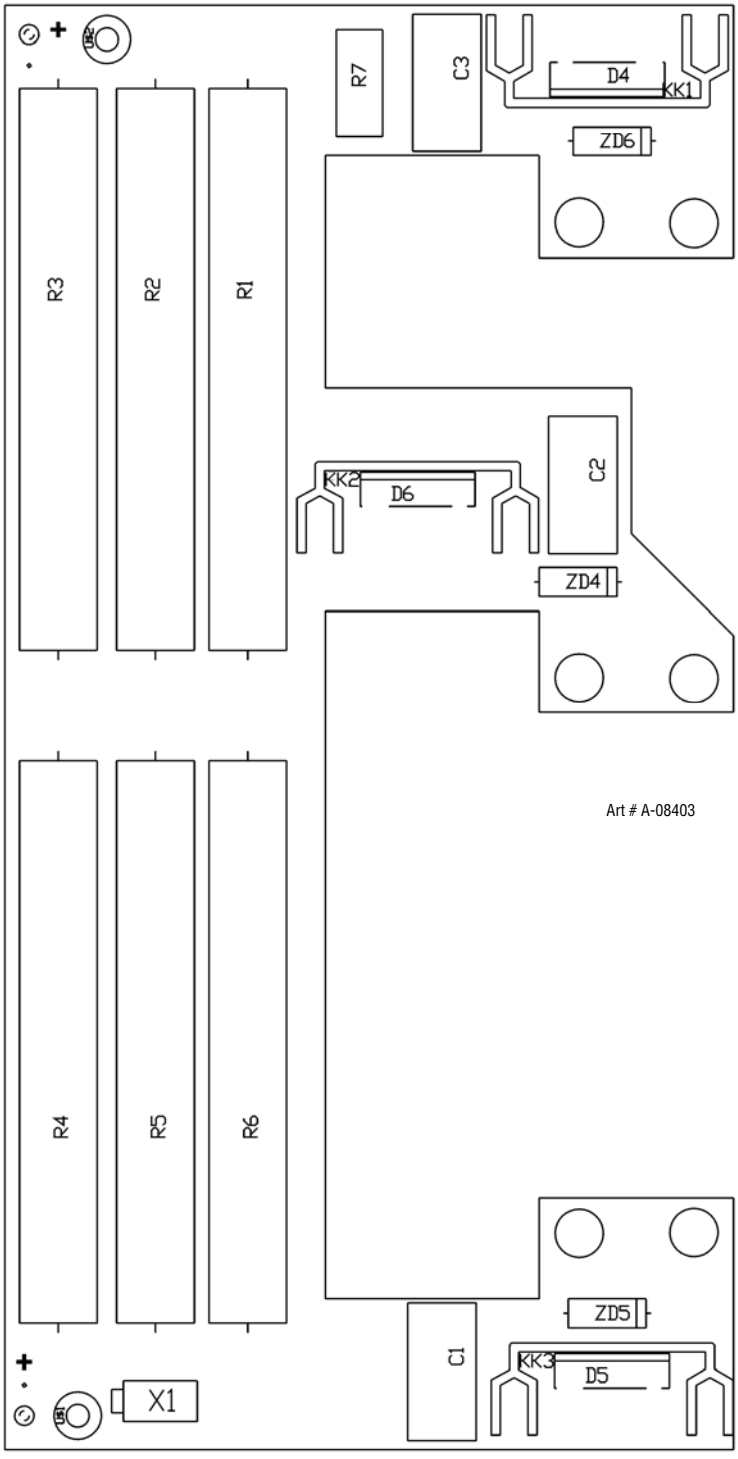
7.35 DK-GLCL PC Board

The DK-GLCL PC board is for wiring the secondary rectifier diodes.

Functions

- wiring
- pulse smoothing

7.36 DK-GLCL PC Board Diagram



7.37 DP-UFI-BO PC Board

Functions

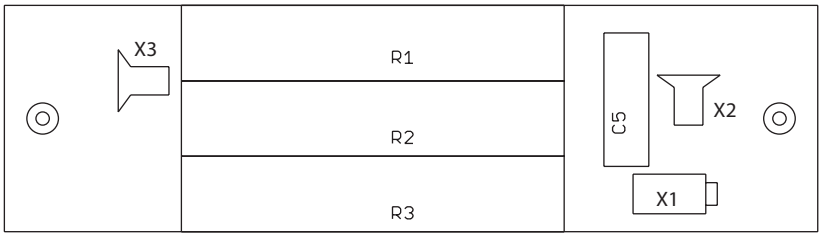
- wiring welding sockets
- providing output voltage

Normal DP-UFI-BO LED Displays:

LED	state	designation
1 (green)	on	holf-function active

connector	Pin	Designation	Signal
X1	**connector**		
X1	1	“+“ welding voltage (in MMA mode)	+ 80V DC
X1	2	“-“ welding voltage	
X2, X3	**connector**		
X2		“-“ welding voltage	
X3		“+“ welding voltage (in MMA mode)	+80V DC

7.38 DP-UFI-BO PC Board Diagram



Art # A-08405

7.39 DP-EMV PC Board

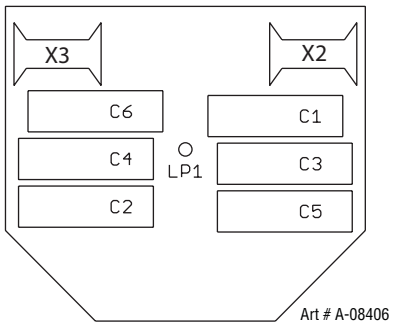
Functions

- EMC filter

7.40 DP-EMV Connector Descriptions & Measuring Points

Connector	Pin	Designation	Signal
X2, X3	**connector**		
X2		"-" welding voltage	
X3		"+" welding voltage (in MMA mode)	+80V DC

7.41 DP-EMV PC Board Diagram



7.42 DS-VA PC Board

The DS-VA PC board is the digital volt and ampere display.

Functions

- display nominal and actual values of welding voltage and welding current
- hold-function of the last welding values

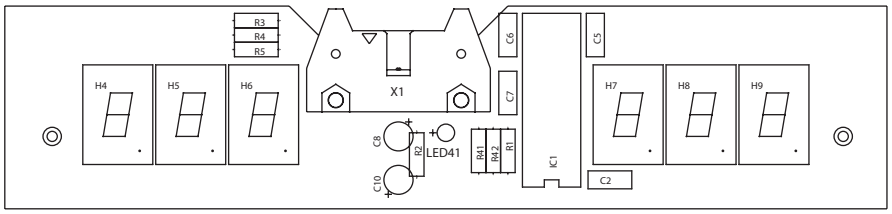
Normal DS-VA LED Displays:

LED	state	designation
1 (green)	on	hold-function active

7.43 DS-VA Connector Descriptions & Measuring Points

Connector	Pin	Designation	Signal
X1	**connector VA display**		
X1	1	gnd	gnd
X1	2	data	
X1	3	gnd	gnd
X1	4	data	
X1	5	supply	+5V DC
X1	6	load	
X1	7	clock	
X1	8	gnd	gnd
X1	9	clock	
X1	10	gnd	gnd

7.44 DS-VA PC Board Diagram



Art # A-08407

7.45 DP-S3NEFI PC Board

The DP-S3NEFI PC board is the mains filter and power up board for the 320SP.

Functions

- mains filter
- reducing start-up peak current for capacitors
- supply and safeguarding for control transformer

7.46 Current Sensor VAC

The current sensor is a 500A sensor with an output ratio of 2000:1

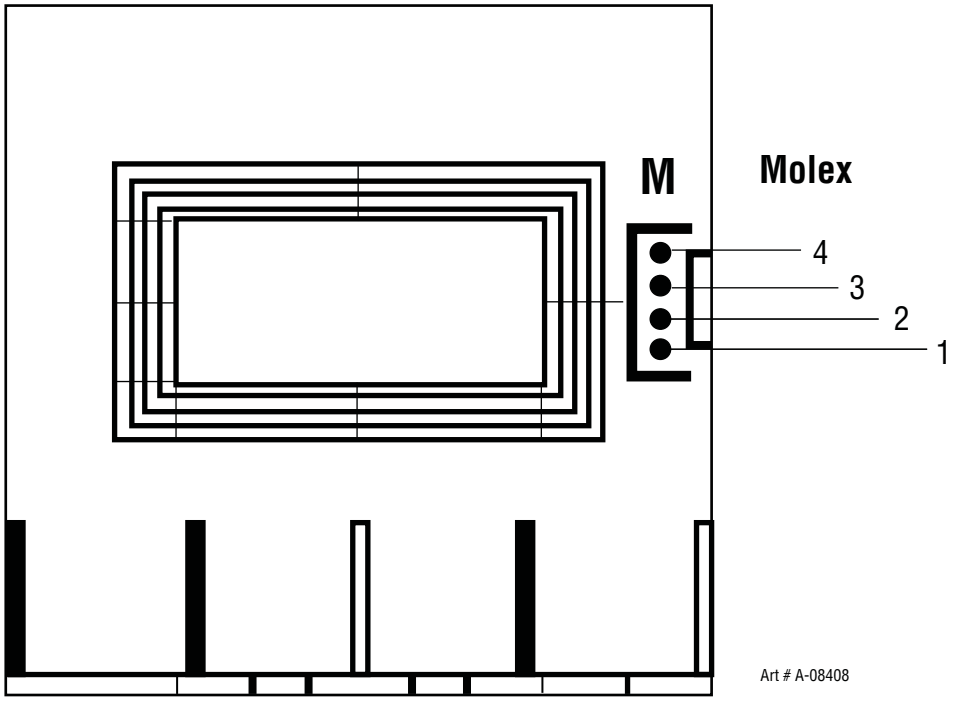
Functions

- measuring welding current

7.47 Current Sensor VAC Connector Descriptions & Measuring Points

Connector	Pin	Designation	Signal
X1		**connector**	
X1	1	supply +	+15V DC
X1	2	supply -	-15V DC
X1	3	sensor output	
X1	4	GND	

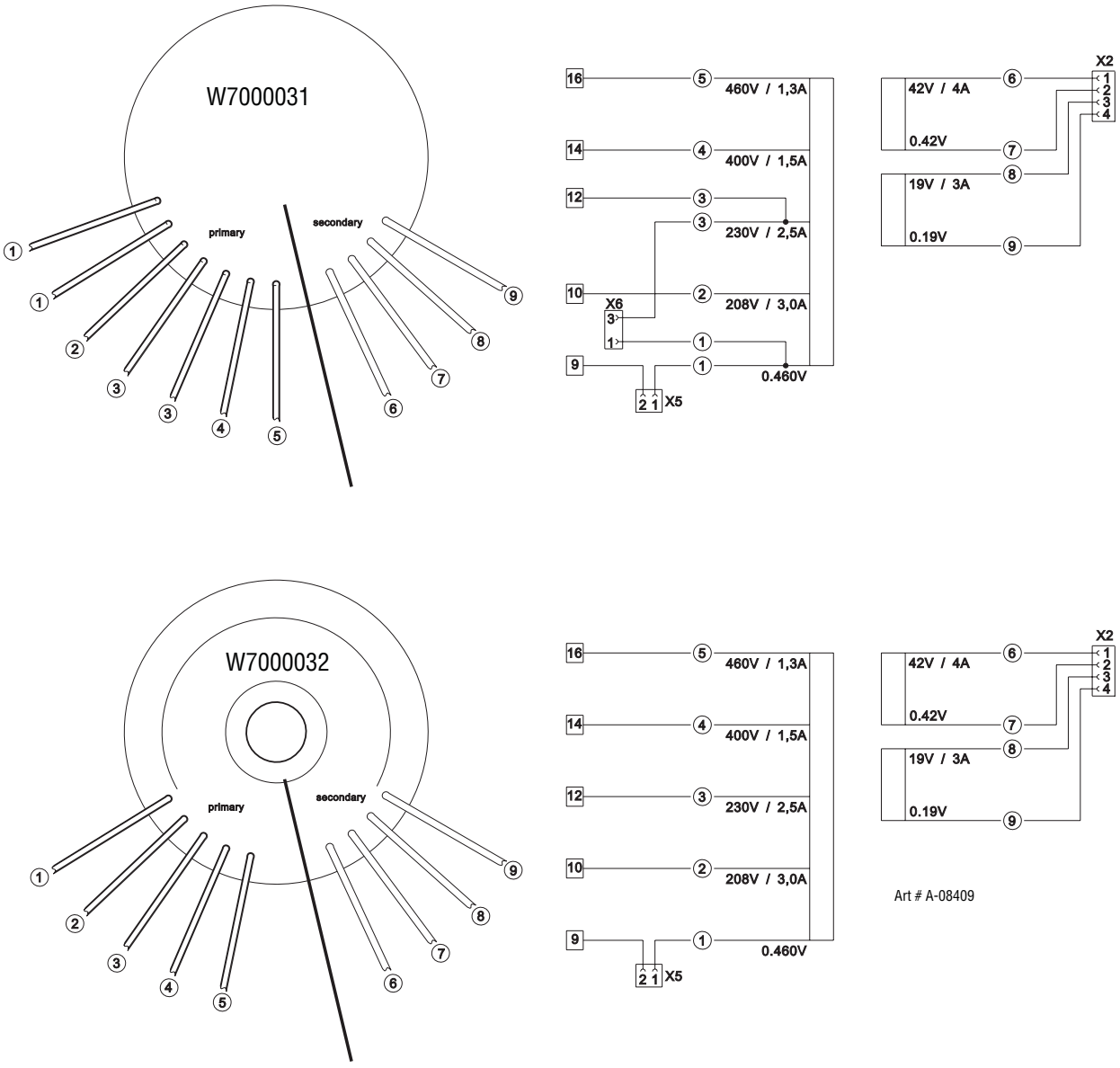
7.48 Current Sensor VAC Diagram



7.49 Control Transformer

W7000031 is used in 400SP and 500SP

W7000032 is used in 320SP



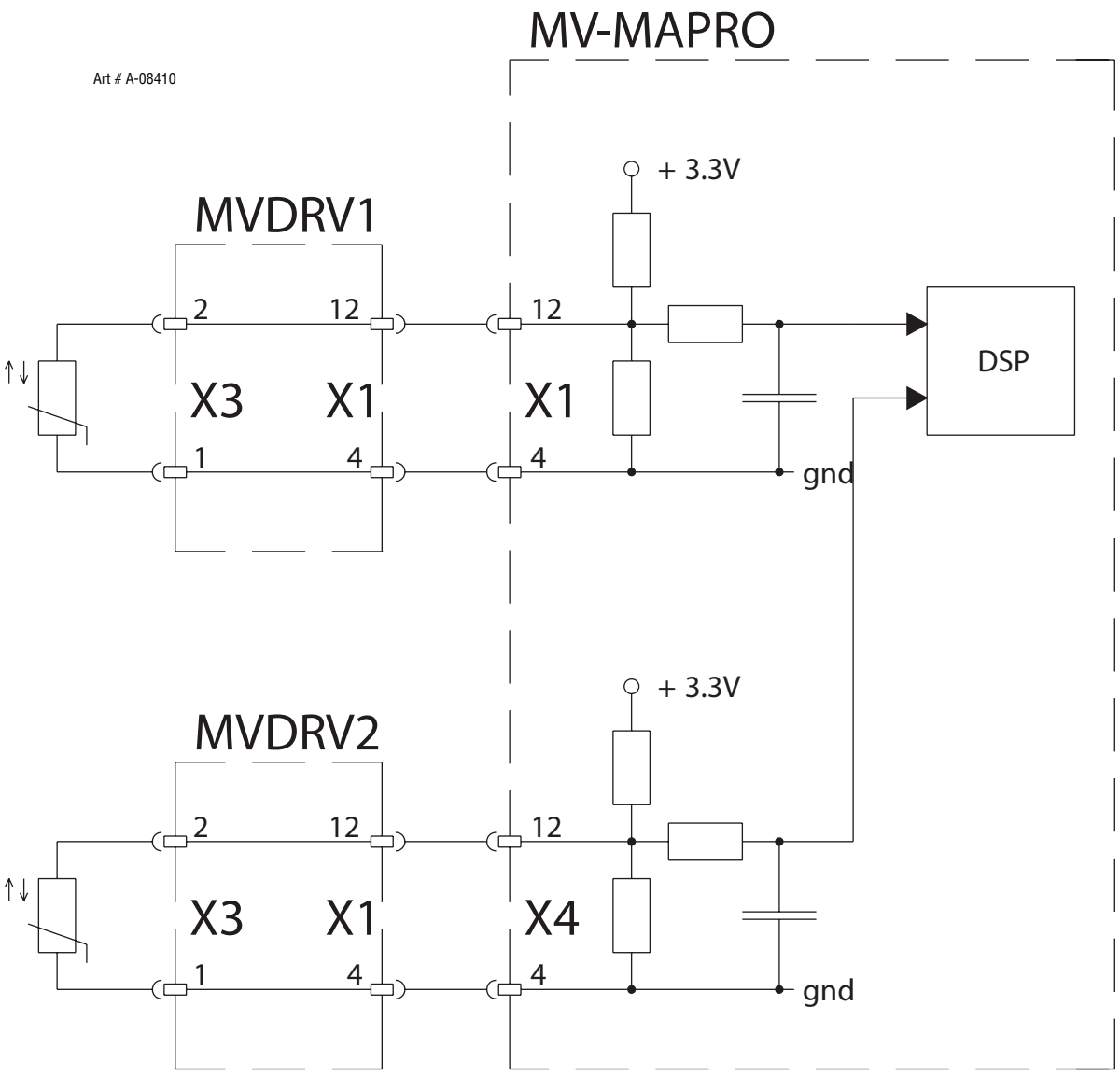
7.50 Measuring Temperature

The temperature of the power unit is measured via an NTC resistor. Each heatsink has one NTC resistor:

The resistor value of the NTC is 10k ohms at 25°C.

Machine Type	No. of NTCs
320SP	1
400SP	2
500SP	2

7.51 PCB Connection Diagram

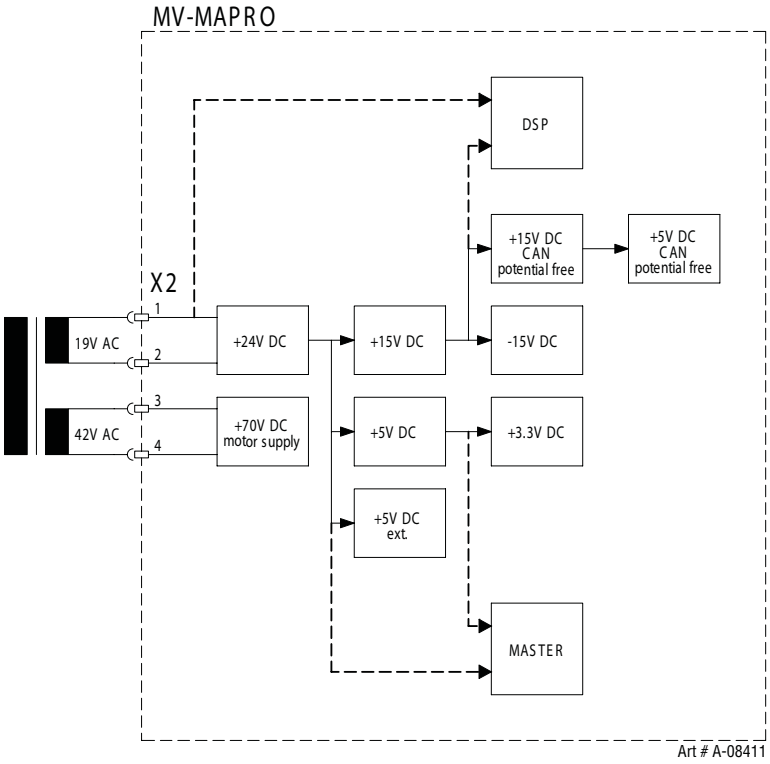


7.52 Supply Voltages

The MV-MAPRO is producing all the necessary supply voltages out of the control transformer.

The 19VAC from the control transformer and the +15V DC are monitored by the DSP (Process).

The +24V DC and +5V DC are monitored by the Master.



If the 24V drops below 17V, the Master will stop the machine and displays E14 (Op. voltages error).

If the 24V are higher than 36V, the Master will stop the machine and displays E02 (mains overvoltage).

If the 19V of the control transformer are not present during initialization (switching on the machine), the DSP (Process) stops the machine and displays E18.

If the 15V drops below 12V or are higher than 17V, the DSP will stop the machine and displays E30 (Op. voltage 15V error).

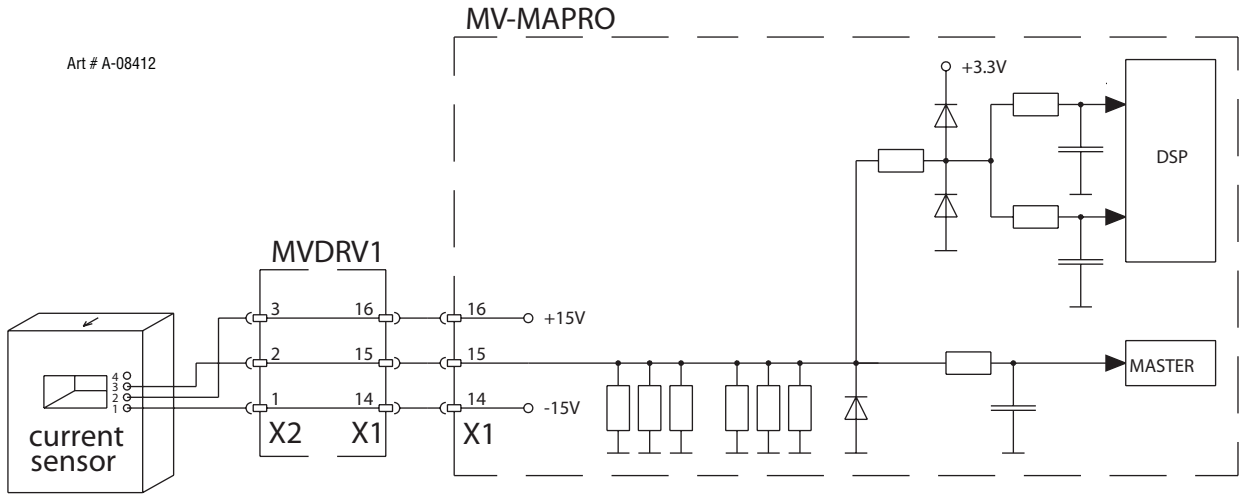
The actual values of the supply voltages 24V and 15V, can be displayed via menu Extras, Diagnosis, Operating Voltages.

7.53 Measuring Welding Current

The welding current is measured with the VAC current sensor. It is connected via the MVDRV (400SP and 500SP) or the MVMDRV (320SP) to the MV-MAPRO.

The output of the sensor is a current with a ratio of 2000:1. For example: if 100A welding current are flowing, the sensor output would be 50mA.

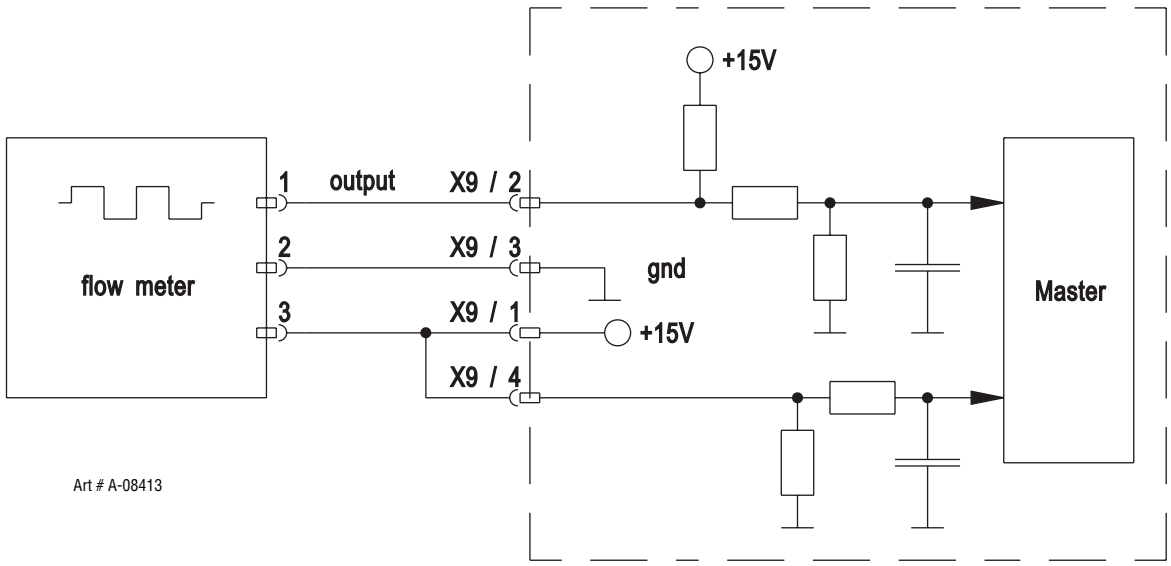
The current is measured simultaneously by the Master and the Process (DSP).



7.54 Measuring the Flow Rate of the Cooling System

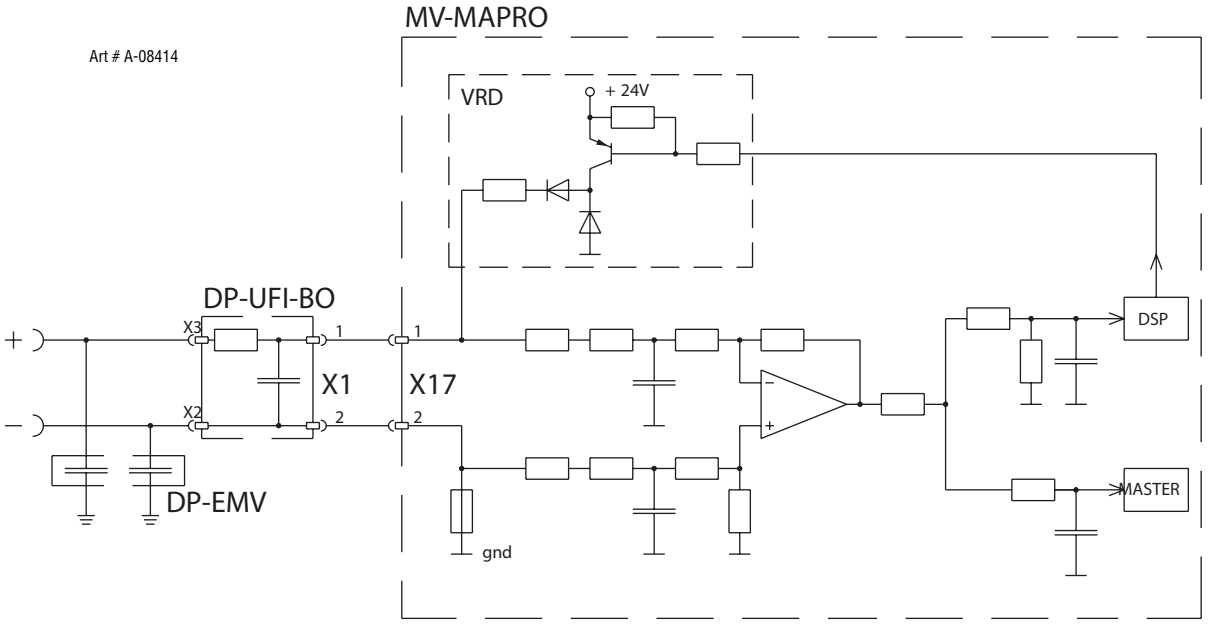
The flow rate of the cooling system is measured by the Master. The actual value can be displayed in menu Extras, Diagnosis, Cooling system. If the flow rate drops below 0.3 l/min, the Master will stop the machine and shows E05 in the display.

The monitoring of the flow meter can be deactivated by connecting pin 1 with pin 4 of the connector X9.



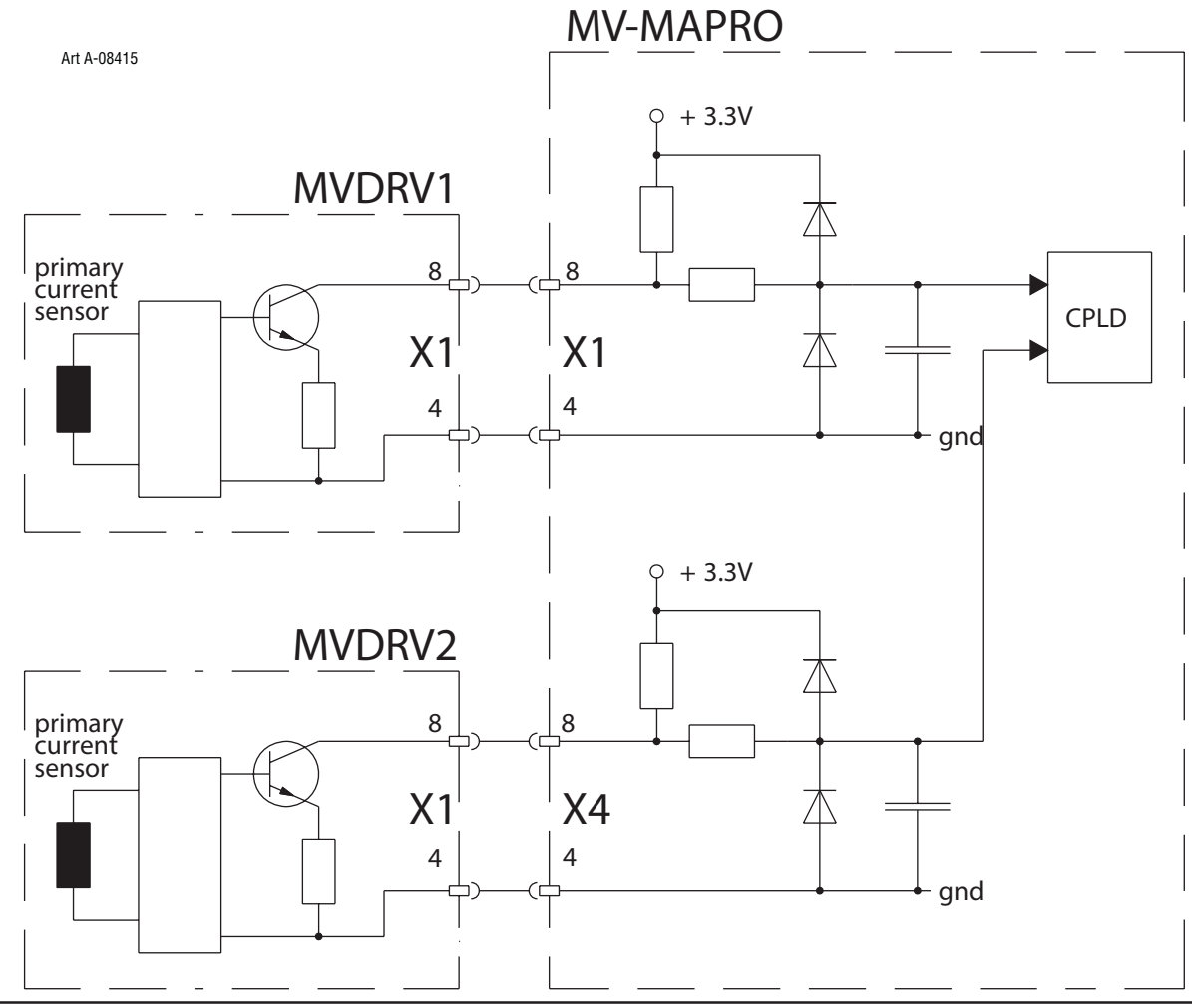
7.55 Measuring Output Voltage

The output voltage is measured by the Master and the Process (DSP) at the same time. The output sockets are wired via the PCB DP-UFI-BO to the MV-MAPRO.



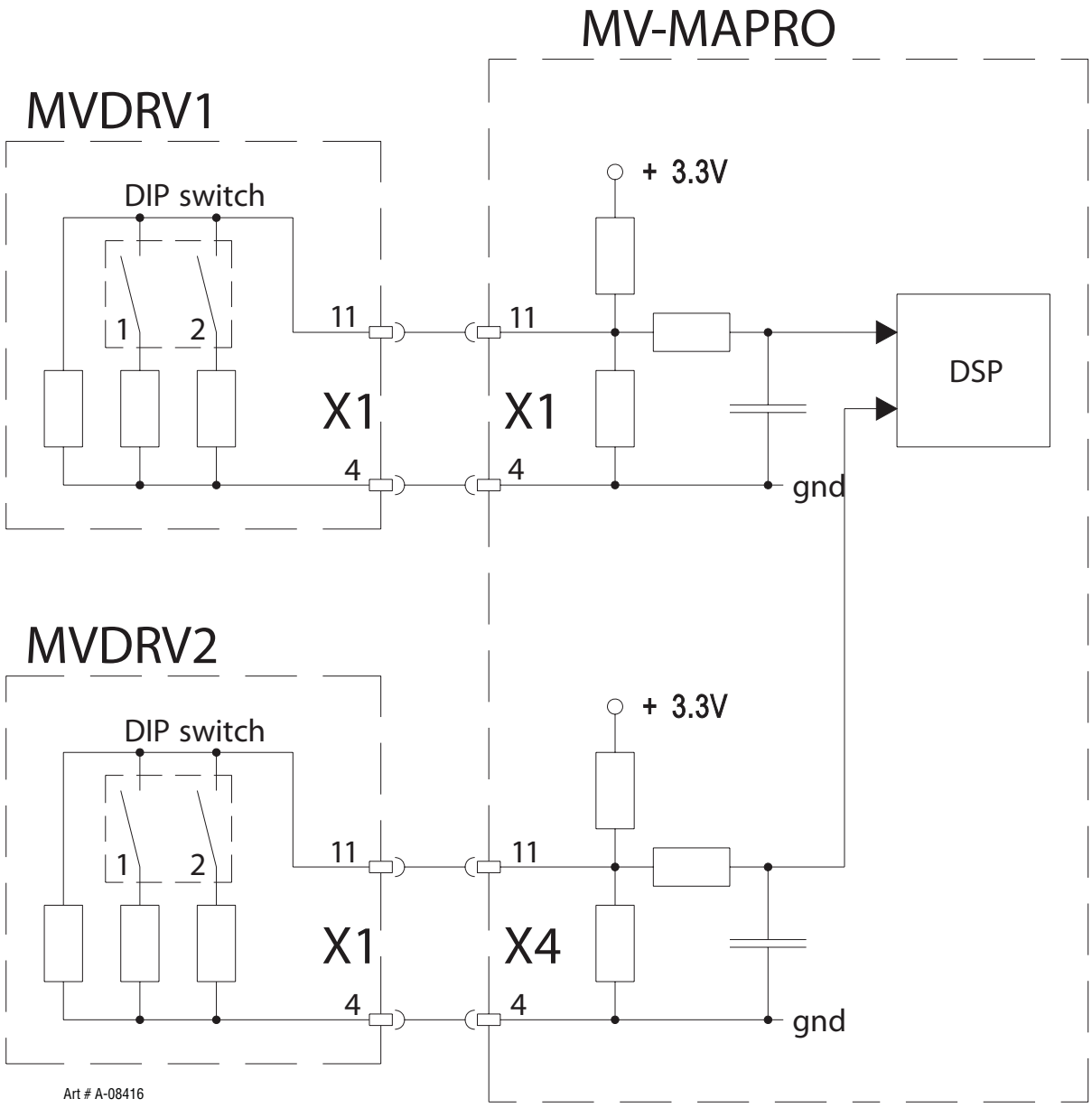
7.56 Overcurrent Protection

As soon as the power units draw too much current from the mains, the machine stops immediately and displays E16 (overcurrent protection power unit 1) or E 24 (overcurrent protection power unit 2).



7.57 Encoding Power Units

During the initialization (switching on the machine), the Process (DSP) is reading the machine configuration and detects what power units are attached to the MV-MAPRO. The type of the power units are set by the DIP switch on the MVDRV 500SP) or MVMDRV boards (320SP).



Encoding Power Unit

jumper J1	jumper J2	setting	machine type
0	0	240 A	400SP
0	1	270 A	320SP
1	0	300 A	500SP
1	1	reserved	

0 = contact open

1 = contact closed

If DIP switches are used instead of jumpers: 0 = "OFF", 1 = "ON"

SECTION 8:
PARTS LIST

8.01 Equipment Identification

All identification numbers as described in the Introduction chapter must be furnished when ordering parts or making inquiries. This information is usually found on the nameplate attached to the equipment. Be sure to include any dash numbers following the Specification or Assembly numbers.

8.02 How To Use This Parts List

The Parts List is a combination of an illustration and a corresponding list of parts which contains a breakdown of the equipment into assemblies, subassemblies, and detail parts. All parts of the equipment are listed except for commercially available hardware, bulk items such as wire, cable, sleeving, tubing, etc., and permanently attached items which are soldered, riveted, or welded to other parts. The part descriptions may be indented to show part relationships.

To determine the part number, description, quantity, or application of an item, simply locate the item in question from the illustration and refer to that item number in the corresponding Parts List.

POWER SUPPLY SYSTEM NUMBERS:

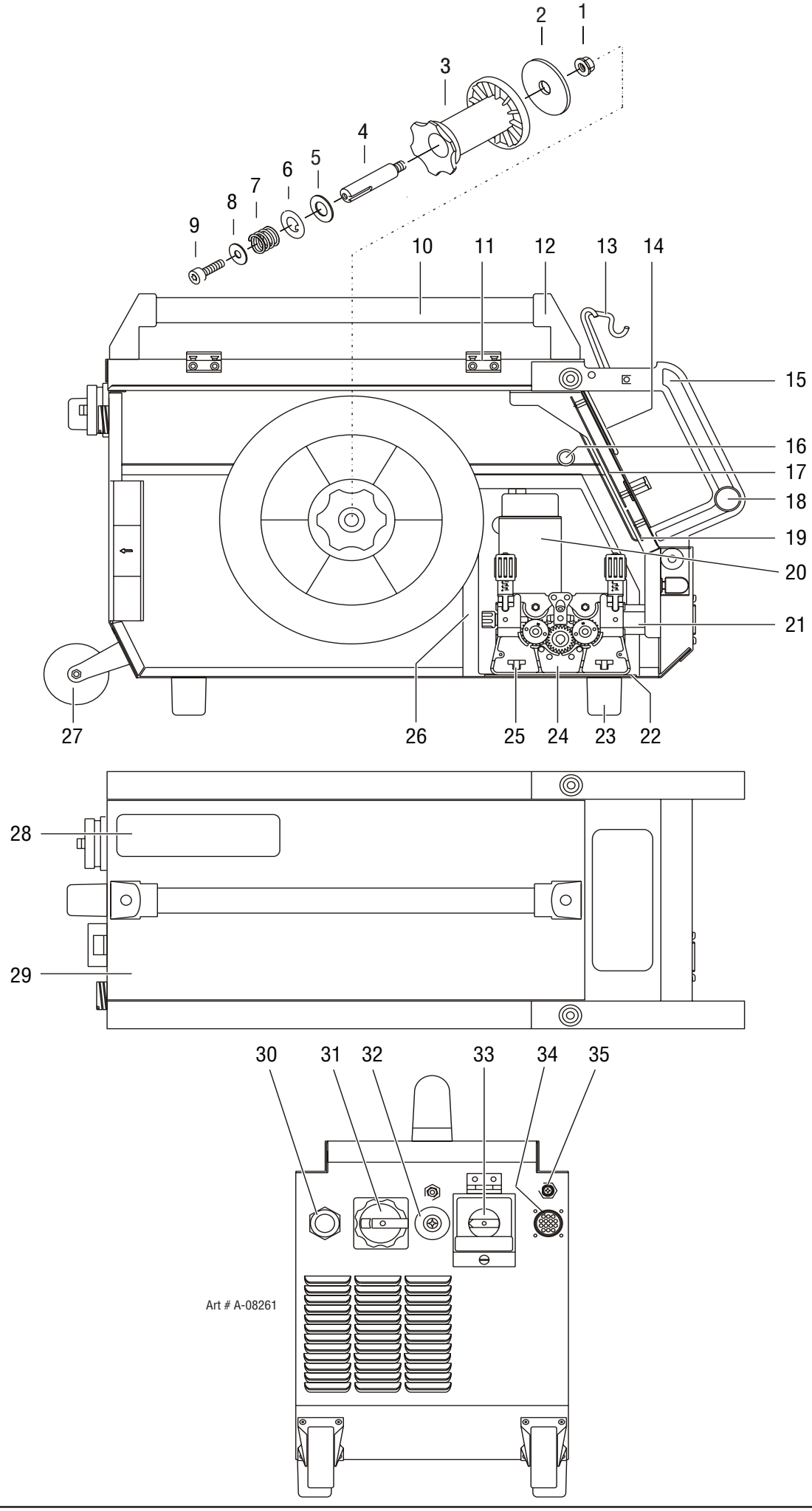
PowerMaster 320SP (US)	**W1000102**
PowerMaster 400SP Bw (US)	**W1000202**
PowerMaster 400SP Bg (US)	**W1000302**
PowerMaster 400SP (US) Compact	**W1000304**
PowerMaster 500SP Bw (US)	**W1000502**

WIRE FEEDER SYSTEM NUMBERS:

Wirefeeder SP4000W Thermal Arc (US)	**W3000202**
Wirefeeder SP4000R Thermal Arc (US)	**W3000302**

8.03 PowerMaster 320SP Exploded View Parts List (1 of 2)

Item	Qty	Description	Schematic Ref	Part Number
1	1	Nut,Safety,M12,SP		W7004108
2	1	Washer,Felt,80x20x4,SP		W7004107
3	1	Spool Hub,SP		W7004106
4	1	Shaft,Spool Hub,SP		W7004105
5	1	Washer,Felt,40x20x4,SP		W7004104
6	1	Washer,Internal Tab,22,SP		W7004103
7	1	Spring,21x30,4.25,SP		W7004102
8	1	Washer,M10x30,SP		W7004101
9	1	Screw,Cap Head,M10x25,SP		W7004100
10	1	Handle Tube Top,Ø30x454,320SP		W7000090
11	3	Hinge,40x40,Black Plastic,SP		W7000093
12	2	Endcap,Handle,320SP		W7000089
13	1	Holder,MIG Gun,SP		W7000086
14	1	Refer to W7000016		#N/A
15	1	Handle,Left Side,Molded SP		W7000071
16	1	Switch PB Wire Inch SP	S2	W7000047
17	1	PCB Front Panel,SP	A7	W6000003
18	1	Handle Tube,30mmx273mm 320SP		W7000073
19	1	PCB Volt-Amp Meter SP	A8	W7000024
20	1	Motor 42V 240rpm SP	M2	W6000008
21	1	Adaptor Tweco No4 SP	X4	W7000023
22	1	Plate Insulation,80x170,SP		W7000098
23	5	Rubber Foot Ø40x46 320SP		W7000082
24	1	Feed Plate,4 Roll,SP		W7000095
25	2	Washer Insulation,SP		W7000097
26	1	Panel,Plastic,Feed Motor,SP		W7000091
27	2	Castor Fixed Ø75 320SP		W7000083
28	1	Label,Warning,SP		W7004116
29	1	Panel, Top Cover,300SP		W7004117
30	1	Strain-Relief M25 Ø30 320SP		W7000019
31	1	Switch On-Off 63A,320SP	Q1	W7000033
32	1	Rubber Foot Ø40x46 320SP		W7000082
33	1	Switch Multi Voltage 320SP	S3	W7000048
34	1	Socket 14Pin Remote RC20 SP	X6	W7000053
34	1	Socket 4Pin CAN SP	X5	W7000052
35	1	Cap,CAN Socket,SP		W7000096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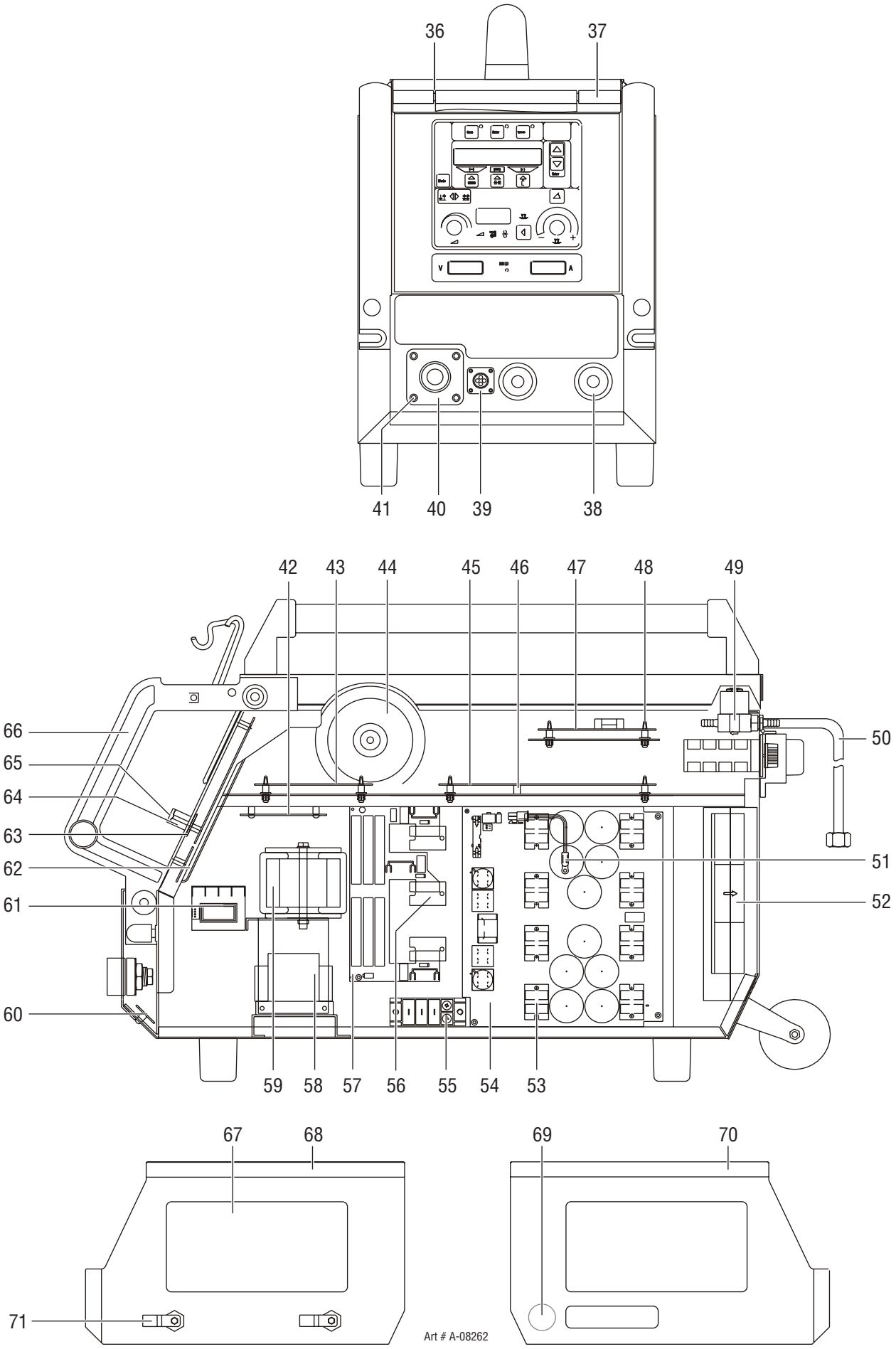
Art # A-08261

8.04 PowerMaster 320SP Exploded View Parts List (2 of 2)

Item	Qty	Description	Schematic Ref	Part Number
–	–	Display Cover Assy,320SP		W7000016
36	1	Refer to W7000016		#N/A
37	2	Refer to W7000016		#N/A
38	2	Terminal Output SP	X2, X3	W7000051
39	1	Socket 4Pin Torch Connector SP	X7	W7000054
40	1	Insulator Flange Tweco No4 SP		W7000021
41	4	Rivet Plastic 5x7.5 SP		W7000022
42	1	PCB Filter,SP	A14	W7000045
43	1	PCB Motor Driver,SP	A6	W6000006
44	1	Transformer208-460/20/42 320SP	T1	W7000032
45	1	PCB Master Control, SP	A5	W7000029
45	1	Fuse 1A 320/400/500SP	F2	W6000012
45	1	Fuse 2,5A 320/400/500SP	F3	W6000011
46	2	Spacer,PCB,M4x3/8",SP		W7004113
47	1	PCB Input Relay, SP	A1	W7000026
48	2	Fuse 4A 320/400/500SP		W6000010
48	13	Spacer,PCB,3/8",SP		W7000099
51	1	Gas Hose,6ft,5/8 18UNF,SP		W7000094
52	1	Solenoid valve 24VDC SP	Y1	W6000001
53	1	Fan 24V DC Ø150x172x38 320SP	M1	W6000104
54	8	MOSFET N-Channel 500V 50A,SP		W7000040
55	1	PCB FET Driver, 320SP	A3	W7000028
56	1	Rectifier 1PH 1600V 88A 320SP	A2	W7000036
57	3	Diode 400V 2x100A,320SP	A10-A12	W7000041
58	1	PCB Output Diode,SP	A9	W6000007
59	1	Transformer Main 320SP	T2	W7000049
60	1	Inductor 320SP	L1	W7000046
60	1	PCB Output Filter,SP	A13	W7000044
62	1	Panel,Plastic,Control Board,SP		W7000092
62	1	Current Sensor 500A 2000:1 VAC	A4	W7000042
63	2	Knob,Encoder,.9"Øx1/4"shaft,SP		W7004164
64	2	Shoulder Washer 1-1/8x3/8x1/4		W7000037
65	2	Cap,Knob,Grey,.9"Ø,SP		W7004165
66	1	Handle,Right Side,Molded SP		W7000072
67	1	Panel,Door,320SP		W7000087
68	1	Thermal sensor 320/400/500SP	F1	W6000000
68	1	Label,Setup Chart,SP		W7004115
69	1	Panel,Side,RH,320SP		W7000088
70	1	Label,Mains Connection,Ø30,SP		W7004114
71	2	Latch Quarter Turn Ø31 SP		W7000013
		Screw Kit,320SP/400SP/500SP		W7004186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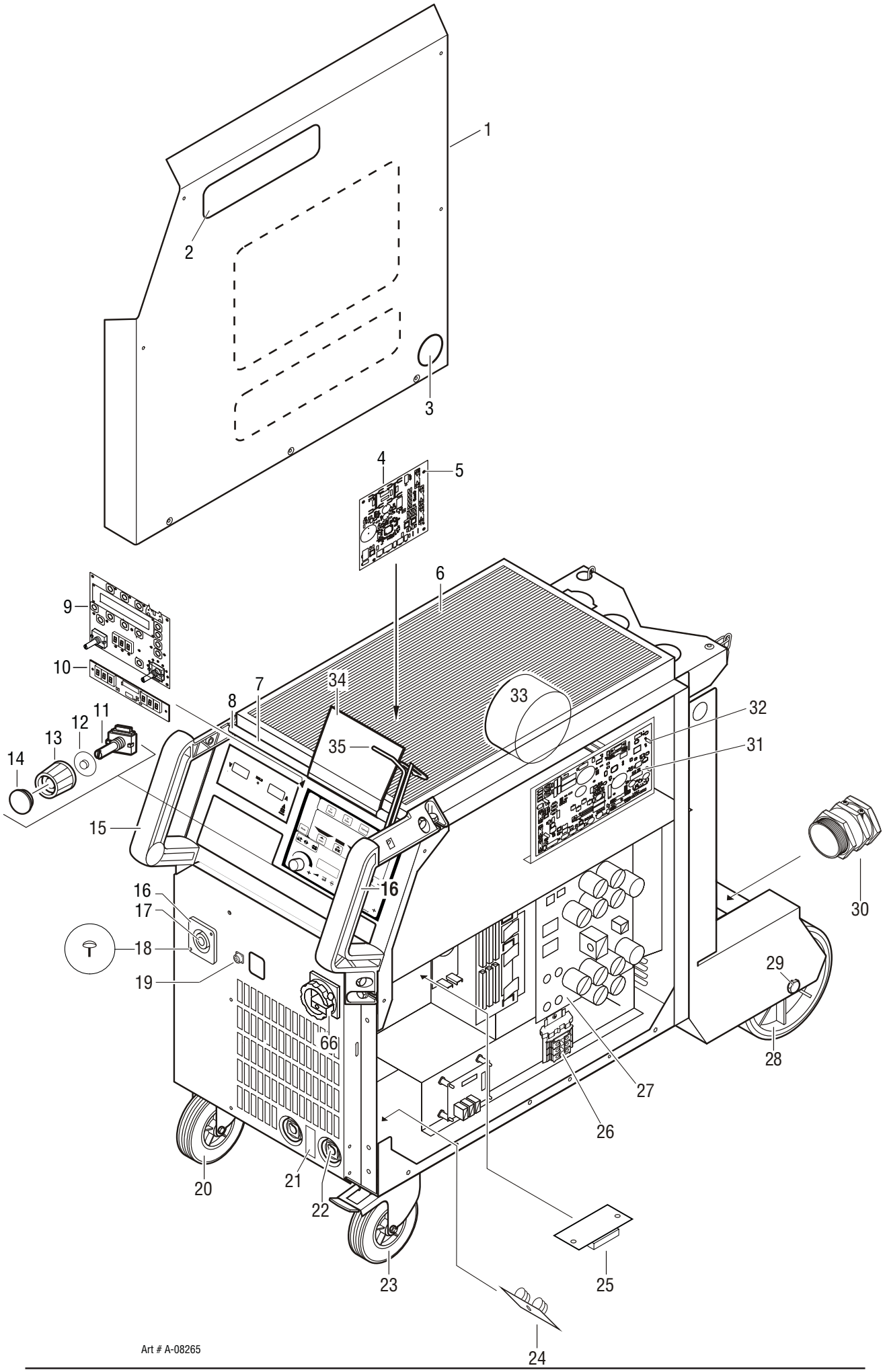
Art # A-08262

8.05 PowerMaster 400SP Compact Exploded View Parts List (1 of 2)

Item	Qty	Description	Ref	Part Number
1	1	Panel,Side,RH,400SP & 500SP		W7004120
2	1	Label,Warning,SP		W7004116
3	2	Label,Mains Connection,Ø30,SP		W7004114
4	1	PCB Motor Driver,SP	A60	W6000006
5	4	Spacer,PCB,M4,12mm,SP		W7004128
6	1	Mat,Rubber,560x350mm,SP		W7004122
7	1	Display Cover Assy,400SP		W7000015
8	1	Refer to W7000015		#N/A
9	1	PCB Front Panel,SP	A7	W6000003
10	1	PCB Volt-Amp Meter SP	A8	W7000024
11	2	Digital Encoder 360' 6.35mm SP		W7000043
12	2	Shoulder Washer 1-1/8x3/8x1/4		W7000037
13	2	Knob,Encoder,.9"Øx1/4"shaft,SP		W7004164
14	2	Cap,Knob,Grey,.9"Ø,SP		W7004165
15	1	Handle,Left Side,Molded SP		W7000071
16	1	Handle,Right Side,Molded SP		W7000072
16	1	Insulator Flange Tweco No4 SP		W7000021
17	1	Adaptor Tweco No4 SP		W7000023
18	4	Rivet Plastic 5x7.5 SP		W7000022
19	1	Socket 4Pin Torch Connector SP	X7	W7000054
20	1	Castor,Swivel,Ø125 SP		W7004121
21	1	Label, -/+, 50x25mm,SP		W7004123
22	2	Terminal Output SP	X2, X3	W7000051
23	1	Castor Swivel Brake Ø125 SP		W7000084
24	1	PCB Output Filter,SP	A9	W7000044
25	1	PCB Filter,SP	A10	W7000045
26	1	Terminal Block Input 4 Way SP	X1	W7000058
27	1	Power Unit 400SP MV	A15	W7000055
28	2	Wheel Ø200 x 50 SP		W7000012
29	2	Shaft Rear Wheel 12.5x59,SP		W7000017
30	1	Strain-Relief M40 Ø30 SP		W7000018
31	1	PCB Master Control, SP	A5	W7000029
31	1	Fuse 1A 320/400/500SP	F1	W6000012
31	1	Fuse 2,5A 320/400/500SP	F2	W6000011
32	6	Spacer,PCB,3/8",SP		W7000099
33	1	Transformer 208-460/20/42,SP	T1	W7000031
34	1	Refer to W7000015		#N/A
35	1	Holder,MIG Gun,SP		W7000086
66	1	Switch On-Off 100A,400/500SP	Q1	W7000034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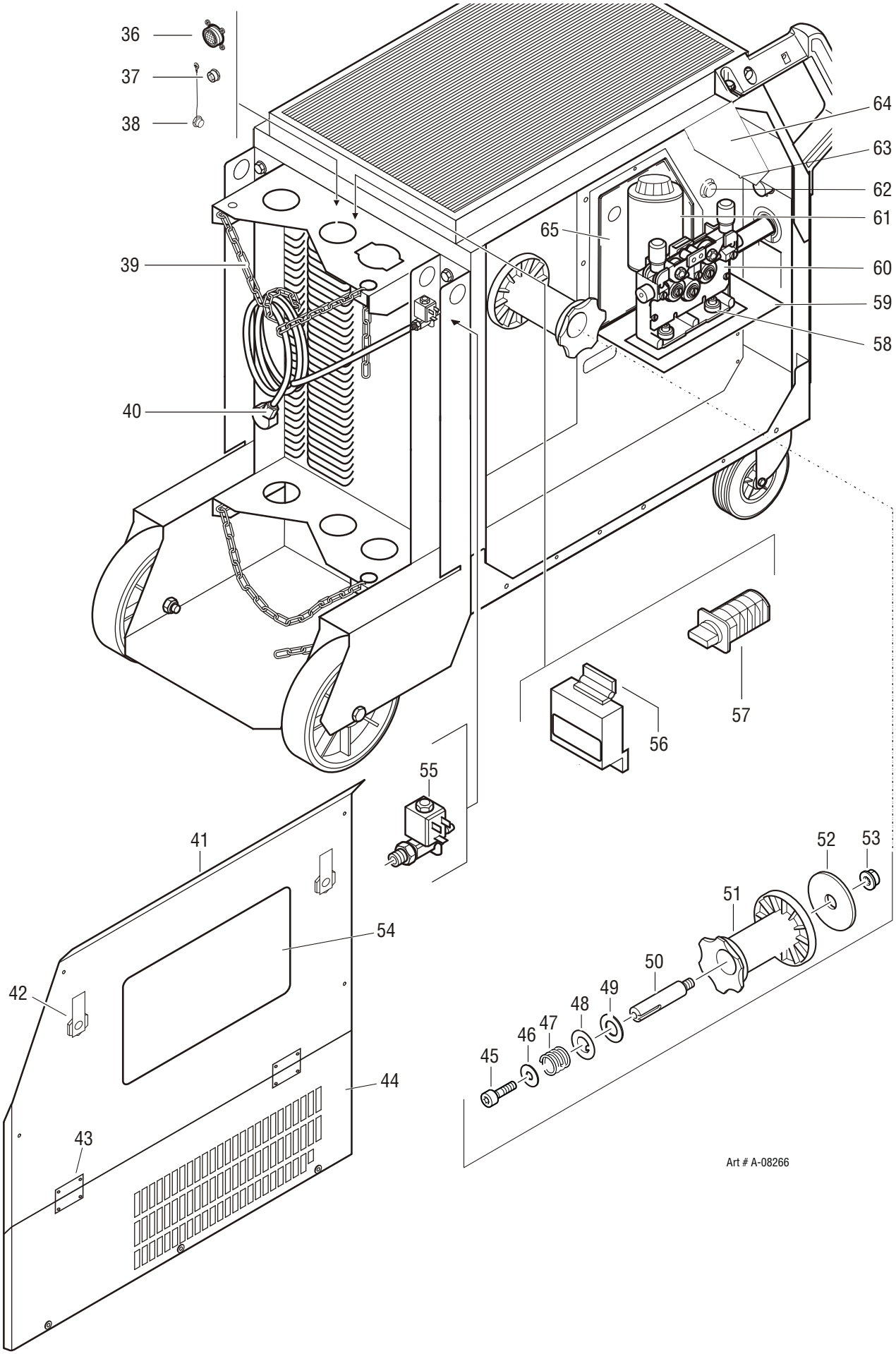
Art # A-08265

8.06 PowerMaster 400SP Compact Exploded View Parts List (2 of 2)

Item	Qty	Description	Ref	Part Number
36	1	Socket 14Pin Remote RC20 SP	X6	W7000053
37	1	Socket 4Pin CAN SP	X5	W7000052
38	1	Cap,CAN Socket,SP		W7000096
39	2	Chain Gas Cylinder 770mm SP		W7000080
40	1	Gas Hose,6ft,5/8 18UNF,SP		W7000094
41	1	Panel,Door Upper,400SP Com		W7004118
42	2	Latch Quarter Turn Ø31 SP		W7000013
43	3	Hinge,40x40,Black Plastic,SP		W7000093
44	1	Panel,Side,LH Lower,400SP Com		W7004119
45	1	Screw,Cap Head,M10x25,SP		W7004100
46	1	Washer,M10x30,SP		W7004101
47	1	Spring,21x30,4.25,SP		W7004102
48	1	Washer,Internal Tab,22,SP		W7004103
49	1	Washer,Felt,40x20x4,SP		W7004104
50	1	Shaft,Spool Hub,SP		W7004105
51	1	Spool Hub,SP		W7004106
52	1	Washer,Felt,80x20x4,SP		W7004107
53	1	Nut,Safety,M12,SP		W7004108
54	1	Label,Setup Chart,SP		W7004115
55	1	Solenoid valve 24VDC SP	Y1	W6000001
56	1	Hinge,40x40,Black Plastic,SP		W7000093
57	1	Switch Multi Voltage 320SP	S3	W7000048
58	2	Washer Insulation,SP		W7000097
59	1	Plate Insulation,80x170,SP		W7000098
60	1	Feed Plate,4 Roll,SP		W7000095
61	1	Motor 42V 240rpm SP	M7	W6000008
62	1	Switch PB Wire Inch SP	S2	W7000047
63	4	Spacer,PCB,M4,12.7mm,SP		W7004129
64	1	Cover,Plastic,332x195x24,400SP		W7004127
72	1	Panel,Plastic,Feed Motor,SP		W7000091
	1	Panel, Top Cover,400/500SP		W7004141
		Screw Kit,320SP/400SP/500SP		W7004186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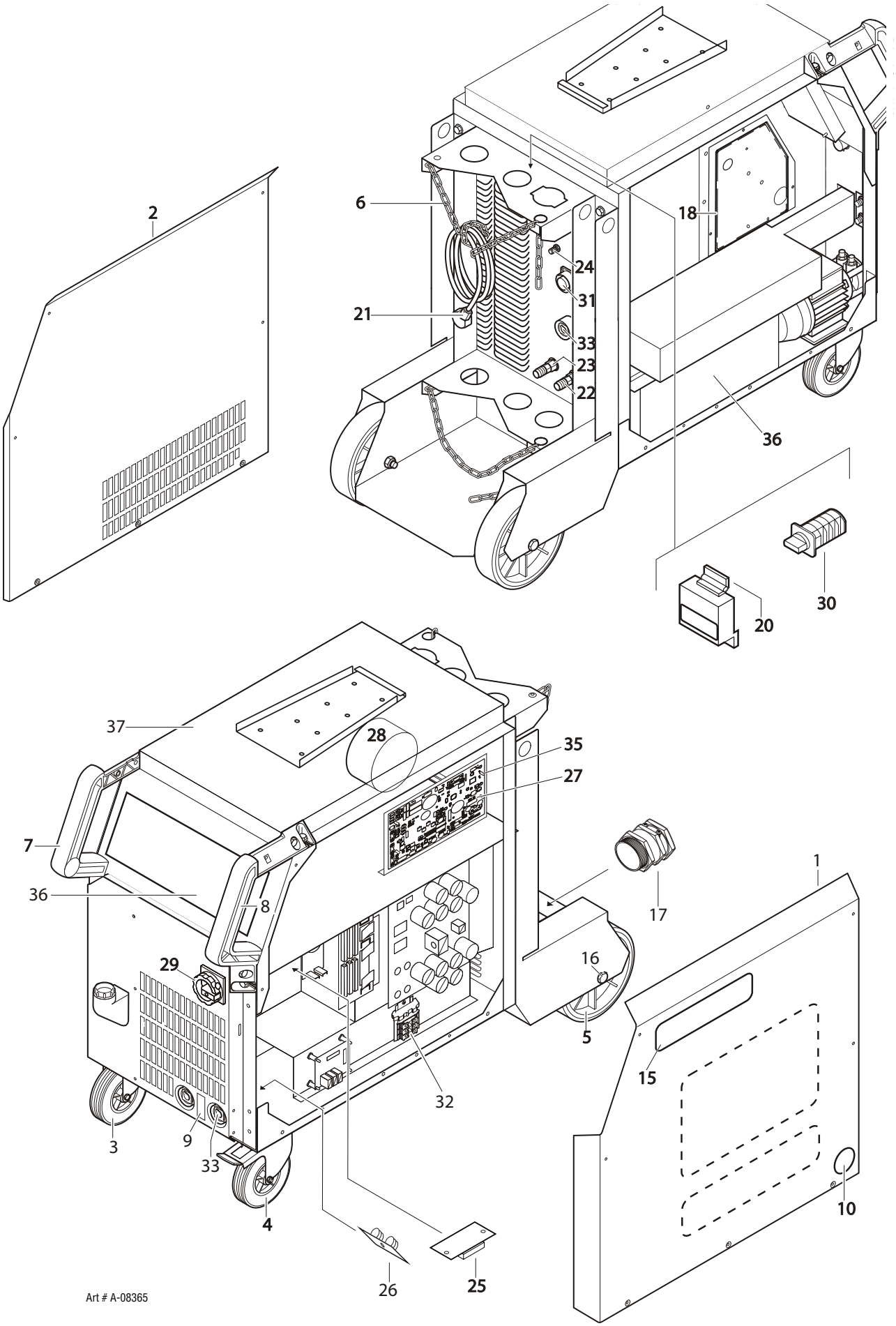
Art # A-08266

8.07 PowerMaster 400SP Remote, Water Exploded View Parts List

Item	Qty	Description	Ref	Part Number
1	1	Panel,Side,RH,400SP & 500SP		W7004120
2	1	Panel,Side,LH,400SP & 500SP		W7004131
3	1	Castor,Swivel,Ø125 SP		W7004121
4	1	Castor Swivel Brake Ø125 SP		W7000084
5	2	Wheel Ø200 x 50 SP		W7000012
6	2	Chain Gas Cylinder 770mm SP		W7000080
7	1	Handle,Left Side,Molded SP		W7000071
8	1	Handle,Right Side,Molded SP		W7000072
9	1	Label,-/+,50x25mm,SP		W7004132
10	2	Label,Mains Connection,Ø30,SP		W7004114
15	1	Label,Warning,SP		W7004116
16	2	Shaft Rear Wheel 12.5x59,SP		W7000017
17	1	Strain-Relief M40 Ø30 SP		W7000018
18	1	Panel,Plastic,Feed Motor,SP		W7000091
20	1	Hinge,40x40,Black Plastic,SP		W7000093
21	1	Gas Hose,6ft,5/8 18UNF,SP		W7000094
22	1	QuickDisconnect,Blue,Female,SP		W7004133
23	1	QuickDisconnect,Red,Female,SP		W7004134
24	1	Quick disconnect,Gas,Female,SP		W7004135
25	1	PCB Filter,SP	A10	W7000045
26	1	PCB Output Filter,SP	A9	W7000044
27	1	PCB Master Control, SP	A5	W7000029
27	1	Fuse 1A 320/400/500SP	F1	W6000012
27	1	Fuse 2,5A 320/400/500SP	F2	W6000011
28	1	Transformer 208-460/20/42,SP	T2	W7000031
29	1	Switch On-Off 100A,400/500SP	Q1	W7000034
30	1	Switch Multi Voltage 320SP	S3	W7000048
31	1	Socket Panel 8Pin SP	X10	W7000060
32	1	Terminal Block Input 4 Way SP	X1	W7000058
33	3	Terminal Output SP	X8	W7000051
35	6	Spacer,PCB,3/8",SP		W7000099
36	1	Panel,Control Cover,400/500SP		W7004140
37	1	Panel, Top Cover,400/500SP		W7004141
	1	Screw Kit,320SP/400SP/500SP		W7004186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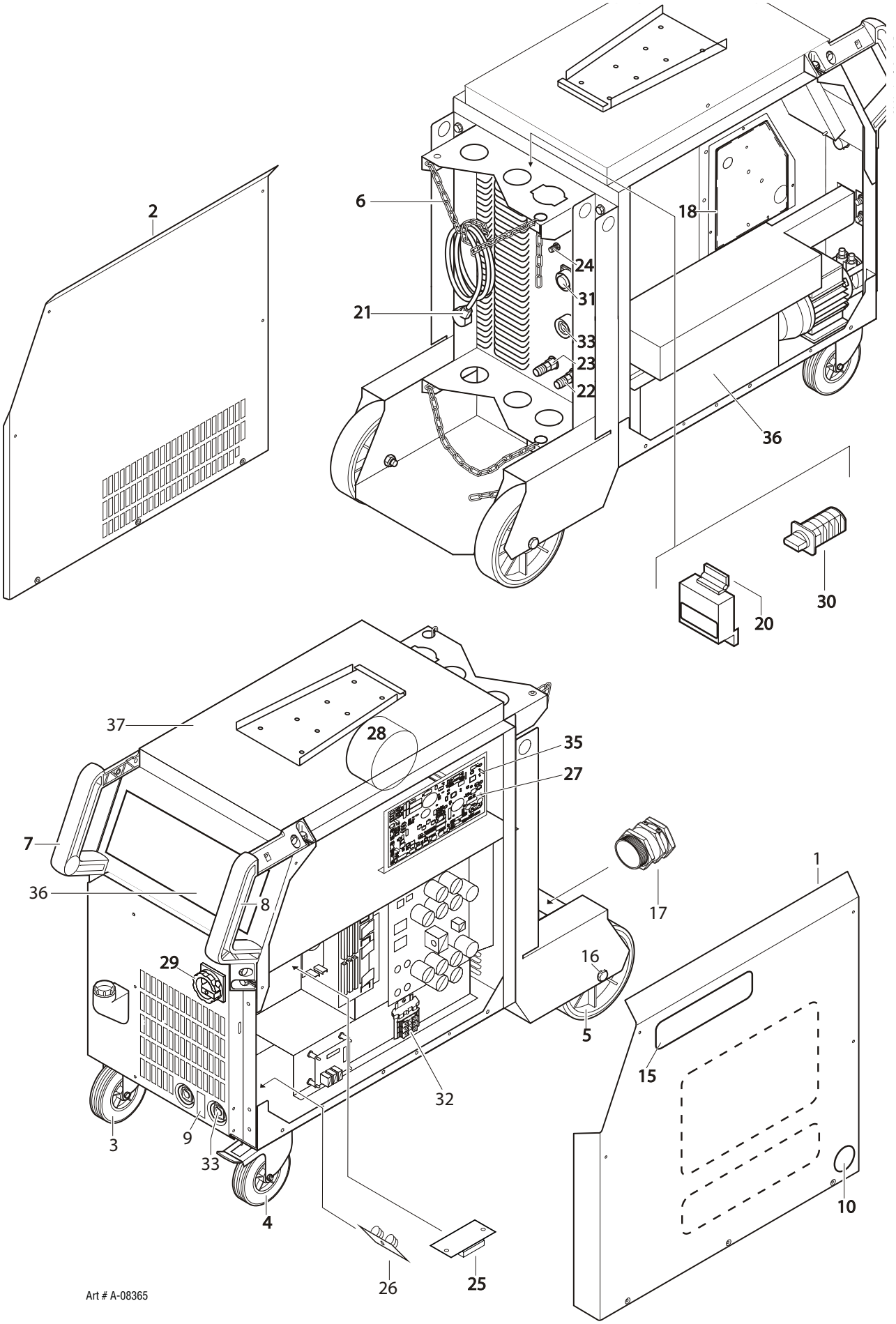
Art # A-08365

8.08 PowerMaster 500SP Remote, Water Exploded View Parts List

Item	Qty	Description	Ref	Part Number
1	1	Panel,Side,RH,400SP & 500SP		W7004120
2	1	Panel,Side,LH,400SP & 500SP		W7004131
3	1	Castor,Swivel,Ø125 SP		W7004121
4	1	Castor Swivel Brake Ø125 SP		W7000084
5	2	Wheel Ø200 x 50 SP		W7000012
6	2	Chain Gas Cylinder 770mm SP		W7000080
7	1	Handle,Left Side,Molded SP		W7000071
8	1	Handle,Right Side,Molded SP		W7000072
9	1	Label,-/+,50x25mm,SP		W7004132
10	2	Label,Mains Connection,Ø30,SP		W7004114
15	1	Label,Warning,SP		W7004116
16	2	Shaft Rear Wheel 12.5x59,SP		W7000017
17	1	Strain-Relief M40 Ø30 SP		W7000018
18	1	Panel,Plastic,Feed Motor,SP		W7000091
20	1	Hinge,40x40,Black Plastic,SP		W7000093
21	1	Gas Hose,6ft,5/8 18UNF,SP		W7000094
22	1	QuickDisconnect,Blue,Female,SP		W7004133
23	1	QuickDisconnect,Red,Female,SP		W7004134
24	1	Quick disconnect,Gas,Female,SP		W7004135
25	1	PCB Filter,SP	A10	W7000045
26	1	PCB Output Filter,SP	A9	W7000044
27	1	PCB Master Control, SP	A5	W7000029
27	1	Fuse 1A 320/400/500SP	F1	W6000012
27	1	Fuse 2,5A 320/400/500SP	F2	W6000011
28	1	Transformer 208-460/20/42,SP	T2	W7000031
29	1	Switch On-Off 100A,400/500SP	Q1	W7000034
30	1	Switch Multi Voltage 320SP	S3	W7000048
31	1	Socket Panel 8Pin SP	X10	W7000060
32	1	Terminal Block Input 4 Way SP	X1	W7000058
33	3	Terminal Output SP	X8	W7000051
35	6	Spacer,PCB,3/8",SP		W7000099
36	1	Panel,Control Cover,400/500SP		W7004140
37	1	Panel, Top Cover,400/500SP		W7004141
	1	Screw Kit,320SP/400SP/500SP		W7004186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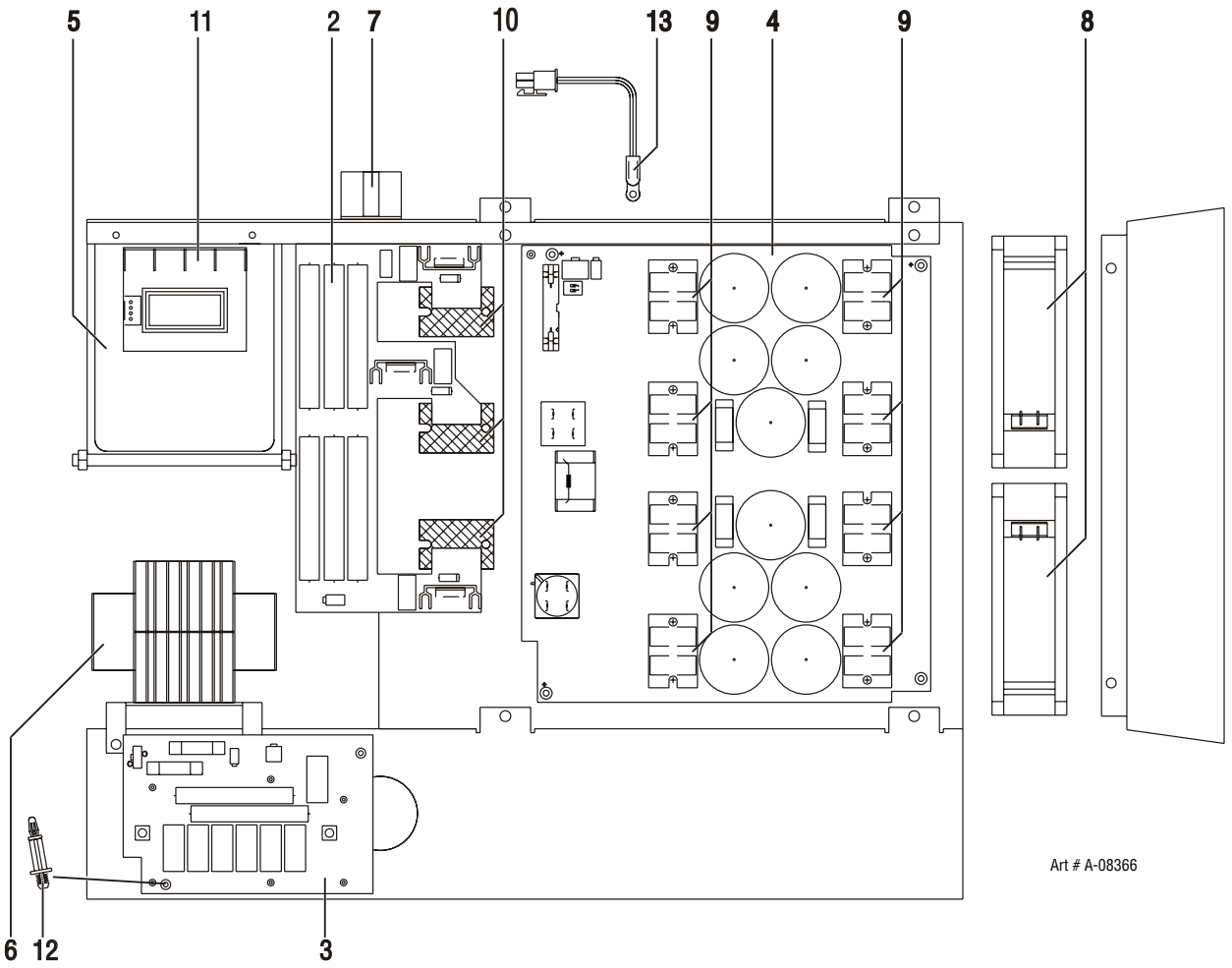
Art # A-08365

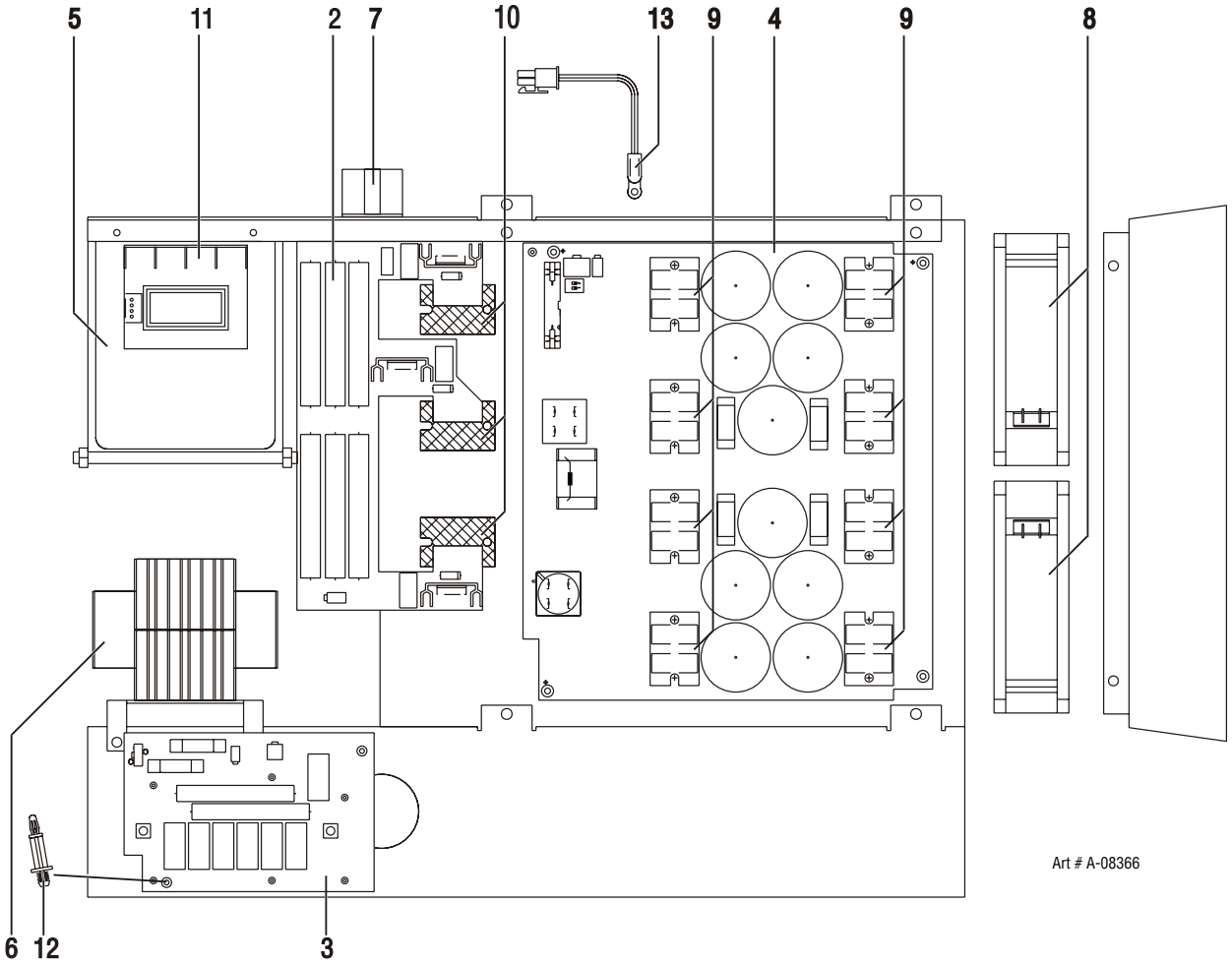
8.09 PowerMaster 400SP Power Module

Item	Qty	Description	Schematic Ref	Part Number
2	2	PCB Output Diode,SP	A11	W6000007
3	1	PCB Input Relay, SP	A1	W7000026
3	2	Fuse 4A 320/400/500SP	F4, F5	W6000010
4	2	PCB Primary Capacitor 400/500SP	A3	W7000027
5	1	Inductor 400SP	L1	W7000056
6	1	Transformer Main 400SP	T2	W7000057
7	1	Rectifier 3PH 1600V 175A,SP	A2	W7000035
8	2	Fan,230V,119x119x38,400/500SP	M1	W7004142
9	16	MOSFET N-Channel 500V 50A,SP		W7000040
10	6	Diode 400V 2x100A,320SP	A12-A14	W7000041
11	1	Current Sensor 500A 2000:1 VAC		W7000042
12	4	Spacer,PCB,3/4",SP		W7004130
13	2	Thermal sensor 320/400/500SP	F3	W6000000



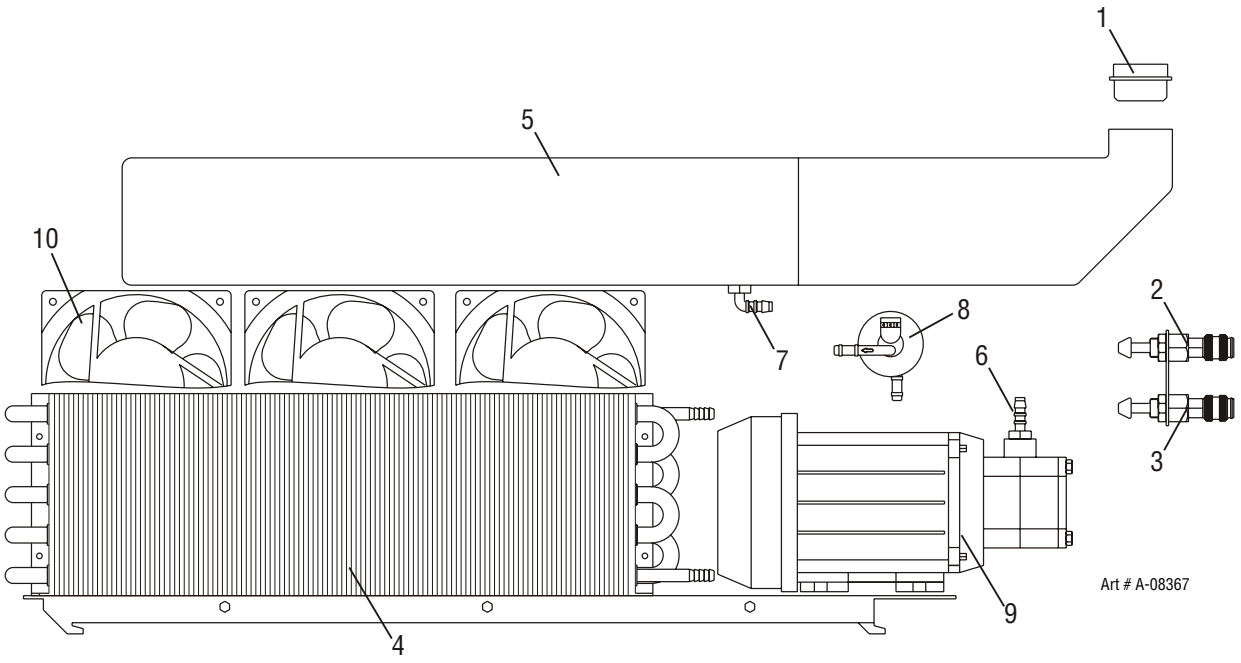
8.10 PowerMaster 500SP Power Module

Item	Qty	Description	Schematic Ref	Part Number
2	2	PCB Output Diode,SP	A11	W6000007
3	1	PCB Input Relay, SP	A1	W7000026
3	2	Fuse 4A 320/400/500SP	F4, F5	W6000010
4	2	PCB Primary Capacitor 400/500SP	C1	W7000027
5	1	Inductor 500SP	L1	W7000068
6	1	Transformer Main 500SP	T2	W7000067
7	1	Rectifier 3PH 1600V 175A,SP	A2	W7000035
8	2	Fan,230V,119x119x38,400/500SP	M1	W7004142
9	16	MOSFET N-Channel 500V 50A,SP		W7000040
10	6	Diode 400V 2x100A,320SP	A12-A14	W7000041
11	1	Current Sensor 500A 2000:1 VAC		W7000042
12	4	Spacer,PCB,3/4",SP		W7004130
13	2	Thermal sensor 320/400/500SP	F3	W6000000



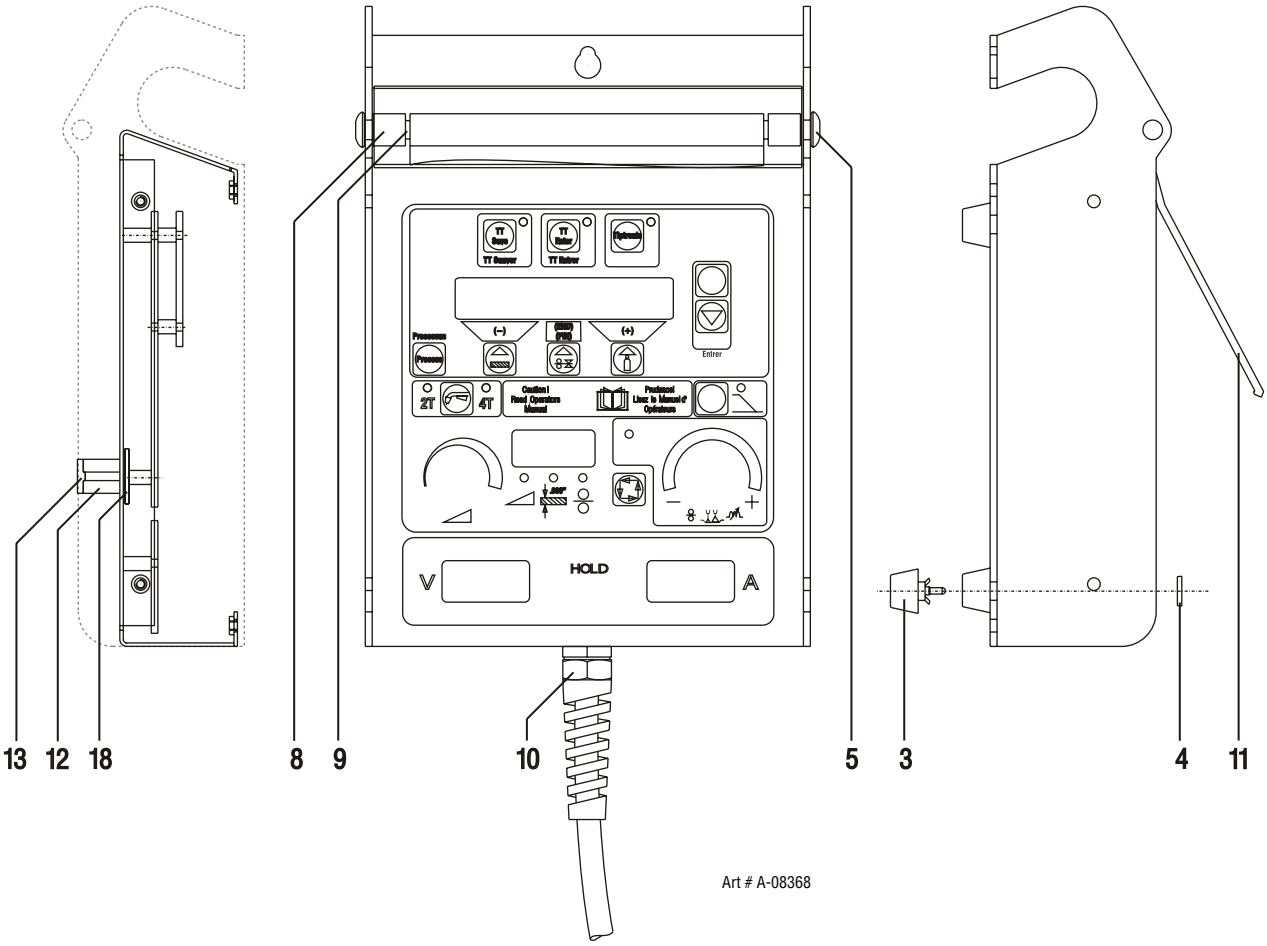
8.11 PowerMaster SP Water Cooling System

Item	Qty	Description	Ref	Part Number
1	1	Cap Water Tank M33x2,SP		W7000014
2	1	QuickDisconnect,Blue,Female,SP		W7004133
3	1	QuickDisconnect,Red,Female,SP		W7004134
4	1	Radiator,390x130x66,SP		W7004136
5	1	Tank,Coolant,640 x 80,SP		W7004137
6	1	Connector,hose,R1/4",SP		W7004138
7	1	Connector,hose elbow,R1/4",SP		W7004139
8	1	Flowmeter 400/500SP	F6	W6000208
9	1	Pump/Motor Coolant 230V,SP		W7000039
10	3	Fan 230V 119x119x38,400/500SP	M1 - M6	W6000209



8.12 PowerMaster SP HR911 Remote Pendant

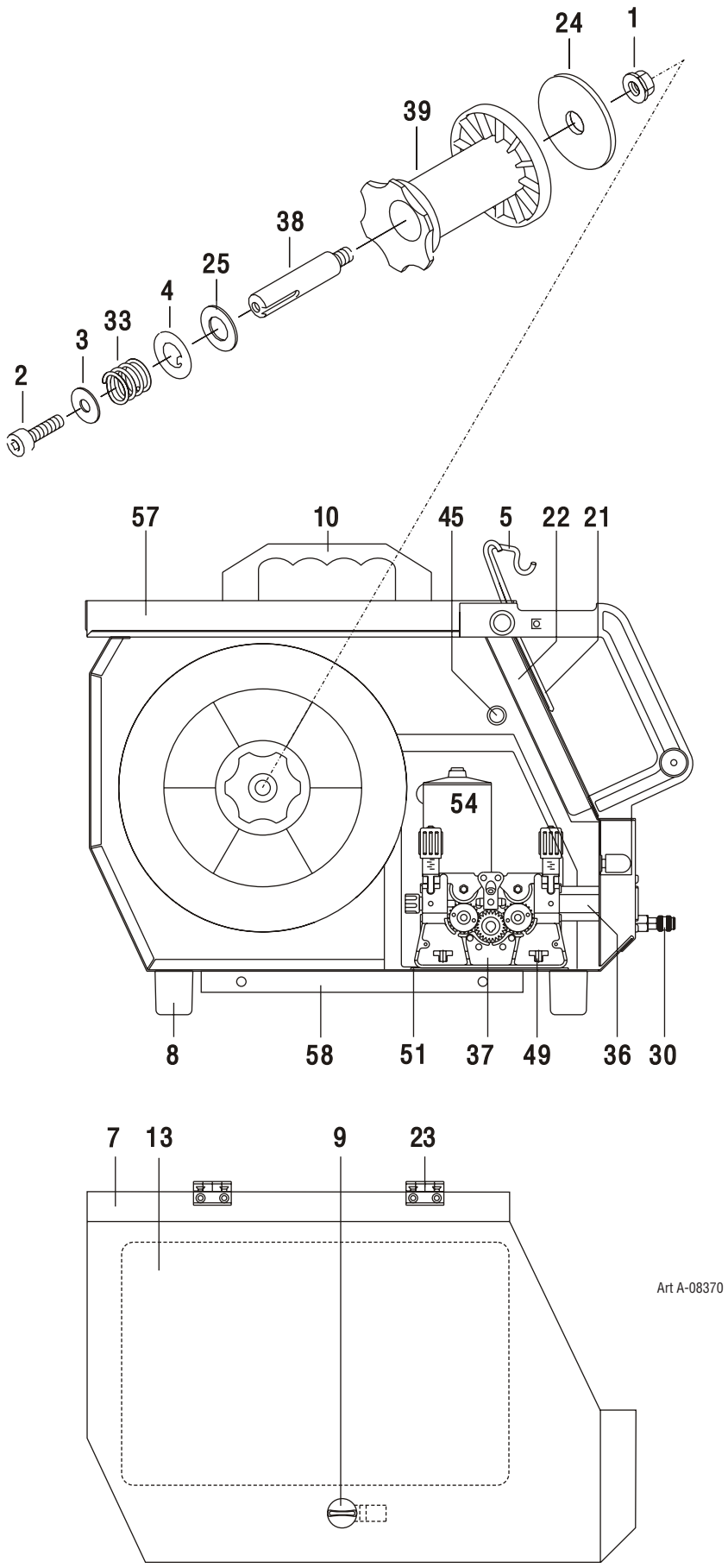
Item	Qty	Description	Ref	Part Number
3	4	Foot,Rubber,20x10 w/stud,HR911		W7004162
4	4	Starlock Cap,Shaft 4mm,HR911		W7004163
5		Display Cover,HR911,SP		W7004167
5	2	Refer to W7004167		#N/A
8	2	Refer to W7004167		#N/A
9	1	Refer to W7004167		#N/A
10	1	Strain-Relief,Nut,HR911		W7004168
11	1	Refer to W7004167		#N/A
12	2	Knob,Encoder,.9"Øx1/4"shaft,SP		W7004164
13	2	Cap,Knob,Grey,.9"Ø,SP		W7004165
14	1	PCB Volt-Amp Meter SP		W7000024
15	1	PCB Front Panel,SP		W6000003
18	2	Shoulder Washer 1-1/8x3/8x1/4		W7000037



Art # A-08368

8.13 PowerMaster SP4000W Wire Feeder (part 1 of 2)

Item	Qty	Description	Ref	Part Number
1	1	Nut,Safety,M12,SP		W7004108
2	1	Screw,Cap Head,M10x25,SP		W7004100
3	1	Washer,M10x30,SP		W7004101
4	1	Washer,Internal Tab,22,SP		W7004103
5	1	Holder,MIG Gun,SP		W7000086
6	1	Panel,Side,RH,SP4000W		W7004143
7	1	Panel,Door,SP4000W		W7004144
8	4	Rubber Foot Ø40x46 320SP		W7000082
9	1	Latch Quarter Turn Ø31 SP		W7000013
10	1	Handle 180mm,SP4000W		W7004145
11	1	Handle,Left Side,Molded SP		W7000071
12	1	Handle,Right Side,Molded SP		W7000072
13	1	Label,Setup Chart,SP		W7004115
17	1	Label,Warning,SP		W7004116
18		Display Cover Assy,SP4000W,SP		W7004166
18	2	Refer to W7004166		#N/A
19	1	Refer to W7004166		#N/A
20	1	Panel,Plastic,Feed Motor,SP		W7000091
21	1	Refer to W7004166		#N/A
22	1	Panel,Plastic,Control,SP4000W		W7004148
23	2	Hinge,40x40,Black Plastic,SP		W7000093
24	1	Washer,Felt,80x20x4,SP		W7004107
25	1	Washer,Felt,40x20x4,SP		W7004104
26	1	Quick Disconnect,Male,Blue,SP		W7000009
27	1	Quick Disconnect,Male,Red,SP		W7000010
28	1	Disconnect,Gas,Female,1/8",SP		W7004146
29	1	QuickDisconnect,Blue,Female,SP		W7004133
30	1	QuickDisconnect,Red,Female,SP		W7004134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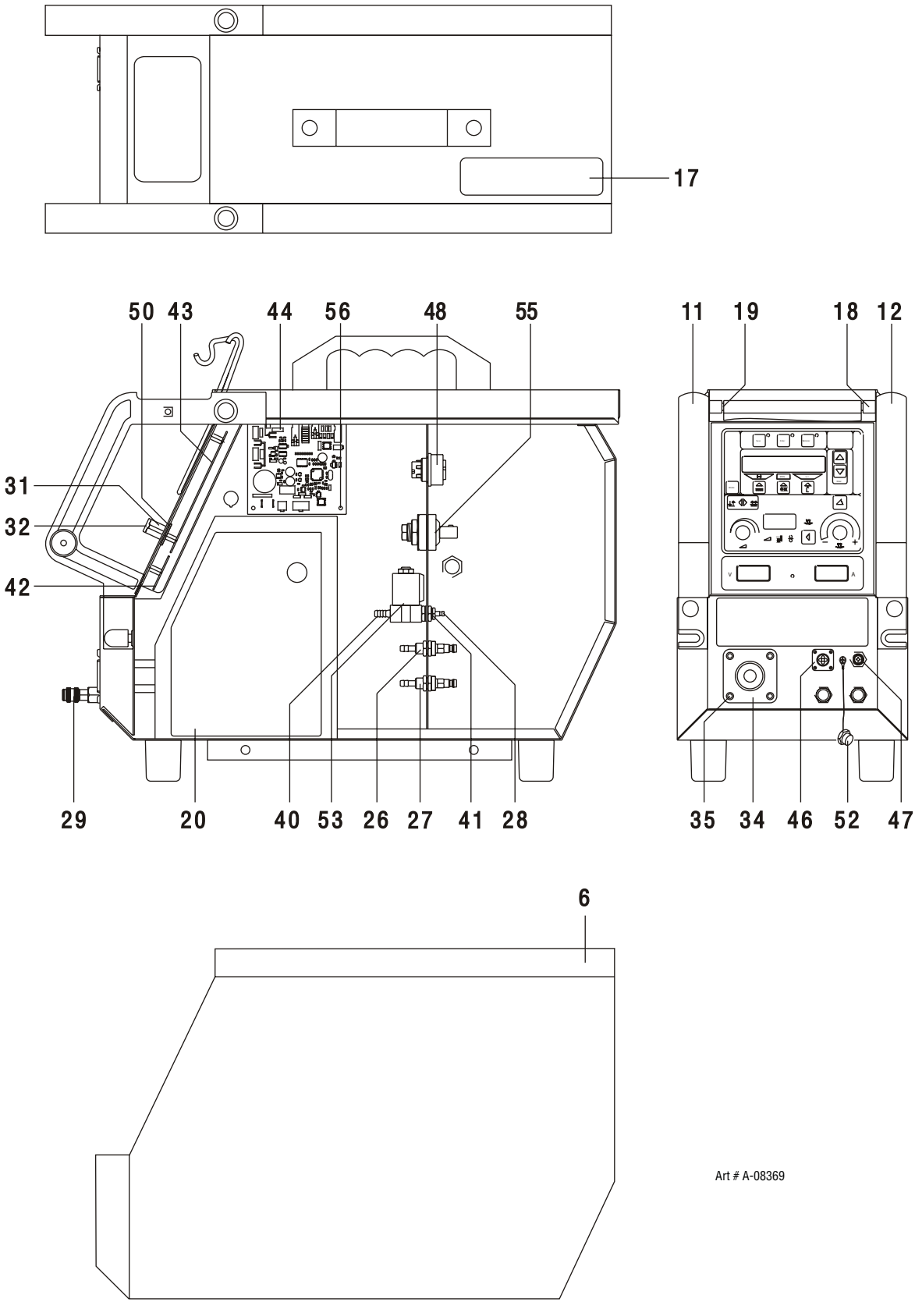
Art A-08370

8.13 PowerMaster SP4000W Wire Feeder (part 2 of 2)

Item	Qty	Description	Schematic Ref	Part Number
31	2	Knob,Encoder,.9"Øx1/4"shaft,SP		W7004164
32	2	Cap,Knob,Grey,.9"Ø,SP		W7004165
33	1	Spring,21x30,4.25,SP		W7004102
34	1	Insulator Flange Tweco No4 SP		W7000021
35	6	Rivet Plastic 5x7.5 SP		W7000022
36	1	Adaptor Tweco No4 SP		W7000023
36	1	Guide,Outlet,Black,023-035,SP		W6000513
36	1	Guide,Outlet,Red,035-045,SP		W6000514
36	1	Guide,Outlet,White,045-1/16,SP		W6000515
37	1	Feed Plate,4 Roll,SP		W7000095
38	1	Shaft,Spool Hub,SP		W7004105
39	1	Spool Hub,SP		W7004106
40	1	Connector,Gas,1/8"x4mm,SP		W7004152
41	1	Bush,Reduction,1/8"x1/4",SP		W7004153
42	1	PCB Volt-Amp Meter SP		W7000024
43	1	PCB Front Panel,SP		W6000003
44	1	PCB Motor Driver,SP		W6000006
45	1	Switch PB Wire Inch SP		W7000047
46	1	Socket 4Pin Torch Connector SP		W7000054
47	1	Socket 4Pin CAN WF SP		W7000063
48	1	Plug 8Pin SP		W7000061
49	2	Washer Insulation,SP		W7000097
50	2	Shoulder Washer 1-1/8x3/8x1/4		W7000037
50	2	Digital Encoder 360' 6.35mm SP		W7000043
51	1	Plate Insulation,80x170,SP		W7000098
52	1	Cap,CAN Socket,SP		W7000096
53	1	Solenoid valve 24VDC SP4000	Y1	W7000038
54	1	Motor 42V 240rpm SP		W6000008
55	1	Terminal Male 500A SP		W7000062
56	4	Spacer,PCB,3/8",SP		W7000099
57	1	Panel,Top Cover,SP4000W		W7004154
58	1	Bracket,Mtg Wirefeeder,SP4000W		W7004155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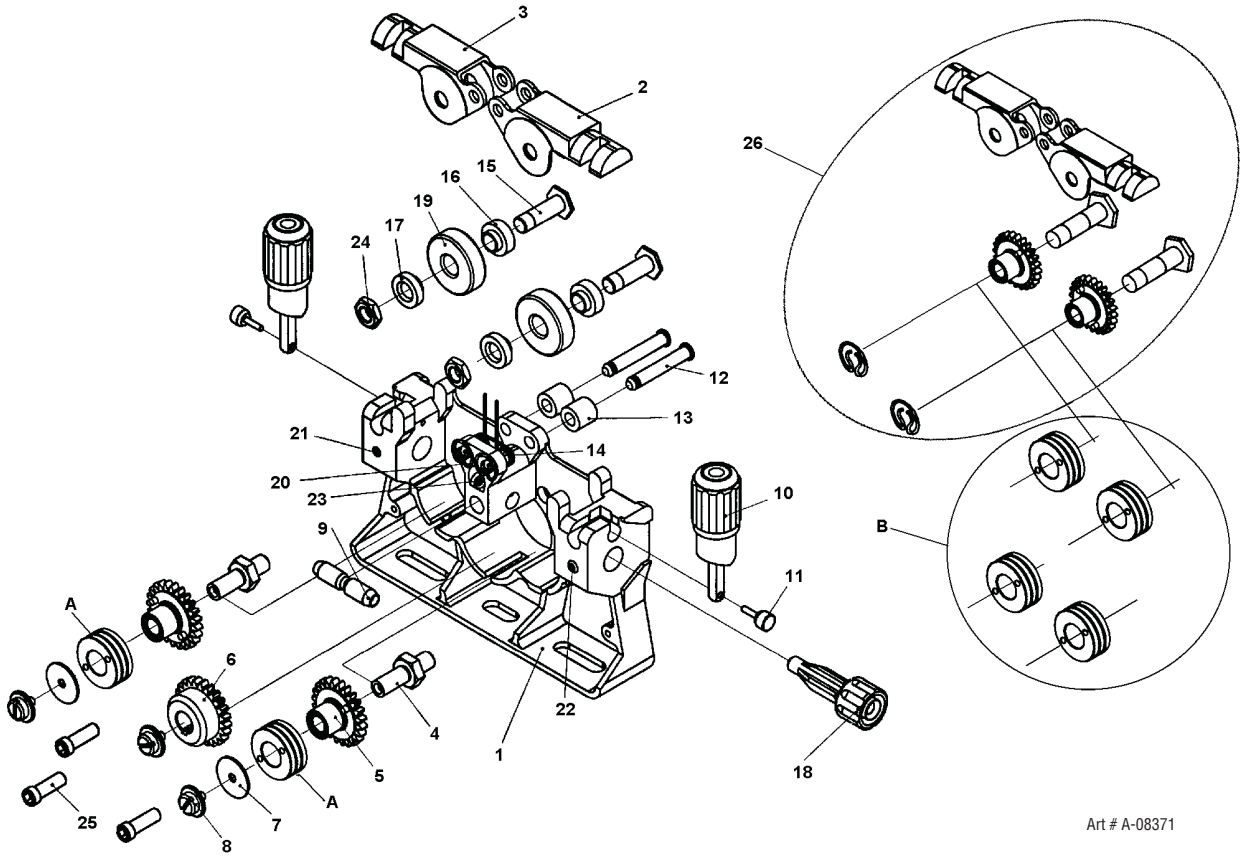
Art # A-08369

8.14 PowerMaster SP4000W Feed Plate Assembly

Item	Qty	Description	Ref	Part Number
1		Feedplate,4R,Mechafin,SP		W7004170
2		Pressure Arm,Right,Mechafin,SP		W7004171
3		Pressure Arm,Left,Mechafin,SP		W7004172
4		Shaft for Feedroll,Mechafin,SP		W7004173
5		Gear,Driveroll,Mechafin,SP		W7004174
6		Drive Gear,Mechafin,SP		W7004175
7		Screw-Washer,Driveroll,M4x6,SP		W7004169
7		Refer to W7004169		#N/A
8		Refer to W7004169		#N/A
9		Guide,Intermideate,023-1/16,SP		W6000512
10		Tension adjust rod,Mechafin,SP		W7004177
11		Pin,Tension adjust,Mechafin,SP		W7004178
12		Shaft PressureArm,Mechafin,SP		W7004179
13		Spacer PressureArm,Mechafin,SP		W7004180
14		Spring PressureArm,Mechafin,SP		W7004181
15		Shaft,PressureRoll,Mechafin,SP		W7004182
15		Refer to W7004182		#N/A
16		Refer to W7004182		#N/A
17		Refer to W7004182		#N/A
18		Guide,Inlet,023-1/16,SP		W6000511
19		Pressure Roll,Flat,SP		W7004183
20		Circlip,Type 6F,Mechafin,SP		W7004184
21		Screw Kit,4R,Mechafin,SP		W7004185
21		Refer to W7004185		#N/A
22		Refer to W7004185		#N/A
23		Refer to W7004185		#N/A
24		Refer to W7004182		#N/A
25		Refer to W7004185		#N/A
26		#N/A		#N/A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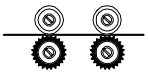
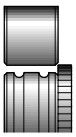
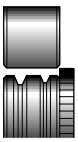
Art # A-08371

APPENDIX 1: OPTIONS AND ACCESSORIES

ACCESSORIES

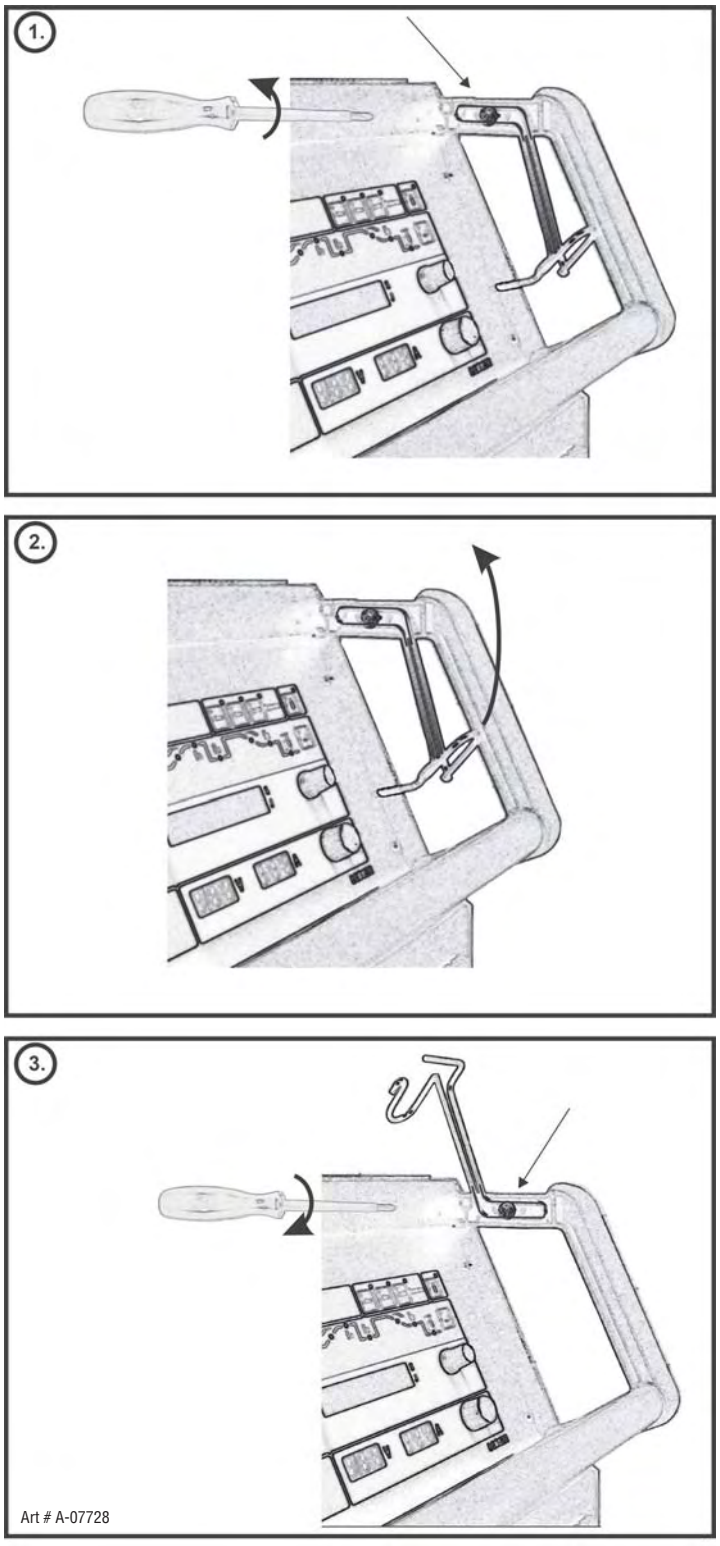
Wirefeeders	Part No.	Feature
SP4000W	**W3000202**	Water cooled connections, 4 Roll, suits 400SP/500SP
SP4000R	**W3000302**	Water cooled connections, 4 Roll suits 400SP/500SP Automation
MIG Guns	**Part No.**	**Feature**
PulseMaster 12ft Smart Gun	**PMA512S-3545**	Built in Remote Controls. Heavy Duty 500 Amp Rated. Suits 320SP/400SP/500SP
PulseMaster 15ft Smart Gun	**PMA515S-3545**	Built in Remote Controls. Heavy Duty 500 Amp Rated. Suits 320SP/400SP/500SP
PulseMaster 12ft Gun	**PMA512-3545**	Heavy Duty 500 Amp Rated. Suits 320SP/400SP/500SP
PulseMaster 15ft Gun	**PMA515-3545**	Heavy Duty 500 Amp Rated. Suits 320SP/400SP/500SP
Options		
Interconnect Cable Assy, 3ft Long	**W4000603**	3/0 Welding Cable, Water Cooled Hoses & Gas Hose. Suits 400SP/500SP
Interconnect Cable Assy, 16ft Long	**W4000604**	3/0 Welding Cable, Water Cooled Hoses & Gas Hose. Suits 400SP/500SP
Interconnect Cable Assy, 32ft Long	**W4000605**	3/0 Welding Cable, Water Cooled Hoses & Gas Hose. Suits 400SP/500SP
Remote Hand Control RC20	**W4000000**	Small Hand Pocket Pendant, Suits 320SP,
Remote Hand Pendant HR 911	**W4000101**	Full Control Panel Pendant. Suits 320SP and 400SP/500SP via SP4000W
Cart	**W4000001**	Rugged Construction, Accepts Full Size Cylinder. Suits 320SP
Swivel Unit K14	**W4001000**	Suits 400SP/500SP with SP4000W Wirefeeder
MIG/TIG Coolant 1 Quart (1L)	**W4001402**	
MIG/TIG Coolant 5 Quart (5L)	**W4001400**	
MIG/TIG Coolant 5 Gal (20L)	**W4001401**	

APPENDIX 2: FEED ROLL INFORMATION

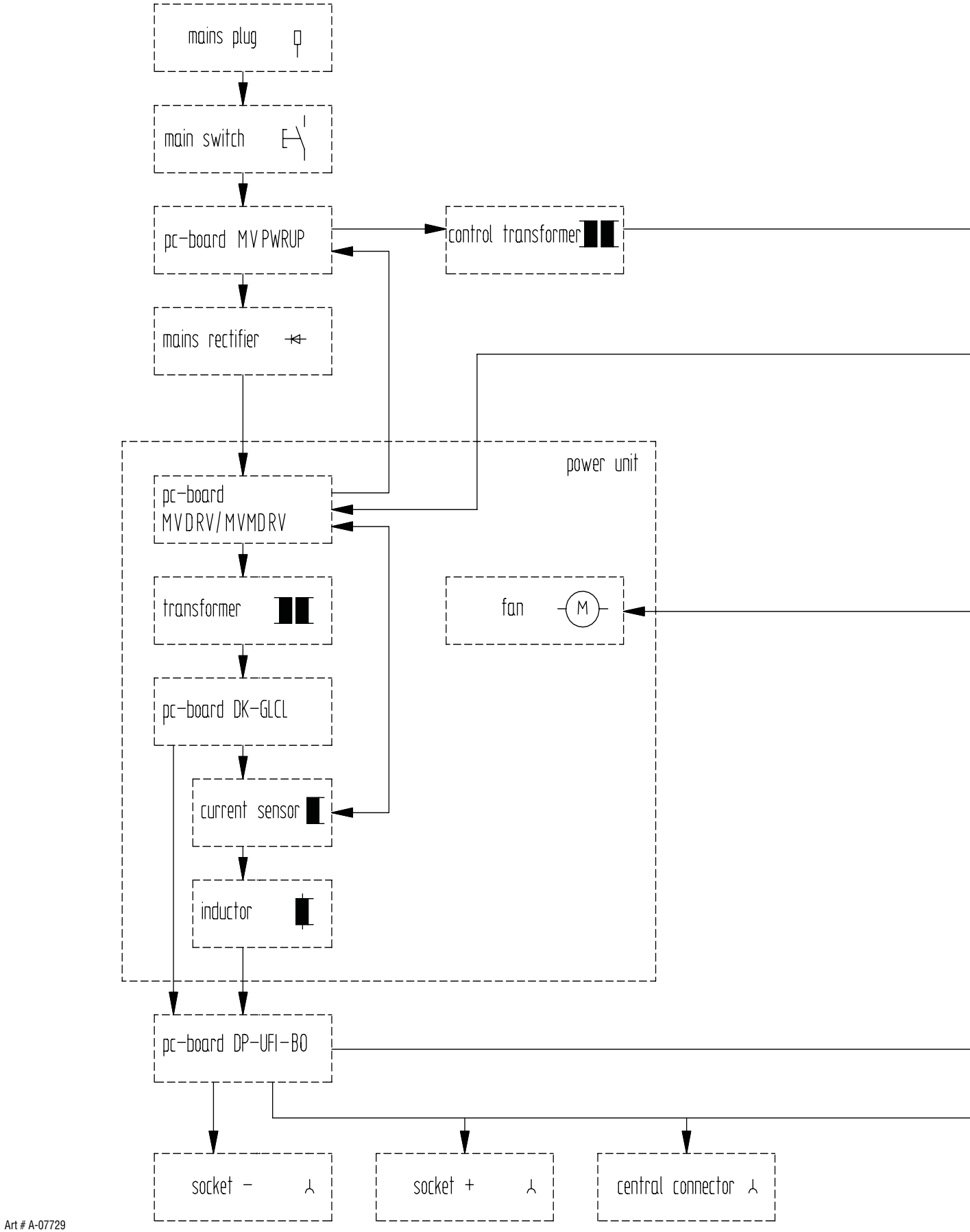
DRIVE ROLL KITS – 4 ROLLS			
Description	**Style 1**	**Style 2**	**Style 3**
 Provides less wire friction in the MIG torch due to the straightening effect of the feed rolls system,			
Top Drive Roll	Flat	Flat	Flat
Bottom Drive Roll	Double “U”	Double Smooth VEE	Double Knurled VEE
Wire Type	Aluminum (Soft) Wire	Solid (Hard) Wire	Flux Cored Wire
Wire Size			
.023”, .030” / 0.6, 0.8mm	–	W6000500	–
.035” / 0.9mm	–	W6000501	–
.035”, .045” / 0.9, 1.2mm	–	W6000502	–
.045” / 1.2mm	–	W6000503	–
.052”, 1/16” / 1.4, 1.6mm	–	W6000504	–
.030”, .035” / 0.8, 0.9mm	–	–	W6000505
.035”, .045” / 0.9, 1.2mm	–	–	W6000506
.045” – .052”, 1/16” / 1.2 – 1.4, 1.6mm	–	–	W6000507
.030”, .035” / 0.8, 0.9mm	W6000508	–	–
.035”, 3/64” / 0.9, 1.2mm	W6000509	–	–
3/64”, 1/16” / 1.2, 1.6mm	W6000510	–	–

ORDERING INFORMATION	
Part No.	**Description**
W6000500	DRIVE RL KIT,2RL,023-030,DS V
W6000501	DRIVE RL KIT,2RL,035-035,DS V
W6000502	DRIVE RL KIT,2RL,035-045,DS V
W6000503	DRIVE RL KIT,2RL,045-045,DS V
W6000504	DRIVE RL KIT,2RL,052-1/16,DS V
W6000505	DRIVE RL KIT,2RL,035-035,DK V
W6000506	DRIVE RL KIT,2RL,035-045,DK V
W6000507	DRIVE RL KIT,2RL,045-1/16,DK V
W6000508	DRIVE RL KIT,2RL,030-035,DU
W6000509	DRIVE RL KIT,2RL,035-045,DU
W6000510	DRIVE RL KIT,2RL,045-1/16,DU
W6000511	Guide,Inlet,023-1/16,SP
W6000512	Guide,Intermideate,023-1/16,SP
W6000513	Guide,Outlet,023-035,SP
W6000514	Guide,Outlet,035-045,SP
W6000515	Guide,Outlet,045-1/16,SP

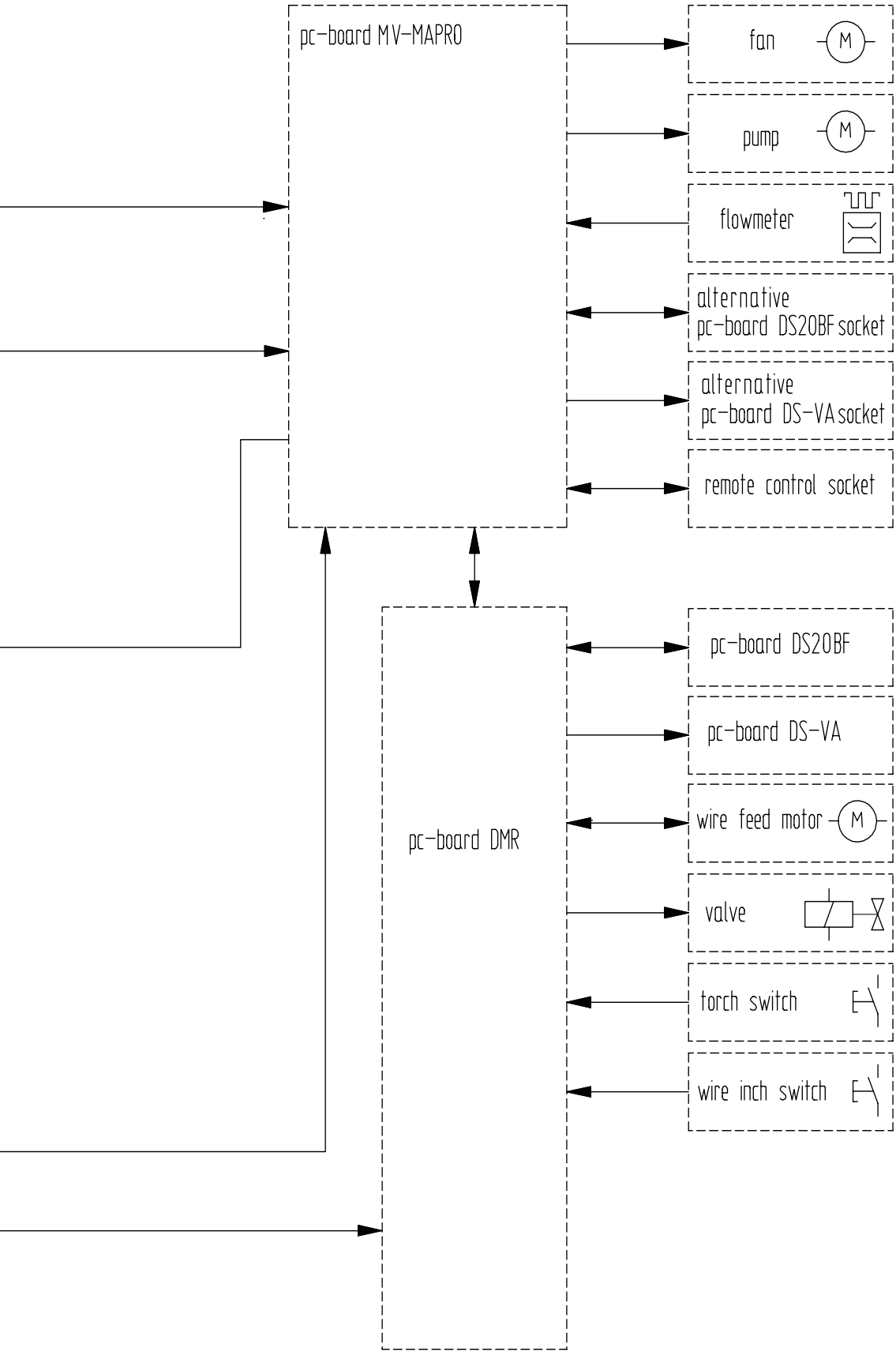
APPENDIX 3: MOUNTING THE TORCH HOLDER



APPENDIX 4: SP-SERIES BLOCK DIAGRAM



Art # A-07729


pc-board MV-MAPRO
fan
M
pump
M
flowmeter
alternative
pc-board DS20BF socket
alternative
pc-board DS-VA socket
remote control socket
pc-board DMR
pc-board DS20BF
pc-board DS-VA
wire feed motor
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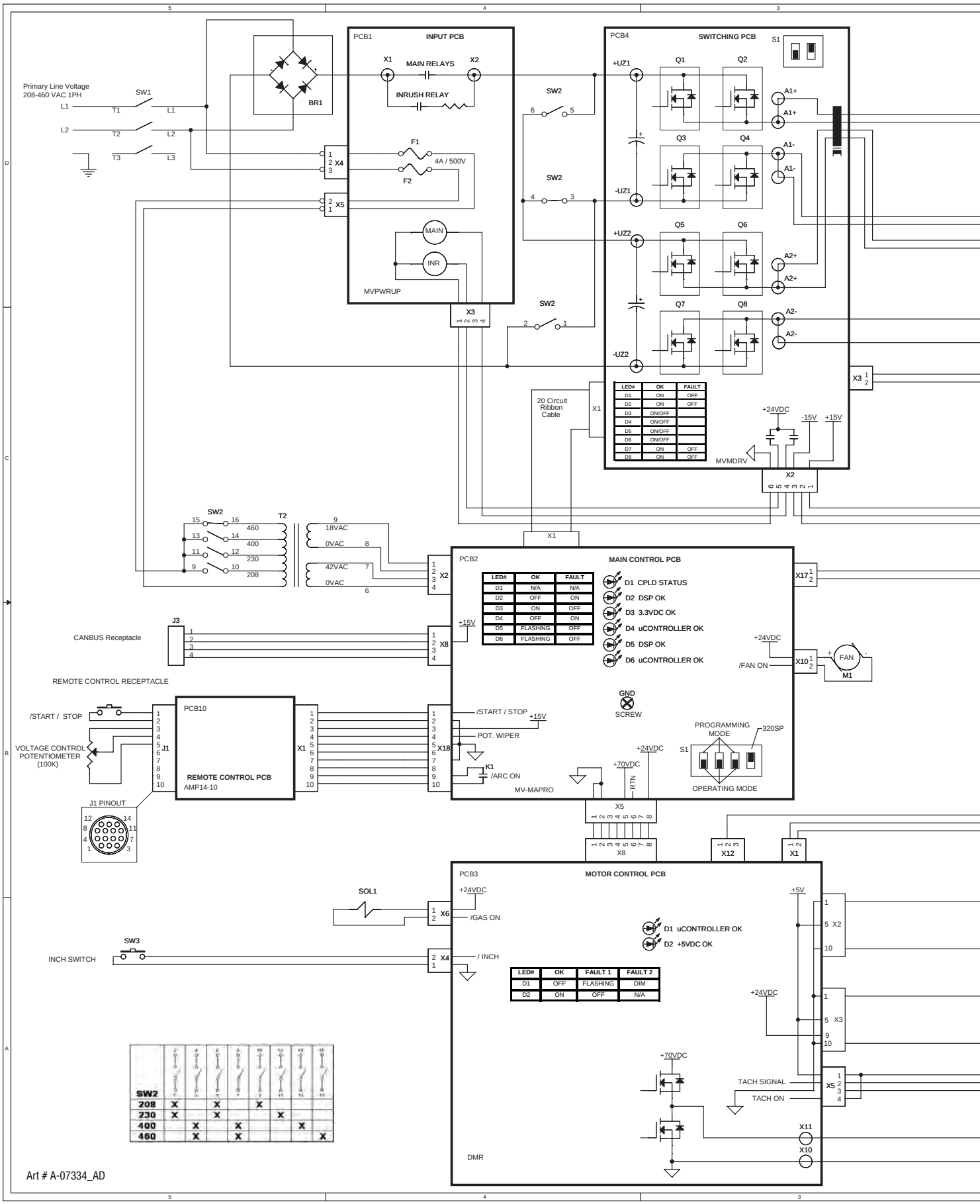
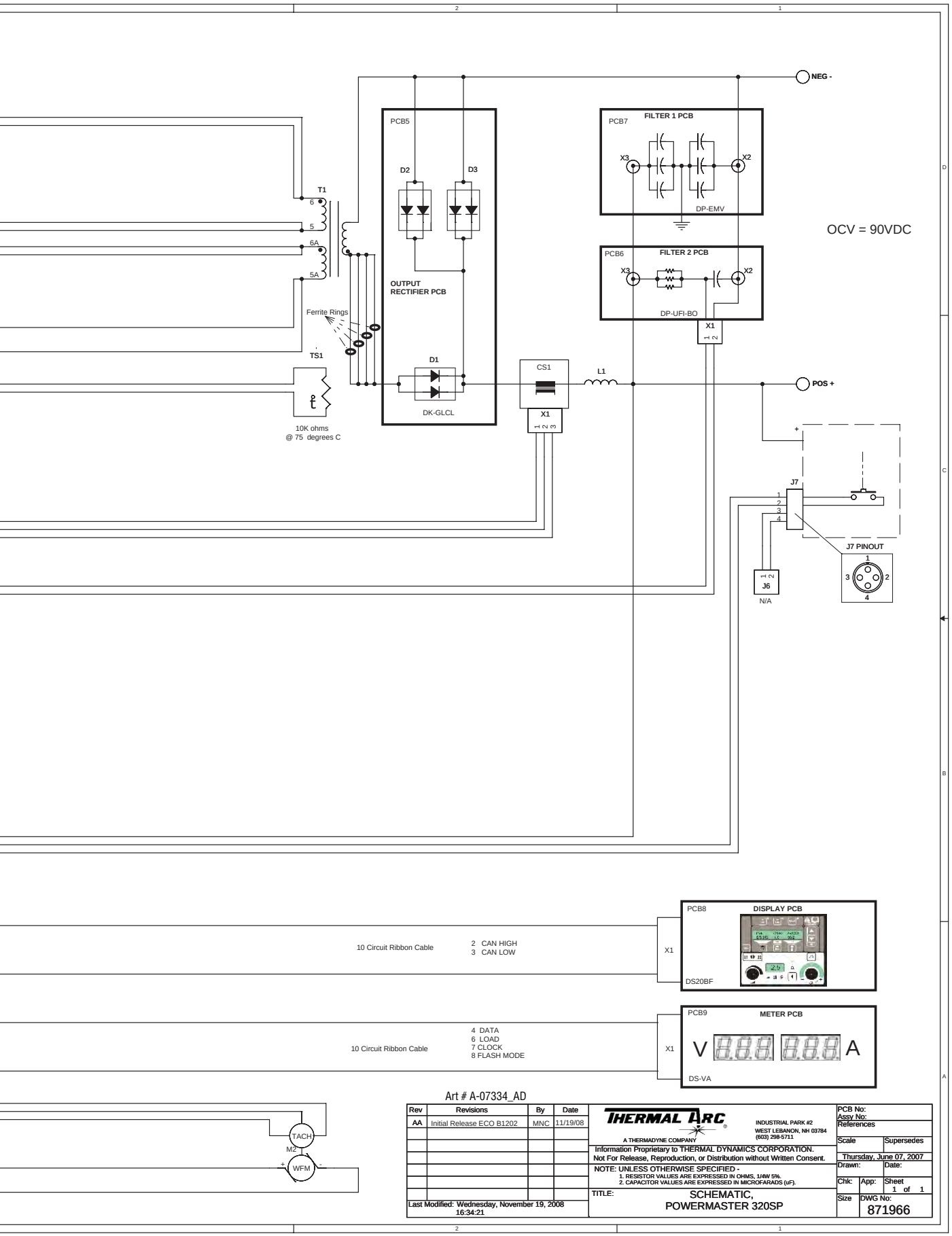
valve
torch switch
wire inch switch

Art # A-07729

APPENDIX 5: POWERMASTER 320P POWER SCHEMATIC



Refer to pages 8-2 and 8-4 for ordering information of parts shown in this schematic.



Art # A-07334_AD

Rev	Revisions	By	Date
AA	Initial Release ECO B1202	MNC	11/19/08

Last Modified: Wednesday, November 19, 2008 16:34:21

THERMAL ARC
A THERMADYNE COMPANY
INDUSTRIAL PARK #2
WEST LEBANON, NH 03784
(603) 298-5711

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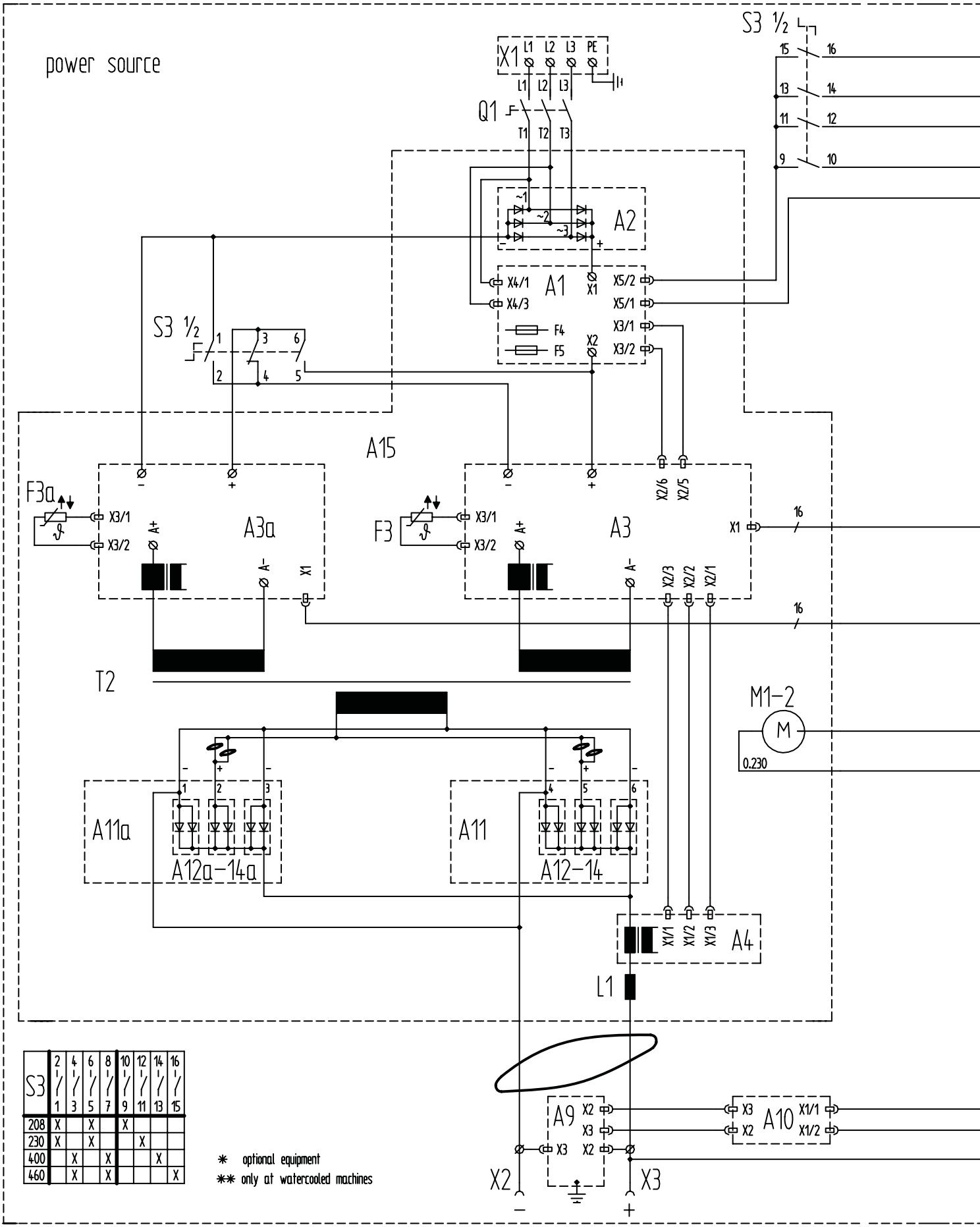
NOTE: UNLESS OTHERWISE SPECIFIED -
1. RESISTOR VALUES ARE EXPRESSED IN OHMS, 1/4W 5%.
2. CAPACITOR VALUES ARE EXPRESSED IN MICROFARADS (uF).

TITLE: SCHEMATIC, POWERMASTER 320SP

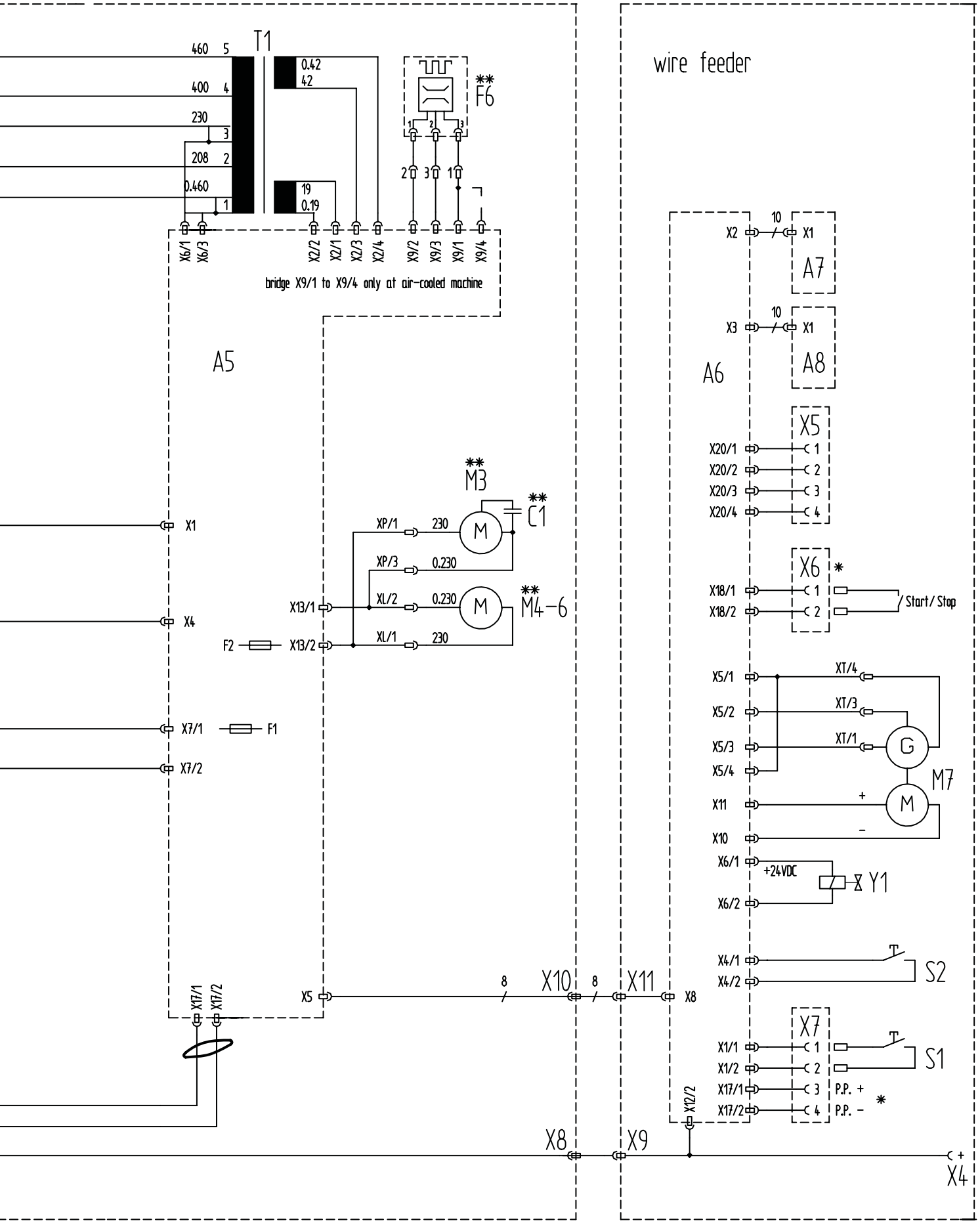
PCB No:
Assy No:
References
Scale
Supersedes
Thursday, June 07, 2007
Drawn:
Date:
Chk:
App:
Sheet 1 of 1
Size
DWG No: 871966

APPENDIX 6: POWERMASTER 400SP POWER SCHEMATIC



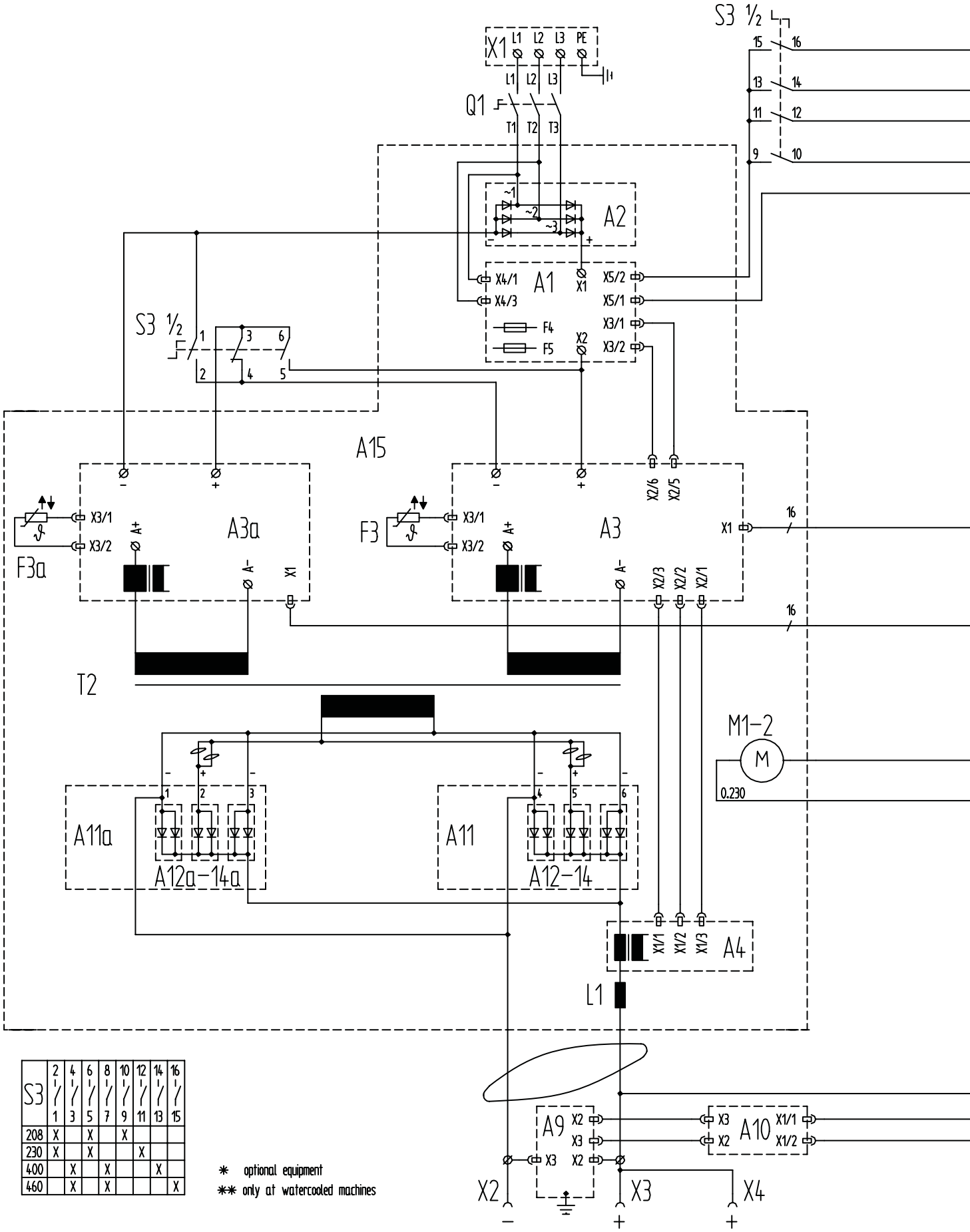
PowerMaster 400SP Power Schematic S00.0023.3-00 Art # A-07735_AB

Refer to pages 8-10 and 8-14 for ordering information of parts shown in this schematic.



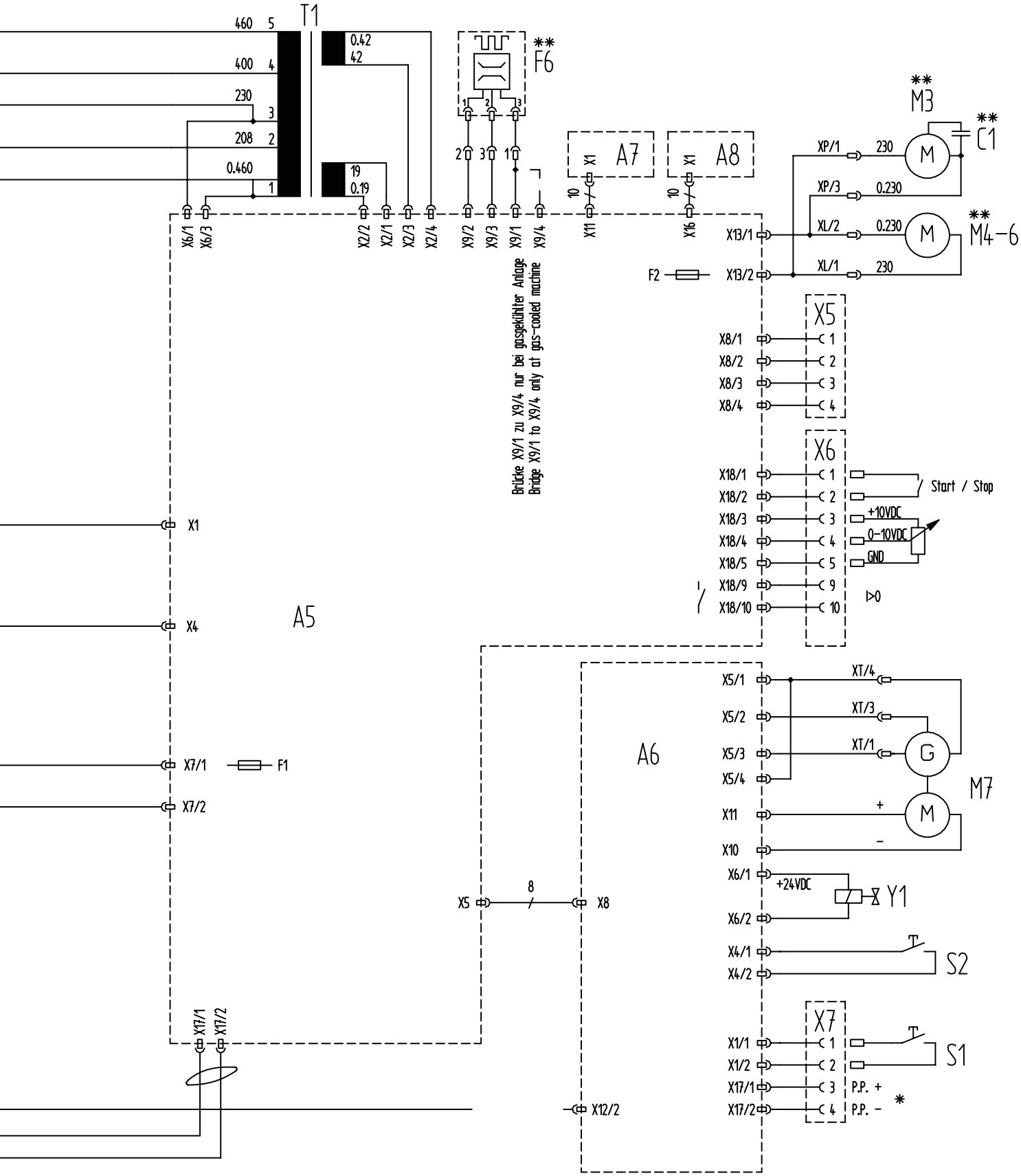
Art # A-07735_AB

APPENDIX 7: POWERMASTER 400SP COMPACT POWER SCHEMATIC



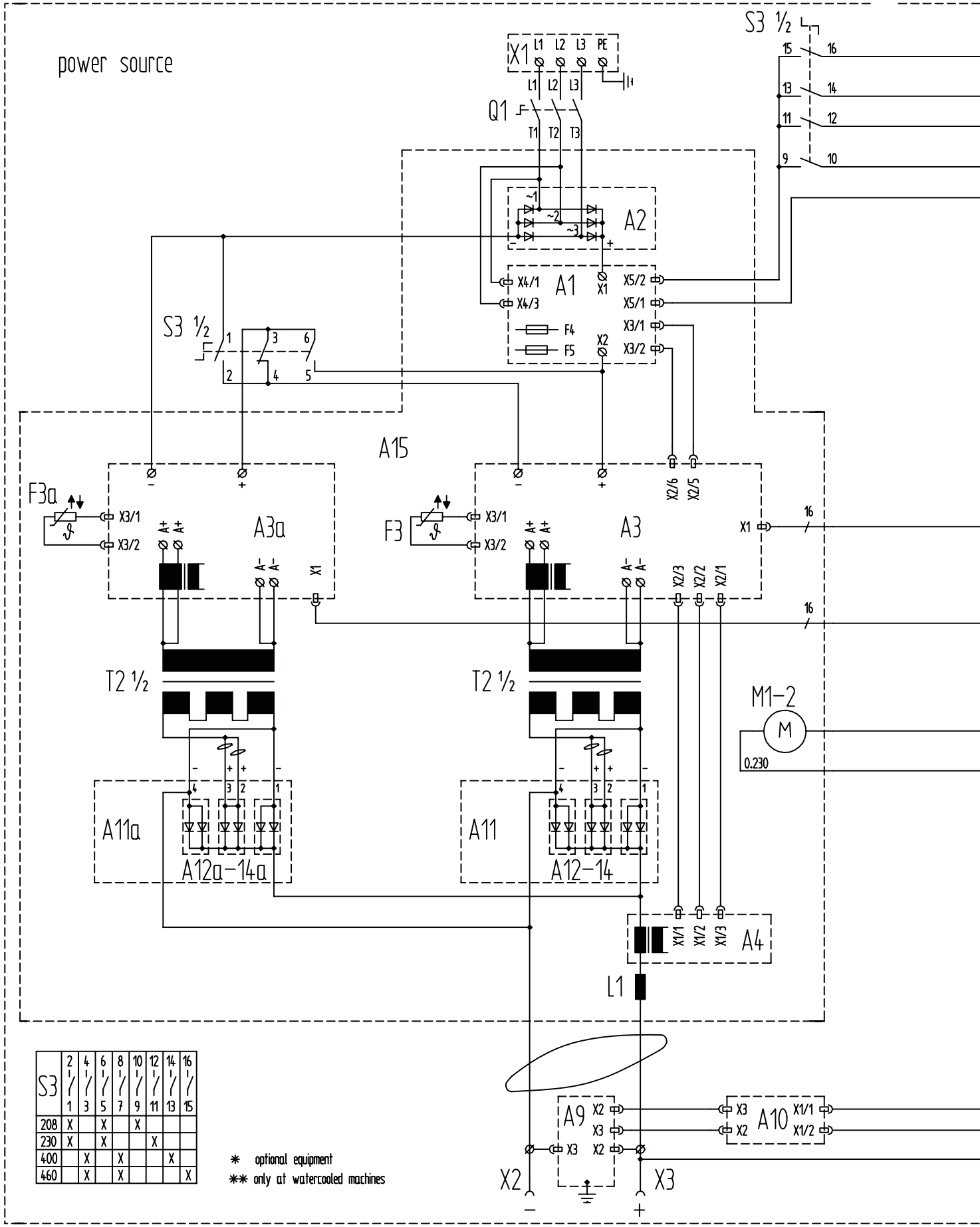
PowerMaster 400SP Compact Power Schematic S00.0023.2-00 Art # A-08553

Refer to pages 8-6, 8-8 and 8-14 for ordering information of parts shown in this schematic.



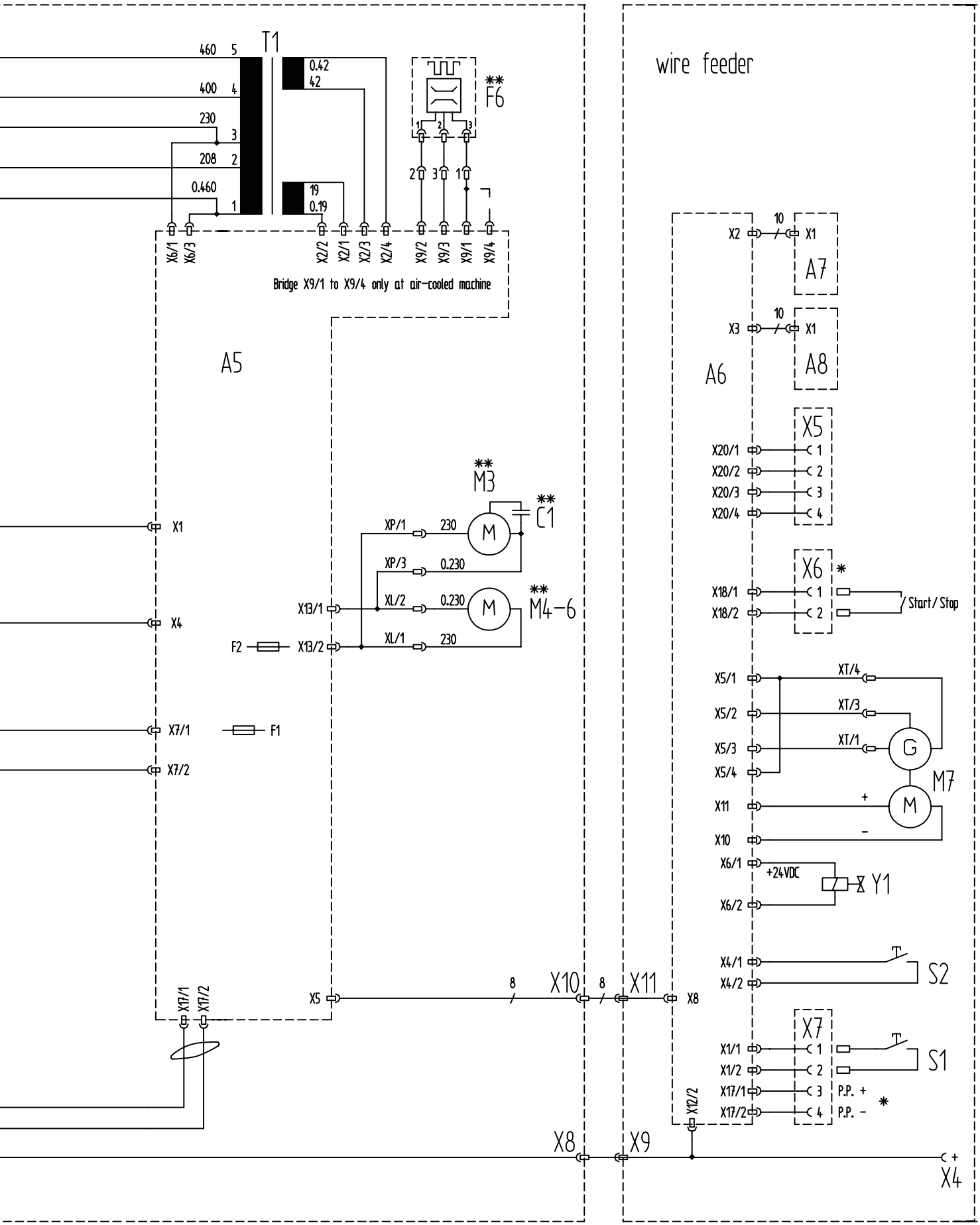
Art # A-08553

APPENDIX 8: POWERMASTER 500SP POWER SCHEMATIC



PowerMaster 500SP Power Schematic S00.0023.5-00 Art #A-07736_AB

Refer to pages 8-12 and 8-15 for ordering information of parts shown in this schematic.



Art #A-07736_AB

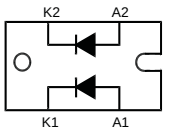
APPENDIX 9: RECTIFIER DIODE DATA SHEET

BYT230PIV-1000
BYT231PIV-1000

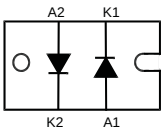
FAST RECOVERY RECTIFIER DIODES

MAIN PRODUCT CHARACTERISTICS

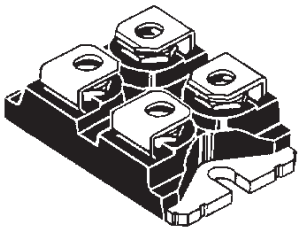
$I_{F(AV)}$	2 x 30 A
V_{RRM}	1000 V
V_F (max)	1.8 V
trr (max)	80 ns



BYT231PIV-1000



BYT230PIV-1000



ISOTOP™
(Plastic)

FEATURES AND BENEFITS

- VERY LOW REVERSE RECOVERY TIME
- VERY LOW SWITCHING LOSSES
- LOW NOISE TURN-OFF SWITCHING
- INSULATED PACKAGE: ISOTOP
  Insulation voltage: 2500 V_{RMS}
  Capacitance = 45 pF
  Inductance < 5 nH

DESCRIPTION

Dual high voltage rectifier devices are suited for free-wheeling function in converters and motor control circuits.

Packaged in ISOTOP, they are intended for use in Switch Mode Power Supplies.

ABSOLUTE RATINGS (limiting values, per diode)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		1000	V
I_{FRM}	Repetitive peak forward current	tp=5 µs F=1kHz	700	A
$I_{F(RMS)}$	RMS forward current		50	A
$I_{F(AV)}$	Average forward current	Tc = 55°C δ = 0.5	30	A
I_{FSM}	Surge non repetitive forward current	tp = 10 ms Sinusoidal	200	A
T_{stg}	Storage temperature range		- 40 to + 150	°C
Tj	Maximum operating junction temperature		150	°C

Art #A-07789

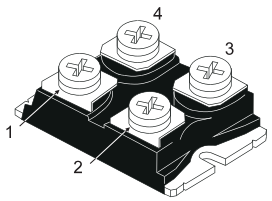
APPENDIX 10: MOSFET DATA SHEET

STE53NC50

N-CHANNEL 500V - 0.070Ω - 53A ISOTOP
PowerMesh™II MOSFET

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STE53NC50	500V	< 0.08Ω	53 A

- TYPICAL R_{DS}(on) = 0.07 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- NEW HIGH VOLTAGE BENCHMARK
- GATE CHARGE MINIMIZED



ISOTOP

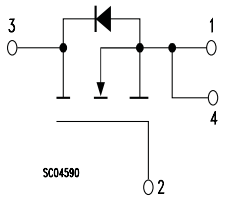
DESCRIPTION

The PowerMESH™II is the evolution of the first generation of MESH OVERLAY™. The layout refinements introduced greatly improve the Ron*area figure of merit while keeping the device at the leading edge for what concerns swithing speed, gate charge and ruggedness.

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVER

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{GS} = 0)	500	V
V_{DGR}	Drain-gate Voltage (R_{GS} = 20 kΩ)	500	V
V_{GS}	Gate- source Voltage	±30	V
I_D	Drain Current (continuos) at T_C = 25°C	53	A
I_D	Drain Current (continuos) at T_C = 100°C	33	A
I_{DM} (•)	Drain Current (pulsed)	212	A
P_{TOT}	Total Dissipation at T_C = 25°C	460	W
	Derating Factor	3.68	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	3	V/ns
V_{ISO}	Insulation Winthstand Voltage (AC-RMS)	2500	V
T_{stg}	Storage Temperature	– 65 to 150	°C
T_j	Max. Operating Junction Temperature	150	°C

(•)Pulse width limited by safe operating area

(1) I_{SD}≤ 53A, di/dt≤100 A/µs, V_{DD}≤ 24V, Tj≤T_{jMAX}

Art # A-07788_AB

LIMITED WARRANTY

This information applies to Thermal Arc products that were purchased in the USA and Canada.

November 2007

LIMITED WARRANTY: Thermal Arc®, Inc., A Thermadyne Company ("Thermal Arc"), warrants to customers of authorized distributors ("Purchaser") that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the warranty period stated below, Thermal Arc shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal Arc's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or damage, correct such defects by suitable repair or replacement, at Thermal Arc's sole option, of any components or parts of the product determined by Thermal Arc to be defective.

This warranty is exclusive and in lieu of any warranty of merchantability, fitness for any particular purpose, or other warranty of quality, whether express, implied, or statutory.

Limitation of liability: Thermal Arc shall not under any circumstances be liable for special, indirect, incidental, or consequential damages, including but not limited to lost profits and business interruption. The remedies of the purchaser set forth herein are exclusive, and the liability of Thermal Arc with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal Arc, whether arising out of contract, tort, including negligence or strict liability, or under any warranty, or otherwise, shall not exceed the price of the goods upon which such liability is based.

No employee, agent, or representative of Thermal Arc is authorized to change this warranty in any way or grant any other warranty, and Thermal Arc shall not be bound by any such attempt. Correction of non-conformities, in the manner and time provided herein, constitutes fulfillment of thermal's obligations to purchaser with respect to the product.

This warranty is void, and seller bears no liability hereunder, if purchaser used replacement parts or accessories which, in Thermal Arc's sole judgment, impaired the safety or performance of any Thermal Arc product. Purchaser's rights under this warranty are void if the product is sold to purchaser by unauthorized persons.

The warranty is effective for the time stated below beginning on the date that the authorized distributor delivers the products to the Purchaser. Notwithstanding the foregoing, in no event shall the warranty period extend more than the time stated plus one year from the date Thermal Arc delivered the product to the authorized distributor.

Warranty repairs or replacement claims under this limited warranty must be submitted to Thermal Arc via an authorized Thermal Arc repair facility within thirty (30) days of purchaser's discovery of any defect. Thermal Arc shall pay no transportation costs of any kind under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the Purchaser. All returned goods shall be at the Purchaser's risk and expense. This warranty dated November 1st 2007 supersedes all previous Thermal Arc warranties. Thermal Arc® is a Registered Trademark of Thermal Arc, Inc.

WARRANTY SCHEDULE

This information applies to Thermal Arc products that were purchased in the USA and Canada.

November 2007

SAFETY EQUIPMENT	WARRANTY PERIOD	LABOR
Auto-Darkening Welding Helmet (Electronic Lens)	1 year	1 year
Harness Assembly	1 Month	1 Month
ENGINE DRIVEN WELDERS	**WARRANTY PERIOD**	**LABOR**
Scout, Raider, Explorer		
Original Main Power Stators and Inductors	3 years	3 years
Original Main Power Rectifiers, Control P.C. Boards	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semi-conductors	1 year	1 year
Engines and associated components are NOT warranted by Thermal Arc, although most are warranted by the engine manufacturer	See the Engine Manufactures Warranty for Details	
GMAW/FCAW (MIG) WELDING EQUIPMENT	**WARRANTY PERIOD**	**LABOR**
Fabricator 131, 181; 140; 180; 190, 210, 251, 281; Fabstar 4030; PowerMaster 350, 350P, 500, 500P; 320SP; 400SP; 500SP; Excelarc 6045. Wire Feeders; Ultrafeed, Portafeed		
Original Main Power Transformer and Inductor	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards, power switch semi-conductors	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, electric motors.	1 year	1 year
GTAW (TIG) & MULTI-PROCESS INVERTER WELDING EQUIPMENT	**WARRANTY PERIOD**	**LABOR**
160TS, 300TS, 400TS, 185AC/DC, 200AC/DC, 300AC/DC, 400GTSW, 400MST, 300MST, 400MSTP		
Original Main Power Magnetics	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards, power switch semi-conductors	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, electric motors.	1 year	1 year
PLASMA WELDING EQUIPMENT	**WARRANTY PERIOD**	**LABOR**
Ultima 150		
Original Main Power Magnetics	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards, power switch semi-conductors	3 years	3 years
Welding Console, Weld Controller, Weld Timer	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, electric motors, Coolant Recirculator	1 year	1 year
SMAW (Stick) WELDING EQUIPMENT	**WARRANTY PERIOD**	**LABOR**
Dragster 85		
Original Main Power Magnetics	1 year	1 year
Original Main Power Rectifiers, Control P.C. Boards	1 year	1 year
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semi-conductors	1 year	1 year
160S, 300S, 400S		
Original Main Power Magnetics	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semi-conductors	1 year	1 year
GENERAL ARC EQUIPMENT	**WARRANTY PERIOD**	**LABOR**
Water Recirculators	1 year	1 year
Plasma Welding Torches	180 days	180 days
Gas Regulators (Supplied with power sources)	180 days	Nil
MIG and TIG Torches (Supplied with power sources)	90 days	Nil
Replacement repair parts	90 days	Nil
MIG, TIG and Plasma welding torch consumable items	Nil	Nil

GLOBAL CUSTOMER SERVICE CONTACT INFORMATION

Thermadyne USA
2800 Airport Road
Denton, Tx 76207 USA
Telephone: (940) 566-2000
800-426-1888
Fax: 800-535-0557
Email: sales@thermalarc.com

Thermadyne Canada
2070 Wyecroft Road
Oakville, Ontario
Canada, L6L5V6
Telephone: (905)-827-1111
Fax: 905-827-3648

Thermadyne Europe
Europe Building
Chorley North Industrial Park
Chorley, Lancashire
England, PR6 7Bx
Telephone: 44-1257-261755
Fax: 44-1257-224800

Thermadyne, China
RM 102A
685 Ding Xi Rd
Chang Ning District
Shanghai, PR, 200052
Telephone: 86-21-69171135
Fax: 86-21-69171139

Thermadyne Asia Sdn Bhd
Lot 151, Jalan Industri 3/5A
Rawang Integrated Industrial Park - Jln Batu Arang
48000 Rawang Selangor Darul Ehsan
West Malaysia
Telephone: 603+ 6092 2988
Fax : 603+ 6092 1085

Cigweld, Australia
71 Gower Street
Preston, Victoria
Australia, 3072
Telephone: 61-3-9474-7400
Fax: 61-3-9474-7510

Thermadyne Italy
OCIM, S.r.L.
Via Benaco, 3
20098 S. Giuliano
Milan, Italy
Tel: (39) 02-98 80320
Fax: (39) 02-98 281773

Thermadyne International
2070 Wyecroft Road
Oakville, Ontario
Canada, L6L5V6
Telephone: (905)-827-9777
Fax: 905-827-9797

World Headquarters
Thermadyne Holdings Corporation
Suite 300, 16052 Swingley Ridge Road
St. Louis, MO 63017
Telephone: (636) 728-3000
FAX: (636) 728-3010
Email: sales@thermalarc.com

www.thermalarc.com

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