MAGNATECH
ORBITAL WELDING SYSTEMS

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Operating and Maintenance
Instruction Manual

For

Pipeliner II Model 609A
Orbital Weld Head

- Wire Feed on Floor (WFOF) version
- Wire Feed on Hand (WFOH version
- Wire Feed Push-pull (WFPP) version

For Use With
MPS 4000 Power Source & Model 712 Controller
(See Separate Manual)

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1.0 INTRODUCTION

The Pipeliner Welding System is designed for mechanized welding applications using the high-deposition GMAW/FCAW processes for efficient joining. Circular Guide Rings allow use for pipe-to-pipe and pipe-to-fitting butt welding. Flx-Track allows linear welding on flat or curved workpieces (ID and OD). A simple adaptor (optional) allows use for socket and fillet welding applications. An optional pendular torch oscillator is recommended for fillet applications, and welding pipe with wall thicknesses over 50mm (2").

The weld Head is designed to be used with the Pipeliner model 712 Controller, MPS 4000 Power Source and Water Circulator.

This Weld Head is available in three versions:

- Floor mounted wire feeder
- Hand mounted wire feeder
- Push-pull system

This manual covers general operating instructions, as well as assistance in weld procedure development.

The appropriate interconnect cables and accessories are provided.

When the equipment is first received we recommend that a quick inventory is taken of all items using the packing list enclosed with the shipment.

ATTENTION:ALL FASTENERS ON THESE WELD HEAD MODELS ARE METRIC

1.1 COPYRIGHT NOTICE

2.0 PIPELINER IIC COMPONENT INVENTORY

Each model comes equipped with the following components:

2.1 WELD HEAD 609A S/N _____

1Pipeliner II Weld Head Model 609A (WFOF)609AF0AWC0
Floor-mounted Feeder with Pneumatic
Mounting and Pendular Oscillation Option
1 - Weld Head - 103951-PD
1 - Torch Cable - 103090-15-PD
1 - Accessories Kit - 104017-1
1 - Dual Regulator - 38416
1 - Operation Manual - Manual

1Pipeliner II Weld Head Model 609A (WFOF)609AF0A0C0
Floor-mounted Feeder with Pneumatic
Mounting
1 - Weld Head - 103951-P
1 - Torch Cable - 103090-15-P
1 - Accessories Kit - 104017-1
1 - Dual Regulator - 38416
1 - Operation Manual - Manual

1Pipeliner II Weld Head Model 609, 609AGEB0CP
Pneumatic Mounting, w/Push Pull Wire
Feeder (WFPP)
1 - Weld Head - 103951-P
1 - Torch Cable - 103364-25-P
1 - Wire Drive Kit - 104022-1
1 - Accessories Kit - 104017-1
1 - Dual Regulator - 38416
1 - Operation Manual - Manual

1Pipeliner II Weld Head Model 609A, 609AGEB0C9
Pneumatic Mounting, 2-Roll Head-
Mounted Feeder (WFOH)
1 - Weld Head - 103951-P
1 - Torch Cable - 103364-25-P
1 - Wire Drive Kit - 104022-1
1 - Accessories Kit - 104017-1
1 - Dual Regulator - 38416
1 - Operation Manual - Manual

1Pipeliner II Weld Head Model 609A, 609AGEBWC9
Pneumatic Mounting, 2-Roll Head-
Mounted Feeder (WFOH), 25' (8m)
Torch Cable
1 - Weld Head - 103951-PD
1 - Torch Cable - 103364-25-P
1 - Wire Drive Kit - 104022-1
1 - Accessories Kit - 104017-1
1 - Dual Regulator - 38416
1 - Operation Manual - Manual

1Pipeliner II Weld Head Model 609A, 609AGEC0C9
Pneumatic Mounting, 2-Roll Head-
Mounted Feeder, 50' (15m)
Torch Cable, (WFOH)
1 - Weld Head - 103951-P
1 - Torch Cable - 103364-50-P
1 - Wire Drive Kit - 104022-1
1 - Accessories Kit - 104017-1
1 - Dual Regulator - 38416
1 - Operation Manual - Manual

1Pipeliner II Weld Head Model 609A, 609AGECW9
Pneumatic Mounting, 2-Roll Head-
Mounted Feeder, 50' (15m) Torch
Cable w/Pendular Oscillator (WFOH)
1 - Weld Head - 103951-PD
1 - Torch Cable - 103364-50-PD
1 - Wire Drive Kit - 104022-1
1 - Accessories Kit - 104017-1
1 - Dual Regulator - 38416
1 - Operation Manual - Manual

2.2 GUIDE RINGS

1103040-XXXXX Guide Ring Assembly - Friction Drive
A/R103070-XXXX Adaptor Foot Set - Guide Ring Radial Extension

2.3 OPTIONAL INSTALLED COMPONENTS/KITS:

1103190-1Torch Axial Slide Assembly - MIG (For Socket Welding)

2.4 OPTIONAL FREE-STANDING (UNATTACHED) COMPONENTS:

1103408-50Extension Cable 15m (50’)

3.0 SAFETY INSTRUCTION AND WARNING FOR OPERATION AND ARC WELDING EQUIPMENT

! WARNING !

Read Before Proceeding

3.1 **IMPORTANT**: The nature of the GMAW process creates some potential hazards. In accordance and compliance with the international safety regulations, the "exclamation symbol" indicates that this equipment is to be considered "Hazardous" UNTIL an operator has been made aware of these potential hazards by READING THIS MANUAL. The "lightening flash" symbol indicates that there are potential electrical hazards. The display of these symbols make it the OPERATOR'S RESPONSIBILITY TO INSURE THAT HE HAS READ AND/OR BEEN MADE AWARE OF ALL OF THE SAFETY RELATED ITEMS CONTAINED IN THIS MANUAL.

READ AND UNDERSTAND THESE INSTRUCTIONS BEFORE INSTALLING, OPERATING OR SERVICING MAGNATECH EQUIPMENT OR AUXILIARY EQUIPMENT SUPPLIED AS PART OF THE WELDING SYSTEM.

3.2 INTRODUCTION

Welding products and welding processes can cause serious injury or death, and possible damage to other equipment 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. Anyone not having extensive training in welding 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 later in this section.

3.3 SHOCK PREVENTION

Bare conductors, or terminals in the output circuit, or ungrounded, electrically-live equipment can fatally shock a person. To protect against shock, have a competent electrician verify that the equipment is adequately grounded. Do not make contact with terminals and parts that are electrically HOT.

The body's electrical resistance is decreased when wet, permitting dangerous

currents to flow through the body. Do not work in damp area without being extremely careful. Stand on dry rubber mats or dry wood and use insulating gloves when dampness or sweat cannot be avoided. Keep clothing dry.

3.3.1 Installation and Grounding of Electrically Powered Equipment

Electrical equipment must be installed and maintained in accordance with the National Electrical Code, NFPA 70, and local codes. A power disconnect switch must be located at the equipment. Check equipment nameplates for voltage and phase requirements. If only 3-phase power is available, connect single-phase equipment to only two wires of the 3-phase line. DO NOT CONNECT the equipment grounding conductor (lead) to the third live wire of the 3-phase line as this makes the equipment frame electrically HOT, which can cause fatal shock.

If a grounding lead (conductor) is part of the power supply cable, be sure to connect it to a properly grounded switch box or building ground. If not part of the supply cable, use a separate grounding lead (conductor). Do not remove a ground prong from any plug. Use correct mating receptacles. Check ground for electrical continuity before using equipment.

3.3.2 Torch and Work Cables

Inspect cables often for damage to the insulation. Replace or repair cracked or worn cables immediately. Do not use a welding current in excess of rated cable capacity, as the cable will overheat.

3.3.3 Power Source Output Terminals

The Fronius TPS-450 Power Source completely shields the output terminals when the Torch and Ground Cables are connected.

3.3.4 Service and Maintenance

Shut OFF all power at the disconnect switch or line breaker before inspecting or servicing the equipment. Unplug the input power cord. If the equipment is wired directly to an electrical box. lock the switch OFF (or remove line fuses) so that power cannot be turned ON accidentally. Disconnect power to equipment if it is to be left unattended or out of service.

3.3.5 Fuses and Circuit Breakers

Replace fuses and circuit breakers with equivalent sizes.

3.4 BURN PREVENTION

The welding arc emits high energy radiation in the infrared and ultraviolet range. This energy penetrates lightweight clothing and is reflected from light-colored surfaces. The arc rays can injure the eyes permanently and burn the skin, just as in "sunburn". Never look at an electric arc without eye protection.

3.4.1 Protective Clothing

Wear gloves, suitable long sleeved shirts/jackets, safety shoes, welding helmet, and other articles needed to shield the skin and to prevent injury from arc burns. Wear ear plugs if welding overhead or in a confined space. Wear a hard hat if others are working above you.

3.4.2 Eye and Head Protection

Protect your eyes and head by wearing a welding helmet fitted with a double lens; use a clear lens outside and a colored, welding filter inside. Use at least a number 10 filter. If welding over 100 amps, use a number 12 filter (or darker as appropriate).

Always lower the helmet before striking the arc. Wear safety glasses with side shields under the helmet to protect the eyes from flying particles and side arc flashes when the helmet is up.

Protect the eyes of other people in the area by use of opaque, non-reflecting and nonflammable screens around your welding station. Allow good air circulation, especially at floor level. Do not permit anyone to view the arc unless he uses a correct hand shield, or helmet.

3.5 TOXIC FUME PREVENTION:

Breathing the fumes created during welding or cutting can cause illness or death if adequate ventilation is not provided. Provide ventilation in accordance with ANSI Standard Z49.1.

Some Fume Sources are:

3.5.1 Weldments

Metals containing lead, cadmium, zinc, mercury and beryllium can produce harmful toxic fumes when welded or cut. Adequate local exhaust ventilation must be used for the operator and persons in the area.

3.5.2 Coated Weldments

Remove coatings that emit toxic fumes when heated or use exhaust ventilation and/or an air-supplied respirator.

3.5.3 Vessels That Have Contained Toxic Materials

Vapors from chlorinated solvents can be decomposed by the arc to form the highly toxic gas called PHOSGENE or other damaging products. The ultraviolet radiant energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form PHOSGENE. Do not weld or cut unless such containers have been thoroughly cleaned following AWS Standard A6.0.

3.5.4 Welding Area

Do not weld in locations close to chlorinated vapors coming from degreasing, cleaning or spraying operations. The heat and rays from the arc react with the vapors to form highly toxic PHOSGENE. Work in a confined space only if it is being adequately ventilated, and if ventilation is not adequate, wear an air-supplied respirator (see ANSI 2.37).

3.6 COMPRESSED GAS CYLINDER HANDLING:

Follow precautions below and those outlined in CGA Standard P-1, Precautions For Safe Handling Of Compressed Gases in Cylinders.

3.6.1 Cylinders

Handle carefully to prevent damage. Keep away from welding cables or other electrical circuits. Use only cylinders with name of gas marked on them; DO NOT rely on color identification. Close valves on empties and return promptly. Secure cylinders so they cannot be knocked over. Keep temperature below 130 degrees F.

3.6.2 Pressure Regulators

Use the correct regulator for the gas and cylinder at hand. Remove any suspected faulty regulator and return to manufacturer's service center for repair.

3.7 EQUIPMENT WARNING LABELS:

Inspect all precautionary labels on the equipment.

3.8 ADDITIONAL SAFETY AND HEALTH INFORMATION:

3.8.1 ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING. Order from the American Welding Society, P. O. Box 351040, 550 N. W. LaJeune Road, Miami, FL 33125.

3.8.2 ANSI Standard Z87.1, SAFE PRACTICE FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION. Order from American National Standards Institute, 1430 Broadway, New York, NY 10018.

3.8.3 ANSI Standard Z241.1, Standard for Men's Safety-Toe Footwear. Order from same as item 2.

3.8.4 American Welding Society Standard F4.1-80, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES. Order same as for Item 1.

3.8.5 OSHA Standard 29 CFR, Part 1910, Subpart Q, WELDING, CUTTING AND BRAZING. Order from Superintendent of Documents, U.S.

Government Printing Office, Washington, DC 20402.

3.8.6 NFPA Standard 51B. CUTTING AND WELDING PROCESSES. Order from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

3.8.7 CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS. Order from the Compressed Gas Association 1235 Jeff Davis Highway, Arlington, VA 22202.

3.8.8 CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING. Order from Canadian Standards Association, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

			
WARNING	● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground.	● Keep flammable materials away.	● Wear eye, ear and body protection.
Spanish **AVISO DE PRECAUCION**	● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aislese del trabajo y de la tierra.	● Mantenga el material combustible fuera del área de trabajo.	● Protéjase los ojos, los oídos y el cuerpo.
French **ATTENTION**	● Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension. ● Isolez-vous du travail et de la terre.	● Gardez à l'écart de tout matériel inflammable.	● Protégez vos yeux, vos oreilles et votre corps.
German **WARNUNG**	● Berühren Sie keine stromführenden Teile oder Elektroden mit ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden!	● Entfernen Sie brennbarres Material!	● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese **ATENÇÃO**	● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra.	● Mantenha inflamáveis bem guardados.	● Use proteção para a vista, ouvido e corpo.
Japanese **注意事項**	● 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。 ● 施工物やアースから身体が絶縁されている様にして下さい。	● 燃えやすいものの側での溶接作業は絶対にしてはなりません。	● 目、耳及び身体に保護具をして下さい。
Chinese **警 告**	● 皮肤或湿衣物切勿接触带電部件及銲條。 ● 使你自己與地面和工件絶緣。	● 把一切易燃物品移離工作場所。	● 佩戴眼、耳及身體勞動保護用具。
Korean **위 험**	● 전도체나 용접봉을 젖은 헝겁 또는 피부로 절대 접촉치 마십시요. ● 모재와 접지를 접촉치 마십시요.	● 인화성 물질을 접근 시키지 마시요.	● 눈, 귀와 몸에 보호장구를 착용하십시요.
Arabic **تحذير**	● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء. ● ضع عازلا على جسمك خلال العمل.	● ضع المواد القابلة للاشتعال في مكان بعيد.	● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.

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

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

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

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

● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone.	● Turn power off before servicing.	● Do not operate with panel open or guards off.	**WARNING**
● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.	● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.	● No operar con panel abierto o guardas quitadas.	Spanish **AVISO DE PRECAUCION**
● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.	● Débranchez le courant avant l'entretien.	● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.	French **ATTENTION**
● Vermeiden Sie das Einatmen von Schwelbrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!	● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)	● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!	German **WARNUNG**
● Mantenha seu rosto da fumaça. ● Use ventilação e exhaustão para remover fumo da zona respiratória.	● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas.	● Mantenha-se afastado das partes moventes. ● Não opere com os painéis abertos ou guardas removidas.	Portuguese **ATENÇÃO**
● ヒュームから頭を離すようにして下さい。 ● 換気や排煙に十分留意して下さい。	● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切って下さい。	● パネルやカバーを取り外したままで機械操作をしないで下さい。	Japanese **注意事項**
● 頭部遠離煙霧。 ● 在呼吸區使用通風或排風器除煙。	● 維修前切斷電源。	● 儀表板打開或沒有安全罩時不準作業。	Chinese **警 告**
● 얼굴로부터 용접가스를 멀리하십시요. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요.	● 보수전에 전원을 차단하십시요.	● 판넬이 열린 상태로 작동치 마십시요.	Korean **위 험**
● ابعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها.	● اقطع التيار الكهربائي قبل القيام بأية صيانة.	● لا تشغل هذا الجهاز اذا كانت الاغطية الحديدية الواقية ليست عليه.	Arabic **تحذير**

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

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

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

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

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

4.0 WARRANTY POLICY & SUPPORT

4.1 General:

Magnatech warrants equipment that it manufactures to be free from defects from material and workmanship under normal use and service for the periods defined below. This Warranty shall apply to the Original Purchaser only, and is not transferable. All warranty time periods start on the date that the equipment was delivered to the original retail purchaser. Our sole obligation under this warranty is limited to repairing or replacing the defective part or parts, which in our judgment show evidence of such defects. All warranty repair work shall be accomplished at the factory and Magnatech assumes no obligation to perform warranty service at a customer's facility. If requested, Magnatech shall supply warranty parts for customer installation, but reserves the right to request the return of parts declared defective. This warranty is given in lieu of and to the exclusion of any and all other warranties, express or implied. Specifically, and without limiting the generality of the above disclaimer, Magnatech disclaims any warranty of merchantability or fitness for any particular purpose as to any and all goods sold to the Buyer (whether for the ultimate use of the Buyer, or any other person) pursuant to the purchase order, contract or in connection therewith.

See Detailed Warranty Terms and Magnatech's General Terms and Conditions.

MAGNATECH LIMITED WARRANTY

Effective November 2008

GENERAL:

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COVERED COMPONENTS:

A. 1 Year – Parts and Labor
- ❑ All Magnatech Power Sources/ Controllers
- ❑ All Model Water Circulators (with exception of Pump)
- ❑ All Weld Heads

B. 6 months
- ❑ Switches

C. 3 months – Parts and Labor
- ❑ Torch cable assemblies
- ❑ Relays
- ❑ Batteries

EXCLUDED COMPONENTS:

Magnatech Limited Warranty shall not apply to:

1. Equipment Supplied Not Manufactured By Magnatech
   With respect to standard equipment supplied by Magnatech as part of a complete welding system, Magnatech extends the same warranty as offered by the individual manufacturer of this standard equipment if any. In many instances such items are warranted directly by the manufacturer, and Magnatech may, from time to time, inform the customers of such warranty coverage; however, Magnatech does not guarantee the accuracy of completeness of its information regarding such warranties.

2. Expendable Items
   This warranty does not cover certain items considered expendable and certain high wear items offered herein. Expendable items consist of welding torch components, wire feed conduits, motor brushes, fuses, bulbs and filters.

3. Modification And Misuse
   This warranty does not apply to products which have been modified in any way by any party other than Magnatech; nor to products which have not been installed and operated in accordance with applicable industry standards; or to products which have been used other than under usual conditions for which they are designed; nor to products that have not received proper care, protection and maintenance under supervision of competent personnel.

UTILIZATION FOR INTENDED PURPOSE ONLY:

The Tubemaster, Pipemaster, and Pipeliner systems are intended to be used SOLELY for GTAW or GMAW/FCAW orbital welding applications. Any other use is deemed to be “not for the intended purpose” and the manufacturer shall not be liable for any damage resulting there from.

Utilization for the intended purpose includes:
- observance of all instructions in the operating manual
- performance of all prescribed inspection and maintenance work

Magnatech products are intended for purchase and use by commercial/industrial users and persons trained and experienced in the use and maintenance of welding equipment.

PERFORMANCE OF WARRANTY REPAIRS – LOCATION:

Magnatech’s obligation under this warranty shall be limited to the repair or replacement, at its option, of any goods or any components or parts thereof sold by Magnatech to Buyer that prove to be defective upon Magnatech’s examination. Returned goods shall be delivered F.O.B. Magnatech’s plant, East Granby, Connecticut, at Buyers risk and expense.

DISCLAIMER:

Magnatech shall not be otherwise liable for any damages including but not limited to incidental damage, consequential damage, or special damages, whether such damages result from negligence, breach of warranty, or the result of repair and replacement activity, including, but not limited to any losses due to downtime or loss of use. Magnatech shall not be held liable for any lost profit or other damage, delay or loss which may result directly or indirectly from the adjustment, alteration, repair, maintenance, operation, or interruption thereof, of any said equipment.

There are no warranties of fitness for any particular purpose of said equipment or any other warranties (expressed, implied or statutory) concerning the performance capabilities thereof. Magnatech shall not be liable for any consequential, indirect or incidental losses or damages incurred as the result of any breach of warranty or as a result of any repair or replacement activity, including, but not limited to any losses due to down time or loss of use. Magnatech shall not be liable for any losses, injuries or damages sounding in tort, whether for the negligence of Magnatech or its agents, officers or employees or in a strict liability theory.

To the extent permitted by law, the remedies provided herein are the sole and exclusive remedies. In no event shall Magnatech be liable for direct, indirect, special incidental or consequential damages (including loss of profit), whether based on contract, tort, or any legal theory.

Any express warranty not provided herein and any implied warranty guaranty or representation as to performance, and any remedy for breach of contract tort or any other legal theory which, but for this provision might arise by implication, operation of the law, custom of trade or course of dealing including any implied warranty of merchantability or fitness for particular purpose, with respect to any and all equipment furnished by Magnatech is excluded and disclaimed by Magnatech.

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www.magnatech-lp.com

MAGNATECH Limited Partnership
Orbital Welding Systems
for your Industrial Revolution

MAGNATECH PRODUCT WARRANTY REGISTRATION

Please provide the following information and mail/fax to Magnatech. This will allow us to insure correct replacement parts are supplied, service bulletins reach the correct person, and provide a contact person for service.

Product Name: _____
S/N: _____

Product Name: _____
S/N: _____

Product Name: _____
S/N: _____

Product Name: _____
S/N: _____

Company Name: _____
Company Address: _____

Dealer: _____

Date Purchased _____

Individual Purchasing: _____
Name: _____
Address: _____
Phone: _____
Fax: _____
E-Mail: _____

Individual to Be Contacted about Upgrades, Service Issues:
Name: _____
Address: _____
Phone: _____
Fax: _____
E-Mail: _____

Magnatech Ltd. Partnership
P. O. Box 260
East Granby, CT 06026

Affix
Postage

Magnatech Limited Partnership
Attn: Sales Dept.
P. O. Box 260
East Granby, CT 06026

4.2 Support:

Now that you have purchased a Magnatech product, we want to confirm that we intend to support you after the sale with the expedient service and technical support which we strive to maintain at world-class standards.

A. Sales

U.S. Headquarters:
Tel: (860) 653-2573
Fax: (860) 653-0486
E-Mail: info@magnatech-lp.com
John Emmerson - President, Ext. 10
Ken LeDuc - Technical Specialist, Ext. 15
Bryan Kirkland - Sales Order Administration, Ext. 14
Glen Gautieri - Quoting, Ext. 37
Reta Holt - Exec. Asst., Ext. 10

Europe, Middle East, India:
Tel: +(31) 321-38-6677
Fax: +(31) 321-31-4165
E-Mail: info@magnatech-europe.com
W. Wijnholds - Cell +31 (653) 32 5818
Ralph Wijnholds - Cell +31 (653) 548891

B. Spare Parts

Bryan Kirkland - Spare Parts, Ext. 14

C. Service Support (U.S.)

Dave Richard, Vice Pres. - Chief Elect. Eng., Ext. 19
Ted Kingsley - Chief Mechanical Engineer, Ext. 24
Patrick Sweeney - Embedded Systems Eng., Ext. 36
Neil Young - Senior Weld Technician, Ext. 28
Ken LeDuc - Technical Specialist, Ext. 15

D. Welding Development Assistance/Problem Solving

Neil Young - Senior Weld Technician, Ext. 28
Ken LeDuc - Technical Specialist, Ext. 15

E. Accounting (U.S.)

Glen Gautieri - A/R, Ext. 37
John Rinaldi - A/P, Bookkeeping, Ext. 12

5.0 SPECIFICATIONS:

5.1 SPECIFICATIONS PIPELINER WELD HEAD

APPLICATIONS

Pipe Size:	6" pipe (168mm) and larger
Guide Rings:	For 6" pipe (168mm) and larger
Wall Thickness:	Wall Thickness: Unlimited
Pipe Material:	All materials which can be welded with GMAW or FCAW process.
Linear and Large Diameter Applications:	Flx-Tracks available.

FILLER WIRE MODULE

Wire Size	0.8/0.9/1.0/1.2mm (.030/.035/0.040/.045") Other sizes available.
Speed Capability	0 - 22m/min. (0 - 722"/min.)
Spool Size	4.5 - 5 kg (10 lb) – Wire Feed on Head or 12kg (25lb) Wire Feed on Floor and Push-Pull

OSCILLATION MODULE

Oscillation Stroke Amplitude:	51mm (2")
Oscillation Speed:	21.4cm/minute (0-100 IPM)
Oscillation Dwell:	0-1.0 second independently adjustable at either oscillation stroke endpoint.
Cross Seam Adjustment:	51mm (2") Standard

TORCH ARC LENGTH – (VERTICAL MOTION)

Stroke:	66mm (2.6") (motorized)
Torch Advance/Retreat (Correction Speed)	152cm (60") per minute maximum.

TORCH PROPULSION MODULE 0-76cm/minute (0-30 IPM)
Clutch allows rapid repositioning of weld Head.

WATER-COOLED TORCH 300 amps at 100% duty cycle.

TORCH CABLE LENGTH WFOF -4.6M (15')
WFOH-1.5M (50')
WFPP-8m (25')
Extension cables available.

WELD HEAD DIMENSIONS/WEIGHT

Model	Axial Length **A**[1]	Minimum Radial Clearance **B**[2]	Overall Width **C**[3]	Weight
609 WFPP	37.5cm 14.75"	24.1cm 9.50"	41.3cm 16.25"	26.5 lbs
609 WFOF	38.7cm 15.25"	24.8cm 9.75"	30.5cm 12"	9.5 kg 21.5 lbs
609 WFOH	66.7 cm 26.25"	26.7cm 10.5"	36.8cm 14.5"	14.4 kg 31.75 lbs

1 Center of oscillation stroke

2 Center of vertical stroke

3 Weight without wire spool (WFOH). Includes 1.6 kg (3.5) of Torch Cable Weight (Partial)

Guide Rings

Diameter Tolerance: For a 2 segment Guide Ring, the tolerance is +/- 6mm or (+/- 0.25") on pipe nominal diameter. (This corresponds to 3 mm =/- 0.125" tolerance per joint X 2.) Each joint adds 3mm (0.125") to the OD tolerance.

Joints per Diameter:

Two joints: For Guide Rings up to 152 cm (60")
Three Joints: For Guide Rings up to 231 cm (91")
Four Joints: For Guide Rings up to 310 cm(122")

Flx-Track

Minimum/maximum Radius: Workpiece ID/OD must be greater than 2.44 m (8')

6.0 INSTALLATION

(Refer to Hook-Up Schematic in Section 17)

Installation of the welding system consists of locating and interconnecting the various system components such as the welding power supply, water circulator, controller, shield gas, work cable, weld Head and extension cables (if any).

6.1 Locate the welding power supply in the work area. Take into consideration the torch cable length and extension cables (if any), as well as cable wrap around the work piece.

6.2 Install and connect electrical service to the MPS-4000 Power Supply, and Model 712 according to the instructions in the separate manual provided.

6.3 For the head-mounted wire feed model, connect the torch cable to the power source (and water/gas connections to the Controller and water cooler). For WFOF and WFPP versions, the torch cable connects directly to the wire feeder central connector.

6.4 Connect the Control Cable for the weld Head to the rear of the Model 712 Controller. (NOTE: This control cable is inside the Torch Cable umbilical.)

6.5 Connect the work cable (ground clamp) to the work piece.

7.0 FUNCTIONAL DESCRIPTION - WELD HEAD

ATTENTION: ALL FASTENERS USED ON THIS WELD HEAD ARE METRIC. ALL MOTORS AND OTHER ELECTRICAL COMPONENTS ON THE HEAD ARE OPERATED WITH 42V DC CURRENT OR LESS, PREVENTING ANY SHOCK HAZARD.

The Pipeliner Weld Head consists of the following subsystems:

Oscillator
Torch Arc Gap Control Mechanism
Tractor
Torch Cable
Wire Feeder (WFOH and WFPP)
Spool Mount (WFOH only).
Guide Ring

7.1 OSCILLATOR

The Oscillation function is powered by a DC motor driven cross-slide.

The purpose of the oscillation mechanism is to provide both torch oscillation (weave) and to provide a means of remotely adjusting the torch cross seam position. Cross seam adjustment iș 1" (25mm) with a maximum oscillation amplitude of 2" (51mm).

Two limit switches in the oscillator prevent over-travel damage in either direction. A rotary potentiometer mounted within the oscillator module provides positional feedback information to servo controls located in the Controller.

7.2 ARC GAP CONTROL (TORCH PROXIMITY CONTROL)

The contact tip-to-work piece distance is manually adjustable via a "JOG" switch on the Remote Control Pendant. The vertical correction motion is produced by a D.C. motor driven cross-slide. Two limit switches on the cross-slides prevent over-travel damage to the mechanism in either direction. The Arc Gap Control stroke is 2.6" (66mm).

7.3 TRACTOR

The Tractor Assembly provides mounting for the previously described assemblies. Propulsion is accomplished by powered rollers which drive against two V-belts mounted on the Guide Ring (or Flx-Track Patented). The permanent magnet gear motor is mounted on a pivoting bracket. A lever is used to pivot the motor pinion gear out of engagement with the drive gear and acts as a clutch.

Four roller bearings directly underneath the four drive/idler rollers retain the Head on the Guide Ring. These rollers provide a load against the underside of the steel rim of the Guide Ring, allowing positive friction propulsion of the multi-vee drive rollers against the mating V-grooves of the Guide Ring. To mount the Head or to adjust the Head for a different size guide ring, see Section 8.

The TRAVEL DIRECTION SWITCH determines the direction of rotation of the weld Head when welding is initiated. It should be noted that there is no conventional "forward" direction for the Pipeliner. This switch allows bi-directional welding - for example the use of double down or double up welding techniques where travel direction is changed twice per pass.

7.4 TORCH AND CABLE

The water-cooled torch is rated at 300 amperes at 100% duty cycle. The torch body is designed to accept standard Binzel torch components. All torch services as well as the control cable for the welding Head functions are contained within the umbilical.

7.5 GUIDE RING/FLX-TRACK

The Guide Ring serves to mount the weld Head on the pipe being welded and forms an integral part of the propulsion system. Rotation of the weld Head around the pipe is accomplished by a friction drive system, consisting of the powered V-rollers driving against the two V-belts which are attached to the guide ring surface (U.S. Patent No.)

Guide Rings consist of two identical half sections which quickly bolt together.

Guide Rings are available for all standard pipe sizes 6" (168mm) and larger.

It is possible to use a Guide Ring on pipe smaller than the size for which it is designed. For example, using stand-off adaptors, a 12" (324mm) Guide Ring can be practically used on pipe as small as 8" (219mm).

Flx-Track allows the Head to be mounted on either flat or curved surfaces using various mounting systems.

ATTENTION! Flx-track is designed to be used within the following limits:

- When using magnets for mounting, ensure that magnets are clean of metal debris before using and have maximum contact with the surface. Be aware that magnets will permanently lose holding force if heated. A safety cable is required to prevent unexpected release of the Flx-Track.

- When using vacuum cups for mounting, periodically clean the cups to ensure a tight seal against the surfaces.

8.0 SET-UP AND OPERATION

8.1 MOUNTING THE FRICTION DRIVE GUIDE RING (P/N 103040-XXXXX)

8.1.1 Adjust the tensioning screw on the "hinge side" of the guide ring so there is approximately ½" (13mm) space between the tab and the slot of each rail.

8.1.2 Open the guide ring and place it over the top of the pipe with the tensioning screw heads facing you. (Hinge at 12 o'clock position.)

8.1.3 Position the feet of the guide ring approximately 6.875" (175mm) from the center of the weld joint.

8.1.4 On the "latch side" of the guide ring (latch at 6 o'clock position), install the catch bar into the receiver block. (Loosen the latch side tensioning screw, if required.)

8.1.5 Tighten the latch side tensioning screw. (Approximately 10 inch/pounds or 1.13 N-M).

8.1.6 If the tab/slot gap is significantly different between the hinge side and latch side of the guide ring, readjust the tensioning screws to balance the gap.

8.1.7 If the two dovetails are not the same radius as the guide ring (see sketch below), the tractor may hesitate or stall as the rollers cross the joint. This can be corrected by careful use of a hammer or heavy pliers.

8.2 INSTALL WELD HEAD ON GUIDE RING

8.2.1 The Pipeliner II Head is mounted on the pipe by rotating four hardened steel rollers under the steel edges of the circular guide ring or Flx-Track. These are spring-loaded with an internal spring to provide the load to firmly engage the V-rollers with the V-belt. (The rim is pinched by the action of the steel roller and V-rollers or the Caliper Actuator.) The spring loading of the four rollers must be released to remove the weld Head. Two options are available to accomplish this:

A. Push-button pneumatic release (standard)
B. Manual thumb screw release

Both methods of actuation include a rotary cam function. As the spring load is reduced to zero, the rollers are simultaneously pivoted outward from under the steel rim, allowing the Head to be removed.

WARNING!! Never disassemble this spring-loaded actuators without obtaining factory instructions. Serious injury to face, eyes and upper body could result. If the spring is accidentally freed, consult factory for directions. **Wear Eye Protection!**

8.2.2 Using the Pneumatic Push Button Release Option

The four thumb screws can be replaced with four miniature pneumatic cylinders (factory installation only). A push-button valve mounted on the Head pressurizes all four cylinders which cause all four rollers to simultaneously move downward and outward, allowing the Head to be installed or removed.

Attention! Keep your finger on the valve until the Head is in place on the Ring/Track or fully removed.

Caution! Keep fingers away from the roller until pushbutton valve released to avoid injury.

The pneumatic option requires 11 - 12 BAR (250 psi) pressure only during actuation of the pneumatic cylinders to release or install the Head. No pressure is required once mounted or removed.

Note: The pressure can be supplied from an external source. A separate pressure hose is included in the torch cable umbilical. We recommend, however, that a special gas regulator be purchased which provides this pressure from the same gas bottle used for torch purge gas. This provides a preset pressure at a fitting to which the pneumatic hose is attached. A secondary pressure regulator/flow meter provide standard control of torch shielding gas.

American Bottle Threading - Order P/N 34816
For European or other bottle threading, contact the local Harris regulator distributors to obtain the adaptor which is threaded into the valve body.

8.2.3 Using the Manual Thumb Screws

To install the Head, rotate all four thumb screws (at the top of each caliper actuator) clockwise (CW) until they stop turning. This will cause all four rollers to move downward from the under space of the weld Head, and outward away from the side of the Head.

To mount the Head, place it on the Guide Ring or Track, ensuring that all four V-rollers are lined up in the V-belt grooves. Holding the Head in place with one hand, turn the four screws CCW until no further force is felt on the screw.

Recommendation! Engage one of the rollers on either side of the Ring/Track first to prevent accidentally allowing the Head to fall.

Attention! When mounted, all four rollers should be fully underneath the steel strip: if not, repeat the mounting procedure above. (Proper location of limit pins in the pivoting caliper assembly is necessary. See Section 8.2.4.)

8.2.4 Using Limit Pins to Limit Pivoting/Swiveling Range of Caliper Assemblies

When placing the Head on the Guide Ring/Track, gravity may cause the assemblies to pivot so as not to be 90° to the V-belt and will require that the assembly be positioned manually using the limit pins to minimize this and simplify installation. The pins are unscrewed by finger and installed in the proper threaded hole location for a specific range or pipe OD sizes, for flat seam welding applications, and for ID tank welding applications.

See following Chart and Sketch.

8.2.5 Remove Tractor Adaptors on ID Welding Applications

The weld Head is equipped with an adaptor to properly position all four rollers on various pipe diameters. These are used, or are left in place for all pipe OD's and flat track applications, but must be removed for ID welding.

8.3 ADJUST HEAD FOR NEW GUIDE RING SIZE

8.3.1 If necessary, change location of limit pins (see Section 8.2).

8.3.2 If necessary, install or remove adaptors (see Section 8.2).

8.4 CHECK ELECTRICAL, GAS, AND WATER CONNECTIONS

Check the electrical power, control, and ground connections to be sure they are correct and tightly mated. Turn on the welding power supply, controller, and water circulator. Check for water leaks. Open the valve on the shield gas bottle and check for leaks.

8.5 TRAINING OUTLINE - PIPELINER IIC

8.5.1 HOOK UP

8.5.1.1 Unpack unit from shipping container or skid

8.5.1.2 Inspect for damage.

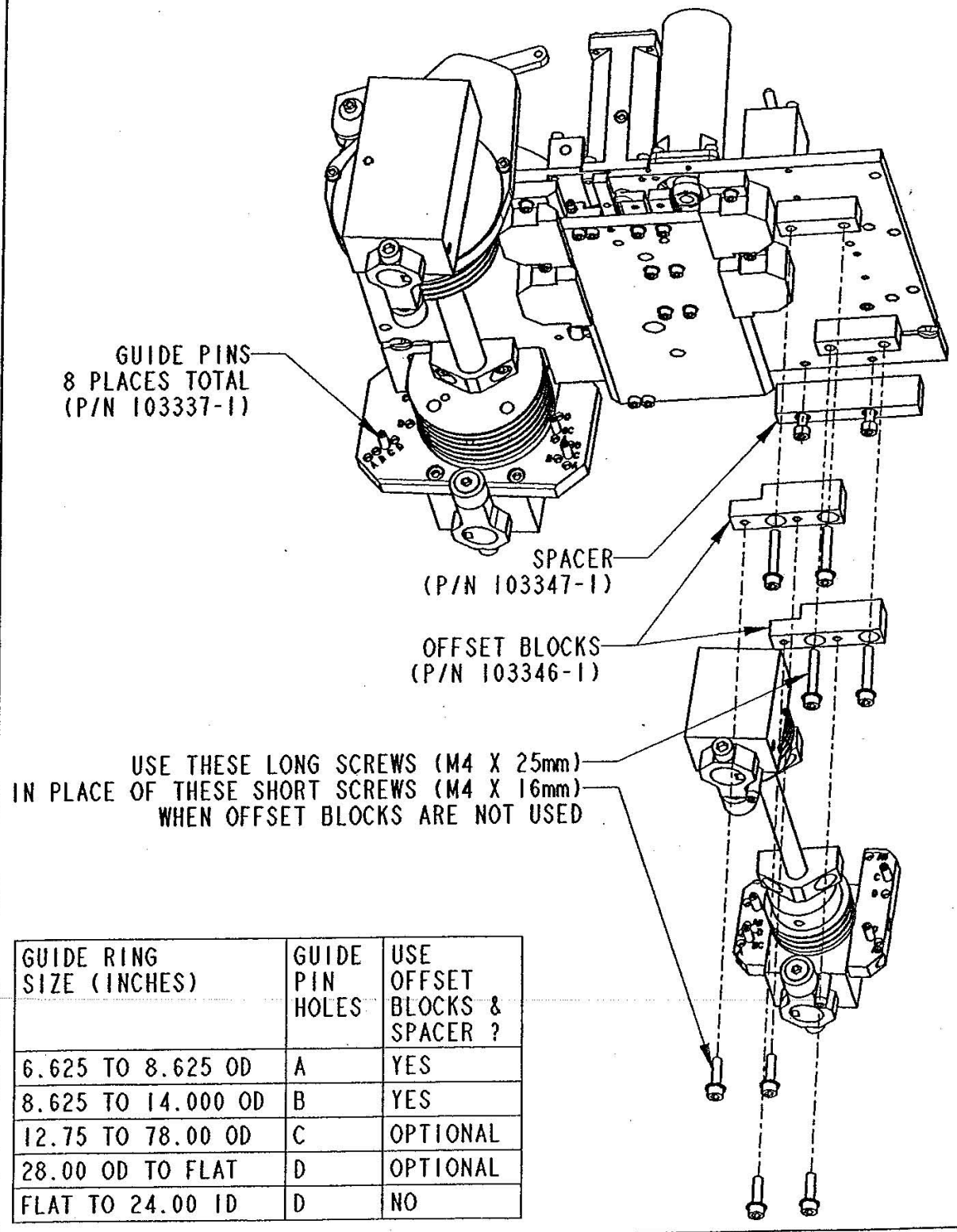
8.5.1.3 Inventory all parts and accessories from packing list.

8.5.1.4 Check primary input power at customer facility.

8.5.1.5 Be sure power supply is switched for proper voltage before connecting.

8.5.1.6 Remove cooler and check or fill with Magnatech-approved coolant. If extension cables supplied, explain possible need for two-step filling operation.

CONFIGURING THE MODEL 609 WELDHEAD FOR DIFFERENT SIZED GUIDE RINGS



GUIDE RING SIZE (INCHES)	GUIDE PIN HOLES	USE OFFSET BLOCKS & SPACER ?
6.625 TO 8.625 OD	A	YES
8.625 TO 14.000 OD	B	YES
12.75 TO 78.00 OD	C	OPTIONAL
28.00 OD TO FLAT	D	OPTIONAL
FLAT TO 24.00 ID	D	NO

103302-X/609-M001 TCK 07/13/99

8.5.1.7 Hook up weld Head to Controller. All connections are specific. Emphasize do not force connection, and if difficult, probably incorrect.

8.5.1.8 Gas In from gas supply, Gas Out to Weld Head.

8.5.1.9 Ensure water lines are correctly mated by color.

8.5.1.10 View fuses and connections.

8.5.1.11 Connect Pendant.

8.5.1.12 Following connection of Weld Head, Controller, and Power Source, power up unit.

8.5.1.13 Check for water leaks and adjust for suitable gas flow.

8.5.1.14 For pneumatic push button option install special regulator/flowmeter and connect pneumatic line in torch cable to the regulator.

8.5.2 WELD HEAD SET-UP - PIPELINER IIC

8.5.2.1 Explain guide ring function.

8.5.2.2 Demonstrate guide ring installation.

8.5.2.3 Special attention to gap spacing at dovetail joint being equal, and distance and squareness to joint to be welded.

8.5.2.4 Explain the use of adaptors for smaller pipe OD's.

8.5.2.5 Initial weld Head set-up Pipeliner IIC

A. Install filler wire on Head. Discuss importance of precision/level wound, clean wire.

B. Explain torch components and wire conducting, break down to view components and change out procedures. Demonstrate cleaning.

8.5.2.6 Weld Head Installation.

A. Install Pipeliner II on properly positioned guide ring

B. Emphasize guide ring placement and the minimized steering required when in correct position

C. Demonstrate torch removal, maintenance and cleaning while on pipe.

D. Demonstrate torch angles, i.e., lag, lead, in (towards weld Head), out, etc. Explain usage advantages and possible problems.

E. Demonstrate weld Head installation on the guide ring at different positions. Demonstrate use of clutch for rapid positioning of weld Head.

8.5.2.7 Pendant.

A. Show and explain Pendant Control layout.

B. Demonstrate each variable on the Pendant, i.e., oscillation dwell time, travel speed, etc.

C. Stress the importance of electrode position when oscillating to ensure sidewall fusion.

D. Explain excursion time and dwell time functions and how these variables determine optimum travel speed.

E. Identify and demonstrate switch on weld Head controlling rotation direction.

F. Demonstrate Use the center function on Pendant and to correctly position torch tip for stringer beads and oscillation.

G. Let operators operate functions on Pendant (no arc) to become familiar with each parameter and adjustment.

8.5.3 WELDING

Note: It is recommended that the initial welding demonstration be carried out by the instructor using developed parameters. Perform demonstration with set-up to be used in construction, i.e. Manual Root and Hot Pass - Fill and Cap with Orbital, use of Internal Clamp, etc. It should be assumed that the trainees have never seen the system in operation; therefore, they need to be shown that the equipment can and will produce high-quality welds with minimal operator adjustments. Stress the fact that the operators must monitor the welding and make corrections, if necessary.

A. Make a good initial weld with pre-established parameters to demonstrate a customer-acceptable weld.

B. On the next weld, demonstrate the effects during welding of changing parameters such as: (I) electrode stick-out, (ii) oscillation width, (iii) dwell and excursion time, (iv) travel speed, (v) wire feed, (vi) arc trim, (vii) gas flow, etc.

C. Stress the importance of watching and pre-positioning of the torch cable to avoid binding or snagging, etc.

D. Demonstrate proper grinding technique and transition of start/stops.

E. Demonstrate different torch positions and possible usage.

F. Demonstrate the adjustment of pre-purge gas time and proper gas flow range.

G. Stress importance of contact tip wear on welding performance.

H. Discuss contact tip location (flush/recessed) for different welding modes.

I. Explain Control functions of the MPS-4000 Power Source, including proper selection of wire diameter, wire alloy, and how these choices select a preferred shielding gas.

J. Explain the synergic concept and that this operates in both “Standard” and “Pulsed modes. Explain Arc Trim.

K. Explain Power Boost function (if applicable).

8.5.3.1 Operator Welding

Once the parameters for a proper weld have been established and used successfully, the trainees should start to make welds under Instructor supervision. Change individual parameters to an unacceptable value and coach trainees on readjusting them until reaching an acceptable range.

Trainees having made successful welds should graduate to using the actual customer pipe, with the Instructor assisting in weld development.

9.0 USE OF WELD HEAD ON PREHEATED PIPE.

If the Pipeliner Head and Guide Ring are to be used on preheated pipe, precautions may be required to prevent damage for preheats of 95º C (200ºF) or lower, no special action is required. For preheat higher (especially if preheat temp is to be over 150ºC (300ºF) it is necessary to use an oversize Guide Ring and spacers (adaptors) to create additional air spaces between the Guide Ring/weld Head and hot pipe surface. We recommend using a Guide Ring which is oversized compared to the pipe OD by 10cm (4") – using 5cm (2") spacers (adaptors) attached to each of the square tubes of the Guide Ring. This will increase the radial distance required for welding. We recommend that the heating coils be wrapped with insulating material to minimize heating of the Head and Guide Rings.

10.0 ADAPTOR FEET KITS FOR PIPELINER GUIDE RING TO ALLOW USE ON SMALLER PIPE SIZES

The standard guide ring uses square aluminum tubes 25mm (1") high which are the component which contacts the pipe OD. There is a number of reasons and situations why you might want to adapt this guide ring to a different size of pipe. You would do this by attaching additional square or rectangular metal tubes on each of the square standard tubes. We can provide an additional 25mm (1") square tube or a 50mm (2") rectangular tube. In some case, however, the pipe sizes are not in even increments or 1" or 25mm or it might even be a special non-standard size. In this case, we have to use a combination of the square or rectangular tube, and a flat metal spacer shim to accommodate the specific pipe OD. It is not possible to use the spacers/adaptors on only some of the square tubes. They have to be applied to each and every square tube. (See Drawing 103040 Guide Ring Assy Friction Drive)

There is a number of reasons why someone might wish to adopt a guide ring to a smaller size pipe. These are:

10.1 To save cost. A given guide ring can be used on pipe up to 125mm (5") smaller in size by using adaptors. This is a less expensive than buying additional guide rings. This is not a good solution, however, for a customer that is changing pipe sizes frequently as it takes some time to screw all the adaptors onto the existing square tubes or subsequently remove them.

10.2 To allow use of a standard guide ring on a special non-standard size of pipe. While Magnatech has the capability of engineering a guide ring for any size, we would charge additional for that service. In most cases, the additional radial clearance is not significant and the customer could use the next size larger standard pipe guide ring with adaptors.

10.3 For applications where the weld Head must be used on preheated pipe. For some pipe materials and applications, a relative high preheat temperature must be used which may have to be maintained during the entire duration of the weld. To avoid damage to the Head, it is beneficial to create more air space between the weld Head and the pipe OD. This can be done with the adaptor/spacers. In addition, sometimes this preheat is done using resistance coils which are wrapped around the pipe. By raising the weld Head off the pipe surface, there is enough room for these heating coils.

The reason that a universal adaptor set to cover any situation is that every size guide ring has a varying number of the standard square tubes - the larger the guide ring size, the greater number of tubes. There are also four distinct situations:

- A situation where the pipe size is close enough to the standard that a 25mm adaptor for tube cannot be used and only a flat metal "shim" can be used which must be machined to the correct height at Magnatech.

- The situation where the customer wants to weld a pipe exactly 2" smaller (or two times 25mm) in size, in which case one additional square tube is used.

- The case where the customer wants to weld a pipe that is exactly 4” (or two times 50mm) smaller in size and will use the rectangular tube.

- The case with either the square or rectangular tube where the flat metal shim is required because of an intermediate size.

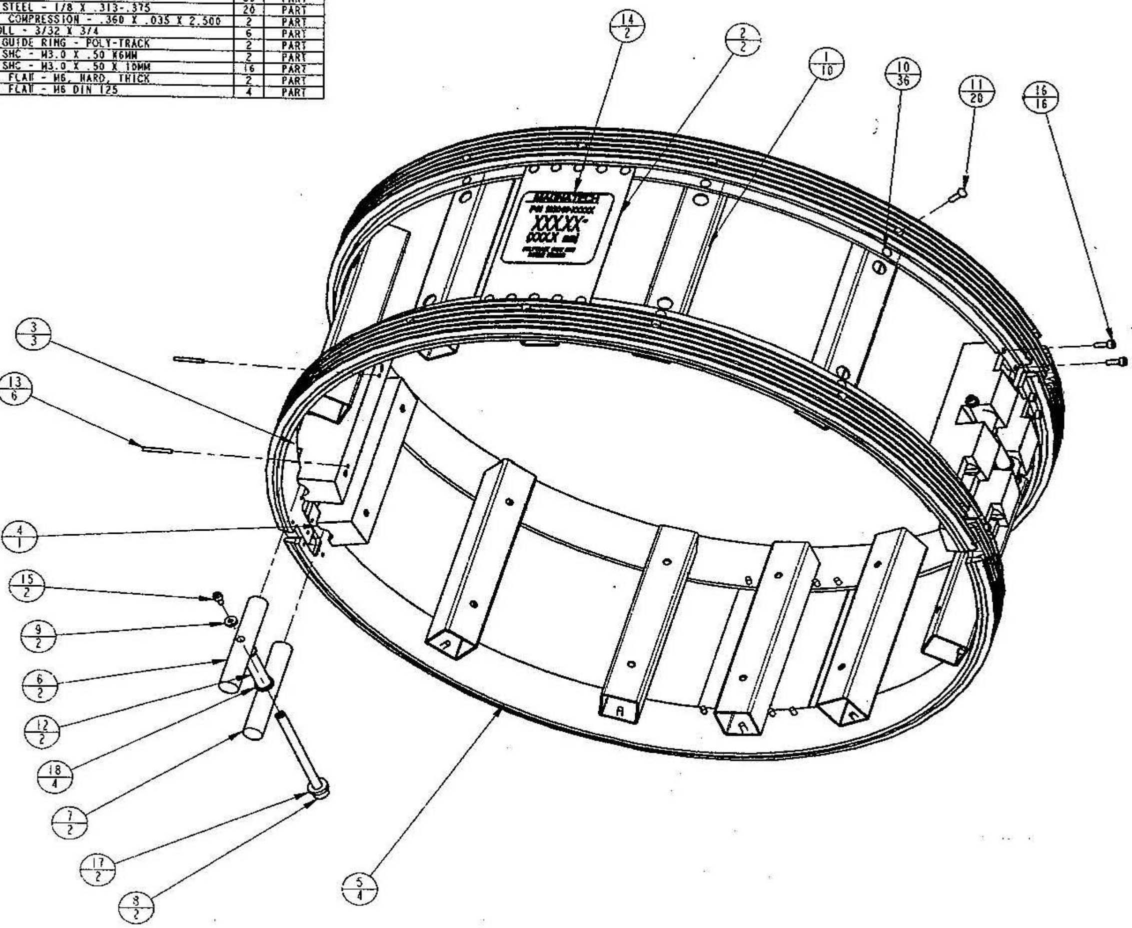
To order adaptor kits separately, specify the following:

1. Guide Ring Size to be used.
2. Actual pipe O.D. (must be smaller)

LET	CHANGE RECORD	DATE	BY
A	[illegible]	[illegible]	TCK
B	[illegible]	[illegible]	TCK

BILL OF MATERIALS
GUIDE RING ASSEMBLY - FRICTION DRIVE
103040-XXXXX REV: B

#	PART #	DESCRIPTION	QTY	TYPE
1	103038-1	TUBE, STANDOFF - GUIDE RING	10	PART
2	103039-1-CXXXXX	PLATE, ALLIGNMENT - GUIDE RING	2	PART
3	103041-3	BAR, CONNECTING - HINGE	3	PART
4	103041-4	BAR, CONNECTING - LATCH	1	PART
5	103042-XXXXX	RAIL AND BELT ASSEMBLY - GUIDE RING	4	ASSEMBLY
6	103043-3	SHAFT, CONNECTING - HINGE	2	PART
7	103043-4	SHAFT, CONNECTING - LATCH	2	PART
8	103757-1	SCREW, CAPTIVE - MODIFIED M6 X 80	2	PART
9	11196	WASHER, FLAT - #4, HARD, THICK	2	PART
10	25008	RIVET, STEEL - 1/8 X .126-.87	36	PART
11	25059	RIVET, STEEL - 1/8 X .313-.375	20	PART
12	35140-C2	SPRING, COMPRESSION - .360 X .035 X 2.500	2	PART
13	5239	PIN, ROLL - 3/32 X 3/4	6	PART
14	5776-XXXXX	LABLE, GUIDE RING - POLY-TRACK	2	PART
15	M101-03C-06-C	SCREW, SHC - M3.0 X .50 X6MM	2	PART
16	M101-03C-10-C	SCREW, SHC - M3.0 X .50 X 10MM	16	PART
17	M20017	WASHER, FLAT - M6, HARD, THICK	2	PART
18	M501-06C-FA-3	WASHER, FLAT - M6 DIN 125	4	PART



DRAWING #	REV
103040	B

NOTE: DASH NUMBER IS NOM. PIPE O.D. IN HUNDRETHS OF AN INCH. (-01275 IS FOR 12.75 O.D.)

MAGNATECH Limited Partnership
East Granby, CT 06026

DESCRIPTION
GUIDE RING ASSEMBLY
FRICTION DRIVE

DIMENSION LIMITS UNLESS OTHERWISE SPECIFIED
ANGLES ± 0.5
FILLETS .031 MAX.
EDGE BREAK .031 MAX.
.XX ± 0.01
.XXX ± 0.005
.XXXX ± 0.0005
FRACTIONAL ± 1/64

DRAWN BY TCK
SCALE 1:2
DATE 31-Jul-96
SHEET 1 OF 1
SIZE C
DRAWING # 103040
REV B

11.0 TORCH EXPENDABLE COMPONENT LISTS

11.1 FOR "BINZEL" TORCH P/N 103364-L

(STANDARD COMPONENTS USED ON BINZEL MB-602-D TORCH)

MAGNATECH P/N	BINZEL P/N	DESCRIPTION
8891	039.0008	GAS DIFFUSER
8894	145.013	NOZZLE, SMALL CONICAL - (0.61"/15/5MM DIA.)
8890	145.0088	NOZZLE, CONICAL (0.71"/18MM)
8893	145.0052	NOZZLE, CYLINDRICAL (0.87"/22MM)

CONTACT TIP COMPONENTS - STANDARD DUTY APPLICATIONS (M8)

8892	142.0023	CONTACT TIP HOLDER
8810	140.0214	CONTACT TIP .035" (0.9MM)
8812	140.0442	CONTACT TIP .045" (1.1MM/1.2MM)

M NUMBERS REFER TO THREADING (M-8 CONTACT TIPS MUST BE USED WITH M-8 CONTACT TIP HOLDER, ETC.)

WIRE CONDUIT

MAGNATECH P/N	DESCRIPTION
101664-45-2-160	Tube, Wire guide-Outlet, 0.35”/.045” (.9mm/1.1mm) x 16” (41cm)
101664-45-1-030	Tube, Wire Guide-Inlet, .035”/.045” (.9mm/1.1mm) x 3” (8cm)

WIRE DRIVE ROLLERS
(Must Be Ordered For Specific Wire Diameters)

MAGNATECH P/N	FRONIUS P/N	DESCRIPTION
80006	42.0001.1827	Wire Drive Roll 0.9mm (.035”)
80007	42.0001.1828	Wire Pressure Roll 0.9mm (.035”)
80004	42.0001.0382	Wire Drive Roll 1.2mm (.045”)
80005	42.0001.0385	Wire Pressure Roll 1.2mm (.045”)

Note 1: One Drive Roll and Three Pressure Rollers used per set.

Note 2: Drive Rolls above have U-shaped groove for hard wire and flux-core. Other groove geometries available - consult factory.

12.0 SUMMARY OF CAUTIONS

12.1 SHOCK PREVENTION

Always disconnect the AC power plug before removing the panels of the Controller to avoid electrical shock and the possibility of shorting or grounding the electrical circuitry.

Always disconnect primary power to the power source before removing panels. Do not remove panels from the power source until the maintenance manual has been read and fully understood, as there may be lethal voltage present even after the primary power is disconnected. Heed all installation instructions and warnings given in the Power Source Manual.

WARNING	***NEVER operate the Pipeliner Head with the MPS Power Supply Switch to Stick Electrode (SMAW) or GTAW modes. Open circuit voltage will be present on the torch at all times. Touch the Torch and a grounded workpiece will result in an electrical shock.***

12.2 SAFETY AND HEALTH PRECAUTIONS

Breathing the fumes created during welding can cause illness or death. Provide adequate ventilation in accordance with ANSI Standard Z49.1.

A MIG (GMAW/FCAW) arc emits intense infrared and ultraviolet radiation which can cause permanent eye damage without adequate protection. We recommend a #10 eye shield or darker. Arc radiation can penetrate light clothing and cause sunburn. Use suitable work clothes and use a sunscreen compound on exposed skin.

12.3 CHECK ELECTRICAL CONNECTIONS

Be sure that all external electrical connections are clean and tight. In particular, the ground-to-work clamp must make a good electrical contact to assure minimum voltage drop. Adhere to the power source manufacturer's grounding recommendations. Check for gas and water leaks immediately following cable hook-up before system is first operated.

12.4 PREVENT TORCH CABLE WRAP-UP

Do not allow the umbilical to "hawser" on the pipe while welding. Keep the number of turns wrapped around the pipe to a minimum by pre-winding if possible. Preventing the Head from rotating may result in damage to the tractor motor or other mechanical assemblies. Prevent the cables from contacting a hot or preheated pipe.

12.5. OBSERVE TORCH POSITION BEFORE OSCILLATING OR "CENTERING" TORCH

Do not set oscillation to an amplitude which will cause the gas nozzle or torch body to contact the work. The sudden impact of the torch against the pipe can

damage the oscillator mechanism. Raise the torch out of the groove before actuating the centering control.

12.6 ALWAYS STOP MOTORS BEFORE REVERSING

Do not snap reverse motors. Switch motor to the "OFF" position before reversing direction. Fast reversing can reduce motor power and shorten life.

12.7 ABRASIVE GRINDING DUST WILL CAUSE PREMATURE WEAR

Avoid grinding in the vicinity of the weld Head and Pendant. Grinding dust is extremely abrasive and should not be allowed to contact weld Head and controls.

12.8 BE CAUTIOUS ABOUT HEAT DAMAGE TO HEAD

Remove the weld Head from preheated pipe when not actually welding.

12.9 DO NOT EXPOSE SYSTEM TO RAIN

Do not allow the weld Head or Pendant to be exposed to rain.

12.10 CHECK TO ENSURE THAT WELD HEAD ROTATION WILL NOT BE OBSTRUCTED

Ensure that the rotation of the weld Head will be unobstructed by adjacent structure, pipes, etc. If a doubt exists, jog the Head around prior to striking an arc and carefully observe for interference.

13.0 WELD PROCESS DEVELOPMENT

It is not possible within the context of this operation manual to provide a comprehensive guide to weld procedure development. Weld procedure development requires the experience of a competent individual experienced in the GMAW or FCAW process.

It is also important to note at this point that the Pipeliner should more properly be termed a Mechanized Pipe Welding System. The Pipeliner Pipe Welding System is not truly automatic in that it is not adaptive. The Pipeliner System will manipulate the torch as required to make the weld in a highly repetitive and accurate fashion. However, the Pipeliner System cannot sense variations in such things as fit-up and bevel geometry which would allow it to make in-process corrections. Any procedure developed must take into account normal variations in fit-up, prep machining etc. which will always occur "in the field". However, the more repeatable the end prep geometry and fit-up can be made, the more repeatable will be the welding results. It is to be expected that several trials will have to be made before a satisfactory weld procedure can be determined. A good starting point in developing any weld procedure is to extrapolate a previously developed program which was been done on similar material, or pipe size, and/or bevel geometry. If a given trial weld is unsatisfactory but shows promise, repeat the weld changing only one parameter at a time. Always develop a procedure with the goal of making it as tolerant as possible to weldment variations.

13.1 GENERAL COMMENTS ON WELD PROCEDURE DEVELOPMENT

The ARC TRIM CONTROL may have to be adjusted when changing shielding gas composition, cable lengths, and sometimes with change of brand of filler material. Start out with the ARC TRIM knob in its center position, and gradually adjust while welding until the desired arc length/stick-out is achieved. It may be necessary to maintain a very short arc length for puddle control when welding in the overhead position - even at the expense of a slight amount of spatter.

13.2 The Pipeliner II can be used in all modes of metal transfer - short circuit (Standard or non-Pulsed), globular, spray, and pulsed spray. We recommend operation in either Standard or Pulsed mode. The MPS-4000 Power Supply will provide programmed synergic operation in both modes. Ensure that the proper filler wire diameters and types have been selected on the power source, and that the appropriate shielding gas is being used. Ensure that the filler wire is of the correct alloy and designated “ALL POSITION”.

13.3 Wire speed may be increased during sidewall DWELL periods (when using POWER BOOST function), usually in the range of 20% - 50%. Wire speed reductions of greater than 10 per cent during DWELL may result in an unstable arc.

13.4 WELD PROCESS TROUBLESHOOTING GUIDE

Irregular arc start.	1. Check gas valves, increase flow 20 liters/min (45-55 CFH).
	2. Check ground-return circuit.
	3. Check circuit to start switch.

Irregular wire feed, burnback.	1. Check drive roll pressure. 2. Check, adjust wire feed speed. 3. Clean or replace contact tip. 4. Check input line voltage for fluctuations. 5. Remove kinked electrode wire; replace wire spool. 6. Lubricate or replace conduit liner.
Overheating welding cables.	1. Use larger cables. 2. Check, tighten cable connections. 3. Use shorter cables.
Unstable arc.	1. Check, tighten cable connections. 2. Clean weld joint areas. 3. Change contact tip. 4. Correct contact tip-to-workpiece distance. 5. Correct ARC TRIM CONTROL setting. 6. Replace low pressure Gas cylinder. Gas mixtures may vary at low bottle pressures.
Incomplete fusion.	1. Check joint geometry preparation. 2. Shorten arc length. 3. Clean weld joint area. 4. Reduce electrode (wire) stick-out. 5. Increase oscillation width and dwell 6. Reduce travel speed.
Dirty welds.	1. Maintain gas nozzle closer to weld puddle. 2. Increase gas flow. 3. Decrease torch angle. 4. Check torch cables for gas leaks. 5. Shield arc from drafts. 6. Check gas diffuser for damage; replace. 7. Keep unused electrode wire in sealed shipping containers. 8. Clean weld joint area.
Arc blow.	1. Rearrange or split ground connection. 2. Demagnetize workpiece.
Excessively wide bead.	1. Reduce power. 2. Increase welding speed. 3. Shorten arc length.
Porosity in welds.	1. Keep unused electrode wire in sealed shipping containers. 2. Clean weld joint areas. 3. Hold gas cup closer to work. 4. Increase gas flow. 5. Decrease torch angle. 6. Check torch and cables for air, water leaks. 7. Shield arc from drafts. 8. Check gas cup for damage; replace.

Undercutting.	1. Reduce power. 2. Reduce welding speed. 3. Shorten arc length.

Cracked welds.

1. Check design of root opening, root face dimensions, angle.
2. Check electrode wire compatibility with base metal.
3. Change welding speed or shielding gas to obtain a more convex bead.
4. Change torch angle to improve deposition.
5. Revise joint design.
6. Determine if alloy requires preheat and/or post weld heat treatment.
7. Check wire for moisture in flux. (Weld using new sealed spool)
8. Check gas for contamination. Change gas bottle.

13.4.1 MAINTAIN PROPER CONTACT TIP RECESS

For FCAW welding, the contact tip should be recessed approximately 13mm (0.5') from the nozzle end.

13.4.2 MAINTAIN PROPER ELECTRODE STICK-OUT

The recommended electrode stick-out is critical for all-position FCAW electrodes. These electrodes have a fast freeze slag. If less than the minimum parameters recommended are utilized, the slag may freeze too rapidly trapping escaping gas moisture and causing worm tracks on the weld surface. The electrode stick out should be approximately 25mm (1") or more from the contact tip.

Many welders are used to welding GMAW vertical-up with the nozzle between 1/4" (6.4 – 9.6 and 3/8" (6.4 – 9.6mm) from the weld surface. They typically use a contact tip that was designed for GMAW spray transfer. The electrode stick-out they often utilize is less than 1/2" (13mm). If you use less than the minimum electrode stick-out, you will use less voltage, less weld energy, and increase the potential for fast freeze weld to trap excess porosity.

Damaged GMAW and FCAW contact tips can be machine down so that the contact tip is at least 1/2" (13mm) recessed in the nozzle for FCAW welds.

13.4.3 CAUSES OF POROSITY AND "WORM HOLES" OR "WORM TRACKS" (FCAW)

Porosity and worm tracks are usually the result of a combination of incorrect electrode extension, incorrect parameters, humidity, electrode moisture, mill scale, rust, paint, oils, or poor weld technique.

With a shorter than recommended electrode extension, the energy to the weld puddle is reduced, resulting in gas moisture which would normally escape before the puddle solidifies being trapped in the freezing puddle. This may appear as scattered pores, or as long connected pores or tracks immediately underneath the slag. The longer electrode extension also provides resistance heat to the electrode which provides additional energy to the weld and reduces the opportunity for moisture or lubricants on or in the electrode to enter into the weld.

In areas where humidity levels are high, porosity and worm track potential increase. The FCAW transfer characteristics are less sensitive to mill scale than in the GMAW spray transfer mode, however the mill scale is often the cause of excess porosity. To avoid effects of surface contaminants, clean the area with a grinder before welding.

Another way to reduce porosity is to avoid weaving. If the correct size flux cored electrode is utilized, weaving is not required for most flux cored applications in any welding position. The backhand technique used for flat and horizontal position weld will also reduce porosity. The backhand technique is also beneficial when a fillet weld size is large, over 5/8" (16mm), and fluid fillet weld puddle is difficult to control. If porosity or worm tracks occur, remember that the best solution is to utilize weld practices that increase heat at the weld.

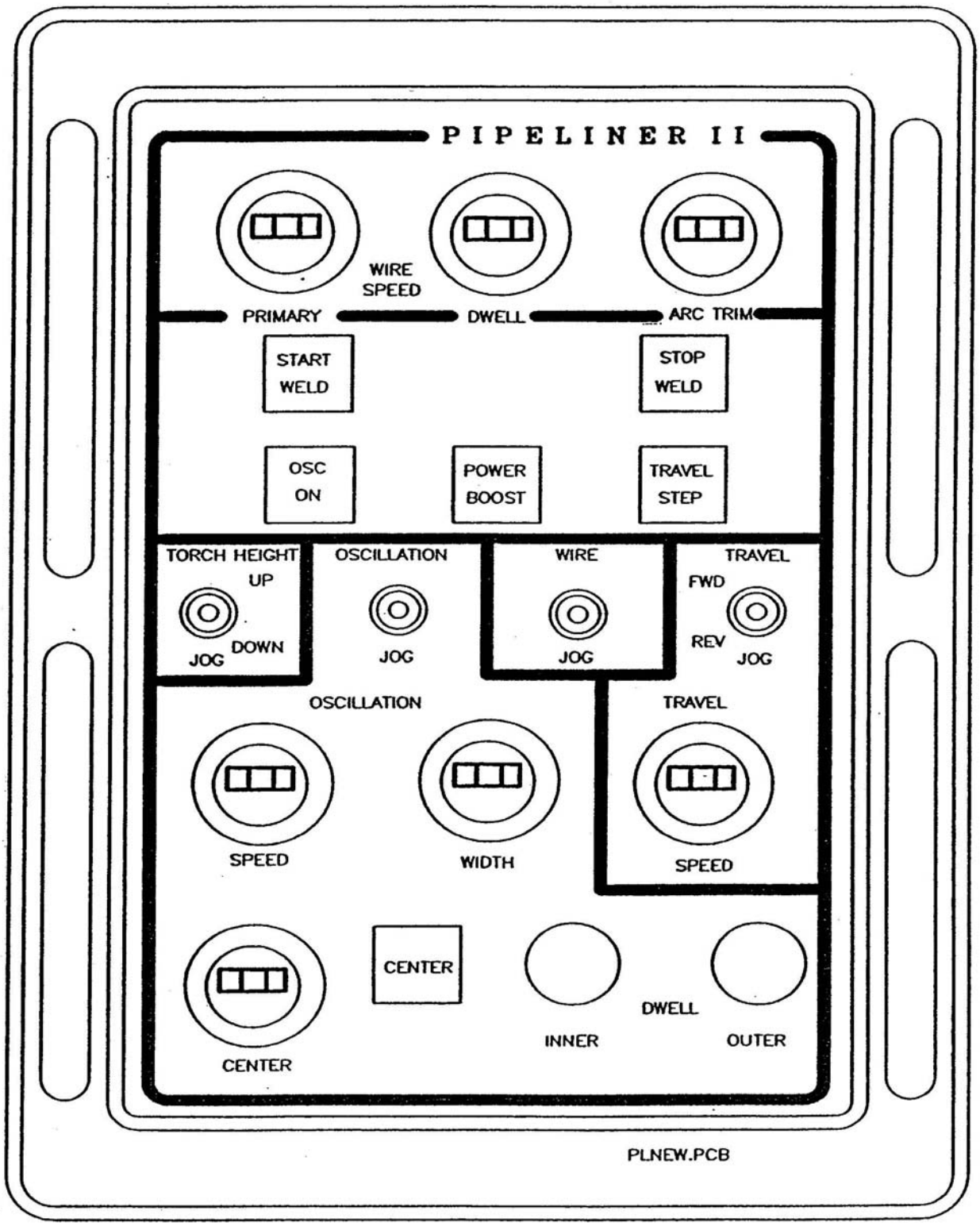
13.4.4 FILLER WIRE – IMPORTANT CONSIDERATIONS WHEN ORDERING

When ordering wire for the Pipeliner LL, specify:

- Level Wound, regardless of spool size
- Wire to be supplied in Sealed Bags or hermetically sealed tins with desiccant (This is an available option from most suppliers.)

Failure to do this will result in wire feeding problems and "worm-hole" type porosity if the flux picks up the moisture.

Remote Pendant



PIPELINER WELD LOG SHEET
INDIVIDUAL PASS DATA

PIPE SIZE:_____

WALL:_____

TRAVEL DELAY:_____

ACTUAL WIRE SPEED:

PRIMARY:_____

DWELL:_____

ARC TRIM DIAL SETTING:_____

ACTUAL VOLTS:_____

ON / OFF PULSE FREQUENCY:_____

TRAVEL SPEED DIAL SETTING:_____

ACTUAL TRAVEL SPEED AT PIPE:_____*

*(GUIDE RING DIA./PIPE DIA. X DIAL SETTING IN IPM)

ON / OFF

ON / OFF

ON / OFF

OSCILLATION SPEED DIAL SETTING:_____

OSCILLATION WIDTH DIAL SETTING:_____

OSCILLATION INNER DWELL: 0. SEC.

OSCILLATION OUTER DWELL: 0. SEC.

GAS NOZZLE ORIFICE:_____

CONTACT TIP SIZE: FLUSH/EXTENDED_____

CONTACT TIP SIZE: STD./TAPERED_____

STICK OUT:_____

LEAD OR LAG ANGLE:_____

SHIELD GAS COMPOSITION:_____

TOTAL ARC TIME:_____

NOTES:_____

_____

_____

_____

_____

_____

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PIPELINER WELD LOG SHEET

DATE:_____

Pipe Size:_____" O.D. (_____mm) x _____" (_____mm) Wall Thickness

Pipe Material:_____

PQR No.:_____

Company Developed For:_____

Program Developed By:_____

Weld Position:_____ Weld Progression (Double-Up or Double-Down):_____

Joint Geometry:_____

Filler Material:_____ Wire Diameter:_____

System Model/Power Source Used:_____

Gas Nozzle Orifice:_____

Contact Tip Size: Flush/Extended_____

Contact Tip Size: Std./Tapered_____

Stickout:_____

Amperage Range Used:_____

Voltage Range Used:_____

(Lead or Lag Angle):_____

Shield Gas Composition:_____

Backing or Root Pass Method:_____

Preheat Required:_____

Interpass Temp Limitations:_____

Heat Input Limitations:_____

Total Passes:_____

Total Arc Time:_____

Notes:_____

_____

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14.0 ELECTRODE EXTENSION OFTEN NEGLECTED WHEN USING SELF-SHIELDED CORED WIRES

Electrode Extension Often Neglected When Using Self-shielded Cored Wires

BY RALPH B. G. YEO

For structural applications where ease of use, high productivity and freedom from defects are required in carbon steel structures that do not have impact requirements, E71T-11 electrodes are increasingly being used in the United Kingdom. Major examples of this use are two very large gas holders, at different steelworks, and various structures built with hollow structural sections. The good penetration and all-position capability of E71T-11 electrodes have proved to be especially valuable in those applications.

Possibly the most significant factor influencing the use of E71T-11 electrodes in the United Kingdom is that it is isolated from the main sources of self-shielded electrodes, and the associated information banks. There is not much authoritative literature around and we have had to develop our own ways of working with self-shielded electrodes. Our success depends on three main factors in a cautious approach to make sure that the electrodes are used correctly:

1) We have had to gain an understanding of the important factors required to make good welds with the correct grade of electrode.

2) Although we promote the use of self-shielded electrodes in many site and shop applications, we do not encourage customers to try them unassisted, if they have not used them before.

3) We demonstrate their correct use with the proper equipment in the hands of skilled welders to show that they can be used in the way we say, and we provide training to ensure that the important points have been understood.

The principles outlined above are applied regardless of whether the job involves ordinary carbon structural steel or premium steels for offshore structures. At one end of the performance scale, E71T-11 electrodes are designed for use in applications that do not have impact requirements. At the premium end of the fabrication spectrum, self-shielded electrodes (mainly E61T8-K2) have been used to weld most of the nodes in the major offshore oil jackets that resist the rigors of low temperatures and 60-ft waves in the North Sea with metal that meets the highest radiographic standards and which has Charpy V-notch impact toughness values that frequently exceed 200 J at –40°C (147 ft-lb at –40°F).

Let us consider the fundamentals of the process, in order to understand how to make good self-shielded welds.

RALPH B. G. YEO is Technical Manager, Lincoln WeldRo Ltd., Sheffield, England.

Controlling Welding Current

All semiautomatic welding machines are fitted with a knob on the wire feeder, that is turned to adjust the current. The knob actually adjusts wire feed speed (WFS). How is WFS related to current? A typical melting rate curve for a given grade and size of electrode wire is shown in Figure 1.

Changing the Electrode Extension

In order to see the effects of changing the electrode extension, a skilled welder should adjust the knob of a welding machine fitted with an ammeter to set the current at some desired value. When the welder changes the electrode extension, the current will change. If he moves the gun closer to the weld, the current will increase. Moving it back from the weld will cause the current to decrease. This proves that the knob alone does not control current, but electrode extension also has an effect. (See Figs. 4.12 and 4.25 of the Eighth Edition of the *Welding Handbook*.)

For a given wire feed setting, the rectifier does not deliver a constant current. It delivers the current required to burn off the wire to maintain a constant voltage, thereby giving what we know as arc regulation. If the wire is preheated by a long electrode extension, it needs less current to melt it when the tip of the wire reaches the arc than it does with a short extension.

To reinforce the importance of electrode extension, any melting rate curve should include the effect of electrode extension. Figure 2 shows the combined effects of WFS and electrode extension on welding current. Manufacturers of cored electrodes should emphasize the correct range of electrode extensions to be used with their products.

Wire Diameter Has an Impact

If you change the wire for one of a smaller or larger diameter, the effect of electrode extension on the welding current will be different. You will find that for a given setting of wire feed speed, the change in welding current for small electrodes is much greater than with larger electrodes. This is because the electrical resistance of the small-diameter wire is greater than that of the large-diameter wire and small changes in electrode extension will make relatively large changes in the resistance of the circuit. In summary, welding current changes with electrode extension for constant wire feed speed, and small-diameter wires are relatively more sensitive to changes in electrode extension than large-diameter wires. These points are shown schematically in Fig. 3.

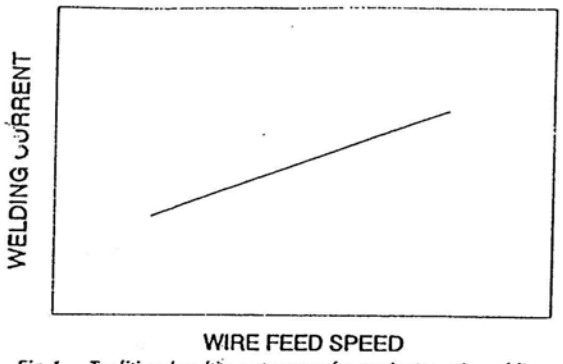

Fig. 1 — Traditional melting rate curve for semiautomatic welding with constant voltage systems.

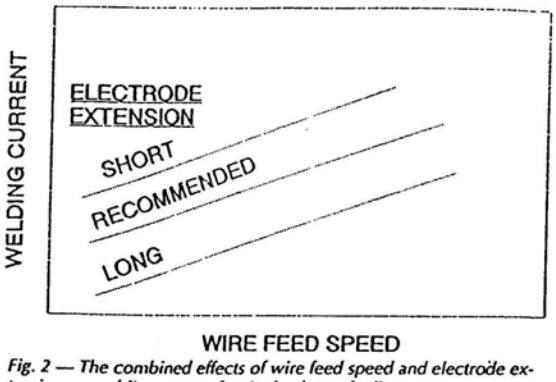

Fig. 2 — The combined effects of wire feed speed and electrode extension on welding current for single electrode diameter.

Influence on Arc Voltage

It is not only current that changes with electrode extension. The rectifier delivers a voltage to the welding circuit, and the voltage at the arc is what remains of that output voltage when the current passes through the other resistances in the rest of the circuit. The rest of the circuit consists of equipment, such as cables, clamps, gun, etc., and the resistance of the electrode that extends from the contact tip to the arc. This is the electrode extension.

If we express this concept as equations, we have:

Total volts drop around circuit = volts drop in cables, clamps, gun + volts drop in electrode extension + volts drop across the arc

Therefore, if the rest of the circuit remains constant,

Arc voltage = (Rectifier output voltage) – (volts drop in cables, clamps, gun) – (volts drop in electrode extension)

Consequently, we see that electrode extension also influences arc voltage.

I have estimated the voltage drops around a typical welding circuit, at a current of about 200 A, and at voltage settings typical of self-shielded FCAW, to be as shown in Table 1.

The effects of electrode extension on arc voltage, for constant machine settings are shown schematically in Fig. 4. Note that even though the machine setting may be within the recommended range, the recommended voltage range can be exceeded if the electrode extension is too short.

Self-shielded flux cored electrodes are formulated to neutralize the amount of nitrogen that will enter the metal from an arc run at the manufacturer's recommended voltage. If that voltage is exceeded, the arc will be longer than optimum and the resultant excess nitrogen will cause the weld metal to be porous. Excessive arc voltage arises from an incorrect machine setting, short electrode extension, or a combination of the two. The onset of porosity at short electrode extension, as a result of the consequent excessive arc voltage, is shown in Fig. 5. Use of the correct range of output voltage and electrode extension is essential to produce sound welds.

Self-shielded electrodes should be run at arc voltages specified by the manufacturer of the wire, not at those judged correct by the welder, even though the welder may have the impression that the weld will be better and more uniform at excessive voltages.

Using Electrode Extension to Control Penetration and Meltback

As described above, moving the gun closer to the work will raise both the current and the arc voltage, thereby raising the energy input, as shown in Fig. 6. This puts a very useful degree of control in the hands of a welder using a semiautomatic system, especially if a self-shielded wire is used because there is no loss of gas shield when the gun is moved away from the work.

This control of energy input, in the hands of skilled welders, is a significant factor in the successful use of self-shielded electrodes in making the critical one-side groove welds in the nodes of North Sea platforms.

Welder Training

If welders are good at gas metal arc welding (GMAW), it is virtually certain they will hold the gun too close to the work when they first use self-shielded cored wires. They should be taught to feed the correct extension from the gun, hold the tip of the wire to the start of the weld, pull the trigger, and hold that distance. The arc should be moved with the leading edge of the pool to keep slag

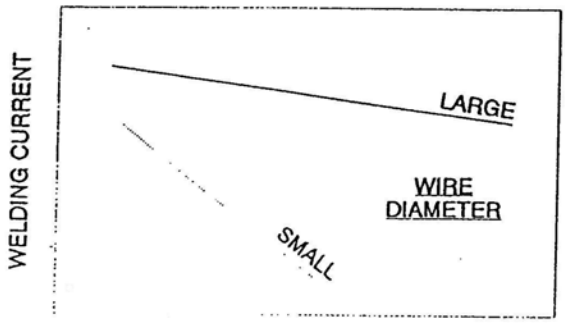

Fig. 3 — The effect of electrode extension on welding current for large- and small-diameter electrode wires at constant wire feed speeds. Electrode extension has more effect on current when welding with small-diameter wires.

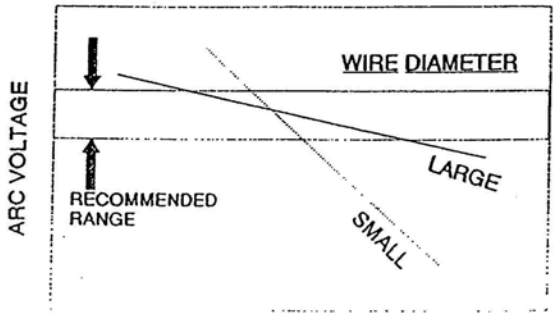

Fig. 4 — The effect of electrode extension on arc voltage for small- and large-diameter wires at constant rectifier output voltage. Electrode extension has more effect on voltage when welding with small-diameter wires.

out of the weld metal, and of course, GMA welders should be trained to use a trailing angle. Playing the arc on the slag can cause porosity and trapped slag.

Choosing Self-Shielded Cored Wire Electrodes

A thorough analysis of the application is needed to make the correct recommendations for choice of electrodes.

For instance, an electrode recommended for multipass welds, such as E71T-8 should be chosen for relatively thick structural steel. An E71T-11 electrode is not the best choice. The use of E71T-11 electrodes for 1-in.-thick carbon steel may cause cracking in the final passes, especially if the weld is not completed while hot. The appendix to AWS A5.20 gives excellent guidance in the choice of electrodes.

Attention to electrode extension becomes increasingly critical when small-diameter wires are used, but to put the matter into perspective: 1) the control of energy input via electrode extension is a useful tool in the hands of a skilled welder; and 2) the control of extension is no more important with self-shielded electrodes than it is with other manual welding processes.

Self-shielded electrodes require good control of arc voltage to avoid excessive nitrogen absorption, which can cause porosity. Arc voltage is controlled by the combination of machine setting and electrode extension. The best welding machines are those that use a sensing connection to the workpiece to monitor voltage, thereby eliminating the effects of poor connections around the circuit.

In general, self-shielded electrodes are equally good for fillet and groove welds. Some electrodes have been specifically developed for making high-speed fillet and lap joint fillet welds. Do not guess at applications from knowledge of other processes. One of the main lessons that is still not widely appreciated is that self-shielded electrodes have been developed for applications that might not be considered with other processes. As an example, self-shielded FCAW is used with downhill progression for most offshore fabrications, to develop good impact toughness from small weld beads, whereas it would not be admissible with solid wire GMAW that requires the use of short circuiting transfer.

Table 1 — Estimated Voltage Drops Around Typical Welding Circuit

Position in Welding Circuit	Estimated Voltage Drop, Volts
Total output voltage at rectifier	16–21
Work cable	1–2
Ground cable	1–2
Workpiece and clamps	1–2
Electrode extension	3–5
Welding arc (This voltage is not constant, but depends on the other voltage drops throughout the circuit, especially the electrode extension.)	10–20

Conclusions

In constant voltage systems wire feed speed is the major control of welding current, but at any WFS setting, electrode extension plays a significant additional role. At any WFS, increased electrode extension will lead to lower current and vice versa.

Arc voltage is controlled mainly by the rectifier setting, but it is also sensitive to electrode extension.

Control of electrode extension is especially important in the prevention of porosity when welding with small-diameter self-shielded flux cored wires.

The effects of electrode extension become more pronounced with smaller-diameter electrodes. Use the largest electrode size that is practical. This will minimize the detrimental effects of changes in electrode extension. Do not assume that flux cored electrode wires should be the same diameter as solid electrode wires for any given job. Virtually all the self-shielded electrode wires used in North Sea structures are ¾ in. (2.0 mm) diameter. Do not use 0.045 in. (1.2 mm) cored electrodes for welding heavy sections.

Although the settings of the wire feeder and rectifier are the major controls of welding current and arc voltage, the welder exerts additional control via the position and angle of the gun. Proper training is essential if mistakes are to be avoided.

Teach the use of weave patterns to maintain constant electrode extension to avoid incomplete fusion in weld roots.

Self-shielded electrodes are a very effective aid to improved productivity. They should always be used as the manufacturer recommends.

Manufacturers of cored wire should emphasize the need for correct setting of wire feed speed and rectifier output voltage, and the importance of electrode extension.

Training should concentrate on the importance of using the correct electrode extension and its value in the control of energy input when making difficult welds. ◆

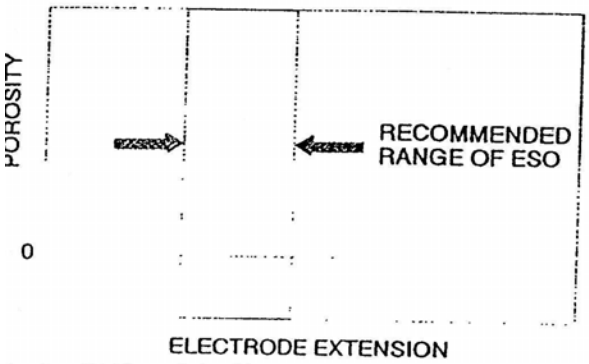

Fig. 5 — Weld metal should not show porosity when the recommended electrode extension range is used. Porosity will occur if the electrode extension is too short because the arc voltage becomes excessive.

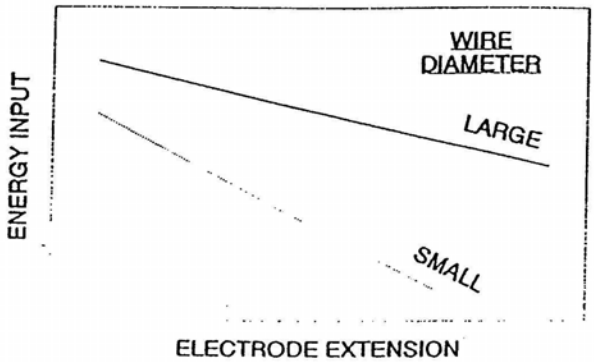

Fig. 6 — At constant machine settings of wire feed speed and output voltage the energy input for a given weld size depends on electrode extension. The dependence is more sensitive with small-diameter electrode wires.

15.0 PREVENTING THE EFFECTS OF MOISTURE CONTAMINATION OF FLUX CORE WIRE

Preventing the effects of moisture contamination on flux-cored wire

Better welds can be achieved by protecting consumables

By John Czarnecki

All arc welding processes produce some level of hydrogen contamination in the arc atmosphere. It has long been known that moisture in the welding process releases hydrogen, which promotes cracking, porosity, and worm tracks in the weld. This is true of shielded metal arc welding (SMAW) electrodes and, to some extent, flux-cored arc welding electrodes. In welding steels of higher strengths and heavier sections, keeping hydrogen levels to a minimum becomes very important. Actually, the safest practice would be to make every attempt to eliminate the presence of hydrogen altogether.

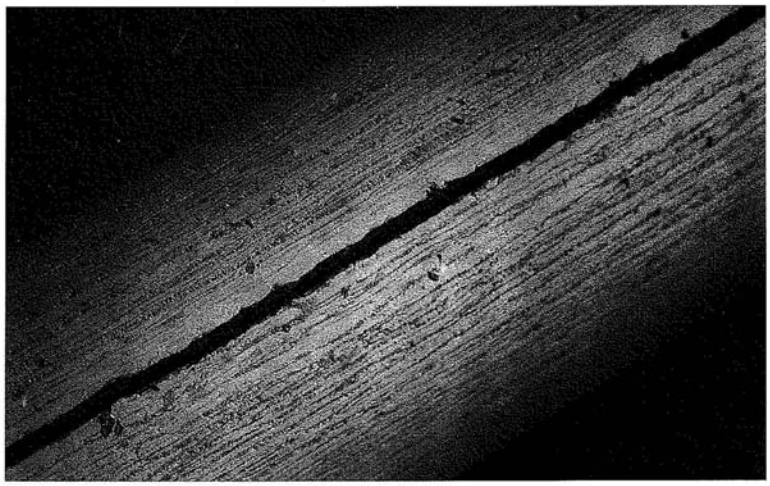

Figure 1

A seam is produced during the manufacture of flux-cored wire, allowing a spot for moisture to enter the wire.

The Effects of Moisture

During the manufacture of most flux-cored wire, a seam is formed along the length of the wire (see **Figure 1**). It is through this seam that moisture can be absorbed into the flux (see **Figure 2**). This moisture produces hydrogen that will go into solution during welding and settle in the weld's structural voids.

Plain water alone would not hurt the weld, but the heat and arc break down water into its basic elements, hydrogen and oxygen. Hydrogen in or near the molten weld can pose a significant threat to the weld quality.

Flux-cored arc welding is generally considered to be a low-hydrogen welding process. However, as material susceptibility to the effects of hydrogen increases, the amount of diffusible hydrogen necessary to cause cracking decreases. When welding high-strength, low-alloy steels, it is important to evaluate the amount of diffusible hydrogen produced during welding.

Certain flux-cored wires can absorb significant moisture if stored in a humid environment, in damaged or open packages, or if left unprotected for extended periods of time. In the worst cases of humidity, even overnight exposure of unprotected wire can lead to levels of crack-inducing hydrogen.

In the event the wire has been exposed, the filler metal manufacturer should be consulted regarding probable damage to the low-hydrogen characteristics and the possibility of reconditioning of the wire.

Exposure to moisture can also cause rust, which is detrimental to weld quality. As well as causing problems in the feeder and gun, rust contains oxygen and hydrogen as a result of the rusting process. This hydrogen can enter the weld and cause problems.

PRACTICAL WELDING TODAY
January/February 1998

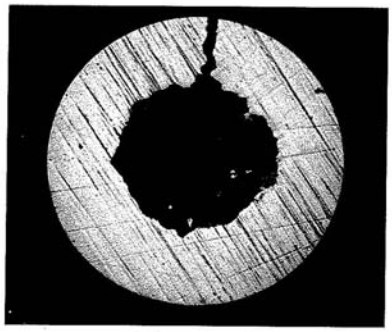

Figure 2

A cross section of flux-cored wire shows the seam's total penetration to the core flux ingredients.

Protecting Wire

The following suggestions include some ways to combat the negative effects of moisture on welding with high-strength, low-alloy flux-cored wire.

1. Just-In-Time (JIT) inventory. Proper forecasting techniques for wire usage can aid in ordering what the user requires in a set time frame. This can help limit the amount of wire awaiting use in the shop or field. JIT also limits the amount of inactive wire that might be susceptible to moisture pickup. Damaged wire that has taken on moisture should be reconditioned. Wire that is damaged or rusted should not be used.

2. Oven storage. Similar to those used to hold SMAW electrodes, ovens are available for holding spools and coils of flux-cored wire. In an oven, the wire can be held at specified temperatures or reconditioned if the wire has taken on moisture.

Once flux-cored wire is removed from its initial packaging, the unused portion should be stored at temperatures not to exceed 300 degrees Fahrenheit (150 degrees Celsius) for coils, masonite spools, or wire baskets, and 150 degrees F (65 degrees C) for plastic spools. Precise temperatures should be obtained from the wire manufacturer's technical department.

3. Climate control. If the amount of flux-cored wire is large and held in a single location, an investment in a climate-controlled facility might be in order. This option offers inventory tracking as well as custom climate controls.

4. Hermetically-sealed packaging. Another option to consider is hermetically-sealed packaging, which decreases the likelihood of moisture contamination. Special care must be taken not to damage the packaging.

Reconditioning

Flux-cored wires exhibiting weld metal porosity or "worm tracks" because of moisture absorption by the flux can be reconditioned by rebaking the wire.

The exact time and temperature for rebake are determined by the wire and spool material. Wire coils, masonite spools, or wire baskets are typically rebaked in a range of 230 to 300 degrees F for a minimum of six to 12 hours. Precise temperatures are available from the wire manufacturer.

It is important to note that some flux-cored electrodes are never baked. Reconditioning these types of electrodes may not only destroy the protectant lubricant on the electrode, but may cause chemicals in the flux to react. This reaction may cause arc stability problems and may change the mechanical properties of the weld deposit. Non-baked flux-cored products can be either self-shielded or gas-shielded electrodes.

Wire on plastic spools cannot be rebaked because of plastic's inability to withstand high temperature.

Another important factor in the storing and rebaking of flux-cored wire is the lubricant on the outside of the wire. Some lubricants can be damaged by high temperatures. The wire manufacturer should be contacted to determine the potential damage.

Operator Technique

While bad operator technique does not create moisture, poor technique can allow hydrogen from other elements besides moisture to enter the weld.

By using a shorter stick-out length (the amount of the wire extending from the gun's end) and higher welding currents, the operator may be promoting higher hydrogen levels. With shorter stick-out, less resistive heating is available to evaporate hydrogen-containing residues from the wire surface. These residues can consist of drawing soaps or other lubricants used in manufacturing the wires. These residues can enter the weld pool, increasing the hydrogen content.

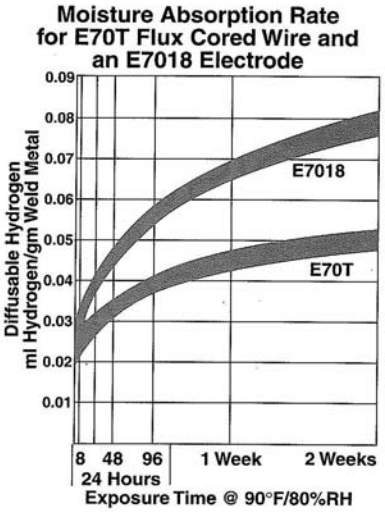

Figure 3

This chart illustrates the moisture absorption rate for a typical flux-cored wire and an E7018 electrode.

Conclusion

The wire manufacturer's technical department should always be contacted for specific instructions involving wire storage and reconditioning. Proper storage and rebaking temperatures depend on the wire and its condition.

As with all types of welding wire, it is important that users of flux-cored wire take great care to keep it from taking on moisture. In addition to avoiding hydrogen cracking, moisture-free flux-cored wire will run easier and cleaner. ●

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