201292 Rev. A

PowCon®

! IMPORTANT !
FOR YOUR SAFETY
READ THIS MANUAL BEFORE
INSTALLING OR USING EQUIPMENT

OPERATION MANUAL

PDVS Wirefeeder

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! IMPORTANT !

THIS MANUAL HAS BEEN DESIGNED FOR EXPERIENCED WELDING AND CUTTING EQUIPMENT OPERATORS AND MUST BE READ COMPLETELY BEFORE USING THIS EQUIPMENT. IF YOU LACK EXPERIENCE OR ARE UNFAMILIAR WITH THE PRACTICES AND SAFE OPERATION OF WELDING AND CUTTING EQUIPMENT, PLEASE CONSULT YOUR FOREMAN. DO NOT ATTEMPT TO INSTALL, OPERATE, OR PERFORM MAINTENANCE ON THIS EQUIPMENT UNLESS YOU ARE QUALIFIED AND HAVE READ AND UNDERSTOOD THIS MANUAL. IF IN DOUBT ABOUT INSTALLING OR OPERATING THIS EQUIPMENT, CONTACT YOUR DISTRIBUTOR OR THE CUSTOMER SERVICE DEPARTMENT OF PowCon.

DEFINITIONS

Throughout this manual, NOTE, CAUTION, WARNING and DANGER are inserted to call attention to particular information. The methods used to identify these highlights and the purpose for which each is used, are as follows:

NOTE

Operational, procedural, and background information which aids the operator in the use of the machine, helps the service personnel in the performance of maintenance, and prevents damage to the equipment.

CAUTION

An operational procedure which, if not followed, may cause minor injury to the operator, service personnel and/or bystanders.

WARNING

An operational procedure which, if not followed, may cause severe injury to the operator, service personnel, or others in the operating area.

DANGER

An operational procedure which, if not followed, will cause severe injury or even death to the operator, service personnel or bystanders.

SAFETY INFORMATION

Safety is a combination of good judgement and proper training. Operation and maintenance of any arc welding and cutting equipment involves potential hazards. Individuals who are unfamiliar with cutting and welding equipment, use faulty judgement or lack proper training, may cause injury to themselves and others. Personnel should be alerted to the following potential hazards and the safeguards necessary to avoid possible injury. In addition, before operating this equipment, you should be aware of your employer's safety regulations.

BE SURE TO READ AND FOLLOW ALL AVAILABLE SAFETY REGULATIONS BEFORE USING THIS EQUIPMENT.

ELECTRIC SHOCK

THE VOLTAGES PRESENT IN THE WELDING AND CUTTING ENVIRONMENT CAN CAUSE SEVERE BURNS TO THE BODY OR FATAL SHOCK. THE SEVERITY OF ELECTRICAL SHOCK IS DETERMINED BY THE PATH AND THE AMOUNT OF CURRENT THROUGH THE BODY.

A) Install and continue to maintain equipment according to USA Standard C1, National Electric Code.

B) Never allow live metal parts to touch bare skin or any wet clothing. Use only dry gloves.

C) When welding or cutting in a damp area, or when standing on metal, make sure you are well insulated by wearing dry gloves, rubber soled shoes, and by standing on a dry board or platform.

D) Do not use worn or damaged welding or torch cables. Do not overload the cables. Use well maintained equipment.

E) When not welding/cutting, turn equipment OFF. Accidental grounding can cause overheating and create a fire hazard. Do not coil or loop the cable around parts of the body.

F) The ground cable should be connected to the workpiece as close to the work area as possible. Grounds connected to building framework or other locations remote to the work area reduce efficiency and increase the potential hazard of electric shock. Avoid the possibility of the cutting current passing through lifting chains, crane cables or other electrical paths.

G) Keep everything dry you might touch, including clothing, the work area, welding gun, torch and welding or cutting machines. Fix water leaks immediately. Do not operate equipment standing in water.

H) Never use a cutting torch or welding gun which is damaged or contains cracks in its housing.

I) Refer to AWS-Z49.1 for grounding recommendations.

PERSONAL PROTECTION

SKIN AND EYE BURNS RESULTING FROM BODY EXPOSURE TO ELECTRIC-ARC WELDING AND CUTTING RAYS OR HOT METAL CAN BE MORE SEVERE THAN SUNBURN.

A) Use a proper face shield fitted with the correct filter (# 10 or greater) and cover plates to protect your eyes, face, neck and ears from the sparks and rays of the cutting/welding arc when cutting/welding or observing cutting/welding. Warn bystanders not to watch the arc and not to expose themselves to the cutting/welding arc rays or to hot metal.

B) Wear flameproof gauntlet-type gloves, a heavy long-sleeve shirt, cuffless trousers, high-topped shoes, and a welding helmet or cap (for hair protection) to protect the skin from arc rays and hot sparks or hot metal.

C) Protect other nearby personnel from arc rays and hot sparks with a suitable non-flammable partition.

D) Always wear safety glasses or goggles when in a cutting or welding area. Use safety glasses with side shields or goggles when chipping slag or grinding. Chipped slag is hot and may travel a considerable distance. Bystanders should also wear safety glasses or goggles.

E) Compressed gas cylinders are potentially dangerous, refer to the suppliers for proper handling procedures.

F) Wear ear plugs or other ear protection devices when operating cutting or welding equipment.

FIRE SAFETY

HOT SLAG OR SPARKS CAN CAUSE A SERIOUS FIRE WHEN IN CONTACT WITH COMBUSTIBLE SOLIDS, LIQUIDS OR GASES.

A) Move all combustible materials well away from the cutting area or completely cover materials with a non-flammable covering. Combustible materials include but are not limited to wood, clothing, sawdust, gasoline, kerosene, paints, solvents, natural gases, acetylene, propane, and similar articles.

B) Do not weld, cut or perform other hot work on used barrels, drums, tanks or other containers until they have been completely cleaned. There must be no substances in the container which might produce flammable or toxic vapors.

C) For fire protection, have suitable extinguishing equipment handy for instant use.

VENTILATION

WELDING AND CUTTING FUMES AND GASES, PARTICULARLY IN CONFINED SPACES, CAN CAUSE DISCOMFORT AND PHYSICAL HARM IF INHALED OVER AN EXTENDED PERIOD OF TIME.

A) At all times, provide adequate ventilation in the welding and cutting area by either natural or mechanical means. Do not weld or cut on galvanized, zinc, lead, beryllium or cadmium materials unless positive mechanical ventilation is provided to prevent inhaling fumes and gases from these materials.

B) Do not weld or cut in locations close to chlorinated hydrocarbon vapors coming from degreasing or spraying operations. The heat of arc rays can react with solvent vapors to form phosgene, a highly toxic gas, and other irritant gases.

C) If you develop momentary eye, nose or throat irritation during welding or cutting, it is an indication that the ventilation is not adequate. Stop work and take the necessary steps to improve ventilation in the welding or cutting area. Do not continue to weld or cut if physical discomfort persists.

D) Use an air supplied respirator if ventilation is not adequate to remove all fumes and gases.

E) Beware of gas leaks. Welding or cutting gases containing argon are more dense than air and will replace air when used in confined spaces. Do not locate gas cylinders in confined spaces. When not in use, shut OFF the gas supply at its source.

F) Refer to AWS Standard Z49.1 for specific ventilation recommendations.

SAFETY REFERENCES

The following publications provide additional information on important welding safeguards.

A) ANSI/ASC Z49.1-1988, American National Standard "Safety in Welding and Cutting".

B) Bulletin No. F4-1, "Recommended Safe Practices for the Preparation for Welding and Cutting Containers and Piping that have held Hazardous Substances".

C) OSHA Safety and Health Standards, 29CFR 1910, available from the United States Department of Labor, Washington, DC 20210.

D) NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", available from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 00210.

E) NEMA Standards Publication/No. EW1-1989, Electric Arc-Welding Apparatus, approved as ANSI C87.1-1989. Available from National Electrical Manufacturers Association, 155 E. 44th Street, New York, NY 10017.

UNPACKING NEW EQUIPMENT

(Receiving and Handling)

Remove the **PowCon** Portable Wire Feeder from its shipping carton and inspect for any possible damage that might have occurred during shipping. Make sure that all items on the packing list are accounted for and identified. One copy of the PowCon Operation Manual is packed with each **PowCon** unit.

Any claims for loss or damage that may have occurred in transit must be filed by the PURCHASER with the CARRIER. Copies of the bill of lading and freight bill will be furnished by the carrier on request, if the need to file a claim arises. When requesting information concerning this equipment, it is essential that model description, serial number and/or part number of the equipment be supplied.

DESCRIPTION OF EQUIPMENT

The PDVS portable wire feeder is designed to control the linear movement of 5/64 inch (.078 mm) diameter (or less) tubular welding electrode or .052 inch diameter (or less) solid welding electrode. The basic feeder is equipped with a gas valve and can be used with either non-shielding or self-shielding welding electrodes.

Metal Inert Gas (MIG) welding process joins metal parts by electric arc which is established between a filler metal (consumable welding wire) and the work. The combination of the consumable wire with the parent metal forms the weld.

This wire feeder may be used with either a constant-voltage or constant-current type welding machine. An inverter, transformer-rectifier, motor-generator, or engine-driven welding machine may be used.

CURRENT CAPACITY AND RATING

The welding current on the equipment is passed through a contactor and the current should be limited to 300 amps or less. Current above this range may shorten the life of the contactor. Care must be taken to make sure that all connections are tight. This includes the connection of the Welding Power Cable to the terminals inside the feeder and the connection between the feedhead and the gun cable. Loose connections cause excessive heating and must be avoided.

This feeder uses arc voltage for its power. The cable connection wire feeder terminal and the power source also provides a power connection for the feeder control. Another power connection is made through the voltage sensing lead connected to the work terminal. Care must be taken to make sure that the power cable connection is made between the power source and the work.

By taking power from the welding arc, two modes of operation result. These are termed CC and CV mode. When a constant voltage power source is used (CV mode), the input voltage to the feeder remains constant. A fixed wire feed speed will result for a given dial selection on the feeder. If either the power source voltage setting or the feeder setting are changed, the output speed will change.

When a constant current power source is used (CC mode), the arc voltage will vary. As a result, the wire feed speed will vary for a fixed dial setting on the feeder. An increase in arc voltage will cause an increase in wire feed speed. An increase in wire feed speed causes a decrease in arc voltage. This is a self-regulating system that keeps the arc voltage constant by varying the wire feed speed as the arc attempts to fluctuate.

A switch on the inside of the feeder is provided to select between CV or CC. This switch selects proper control stability for the mode being used. The switch does NOT select the mode of operation. The mode of operation is determined by the type of power source being used.

The main application for this wire feeder is for CC type welding using tubular self-shielding wire. Since the output terminals on the CC Power Sources are ON when the machine is turned on, a contactor was added inside the wire feeder case. This allows the welding electrode to remain OFF until the gun switch is closed.

After the weld is completed it is recommended to pull the welding gun away from the work while releasing the gun switch. This allows the arc to partially extinguish at the work and reduce arcing at the contactor contacts. Using this procedure will lengthen the life of the contacts, especially when welding at high amps.

Internal limiting circuitry limits the maximum speed to approximately 650 inches/minute independent of input voltage. In addition, a slow run-in circuit is provided which automatically reduces the run in wire feed speed when open circuit voltage from a CC power source is present.

Tabulated Data

Gearmotor	Permanent magnet 20 V DC, 1/20 HP 3.7 A ± .37 amps Speed: 120 RPM ± 12 RPM 142 RPM ± 14 RPM @ no load
Dimensions	
Length	23 - 3/4 inches (603 mm)
Width	9 - 3/4 inches (248 mm)
Height	15 - 1/4 inches (387 mm)
Weight	(less wire) 31 pounds (14.04 kg)
Voltages	
Motor	20 V DC
Gun Circuit	11 V DC or 24 V AC (option)
Speed Range of Wire	
29.1 drive gear ratio - 50 to 600 IPM (inches/minute)	
Wire Data	
Spool Weight	30 pounds (13.6 kg)
Sizes:	
Tubular	5/64 inch (2.0 mm) and smaller
Solid	.052 inch (1.3 mm) and smaller

CONTROLS AND CONNECTIONS - EXTERIOR

1. Feeder Control

The feeder control is on the front end of the center frame.

CV Operation

When using a CV power source, this control is used to control wire feed speed. To increase wire feed speed, turn the control knob clockwise. To decrease wire feed speed, turn the knob counterclockwise.

CC Operation

When using a CC power source, this control is used to control arc voltage by varying wire feed speed. To increase arc voltage (decrease wfs), turn knob counterclockwise. To decrease arc voltage (increase wfs), turn knob clockwise.

NOTE

Many CC power sources have a drooping V-I characteristic. On these types of power sources, the current is not exactly constant. Changing the arc voltage will also change the output current. This again becomes a self-regulating stable system.

2. ON-OFF Rocker Switch

This switch controls the input circuit, applying or removing the input voltage of the unit.

3. Gun Switch Receptacle

The gun switch control cable connects to the gun switch receptacle (quick-disconnect type). It provides control from the gun switch to the wire feed mechanism.

4. Welding Gun Cable Connector

The gun cable is connected to the wire feeder at this receptacle. Connection must always be tight.

5. Gun Holder

This is an insulated holder used to store the welding gun when not welding. Always use this holder so the gun will not accidentally short the electrode and cause arc flash in case the gun switch is accidentally closed.

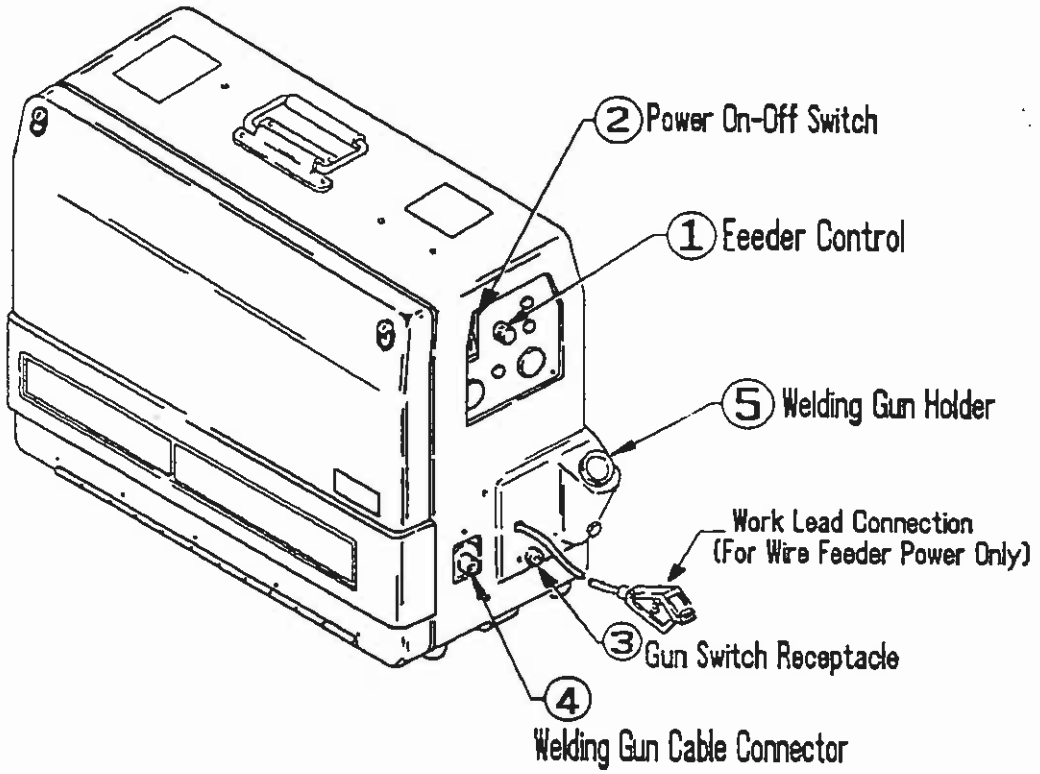

Figure 1, Controls - Connections (Front End)

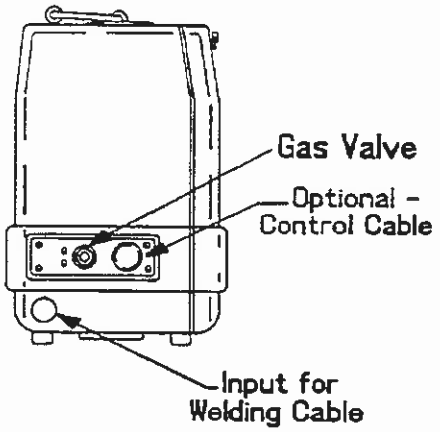

Figure 2, Connections (Rear End of Enclosure)

INTERNAL COMPONENTS - (FEEDHEAD SIDE)

See Figure 3 for details

Fuse 6 Amp

The unit is equipped with a 6 MDX slow blow fuse. This fuse is rated at 125 volt. Never replace it with a fuse of lower voltage rating as this could cause serious damage to the equipment.

Fuse 1/8 Amp

This fuse is in series with the gun switch and provides protection to the Motor Control PC Board in case of a short in the welding gun. Only use a 1/8 amp fast blow fuse.

Fuse 5 Amp

This fuse is used to provide protection for the wire feed motor. Use only a 5-amp slow blow fuse.

CC/CV Switch

This is a two-position switch that controls the droop characteristics of the motor control circuit. When in the CV position, the circuit uses IR compensation giving an almost flat speed torque curve. When in the CC position, the IR compensation is eliminated and the speed torque curve has a fairly high droop. The CV position is recommended for all CV types of power sources. The CC position is generally recommended when using a CC power source. For many types of wires however, the CV position is recommended even when a CC power source is used.

Feedhead Assembly

The drive roll/bearing roll feedhead assembly consists of the following:

a. feed roll assemblies (for various size wire)

b. wire input guide

c. feed plate

d. pressure arm assembly

e. electric drive motor

The drive motor is 20 volt DC. See Figure 5 for details on the feedhead assembly.

To select the proper Drive Roll for wire size and type see Installation, Figure 6 and Table 1.

INTERNAL COMPONENTS - (PC BOARD SIDE)

See Figure 4 for details

Motor Control PC Board

The motor control module starts wire feed motor on command from gun switch when power source is turned ON. It also controls motor speed and dynamic braking for stopping wire feed motor.

Gas Solenoid Valve

The gas solenoid valve controls the flow of shielding gas through the welding torch. The power for the gas valve is provided by the contactor driver board.

Contactor

Controls the power source weld current allowing the electrode to be hot only when the gun switch is closed.

Contactor Driver Board

This board provides power for the contactor.

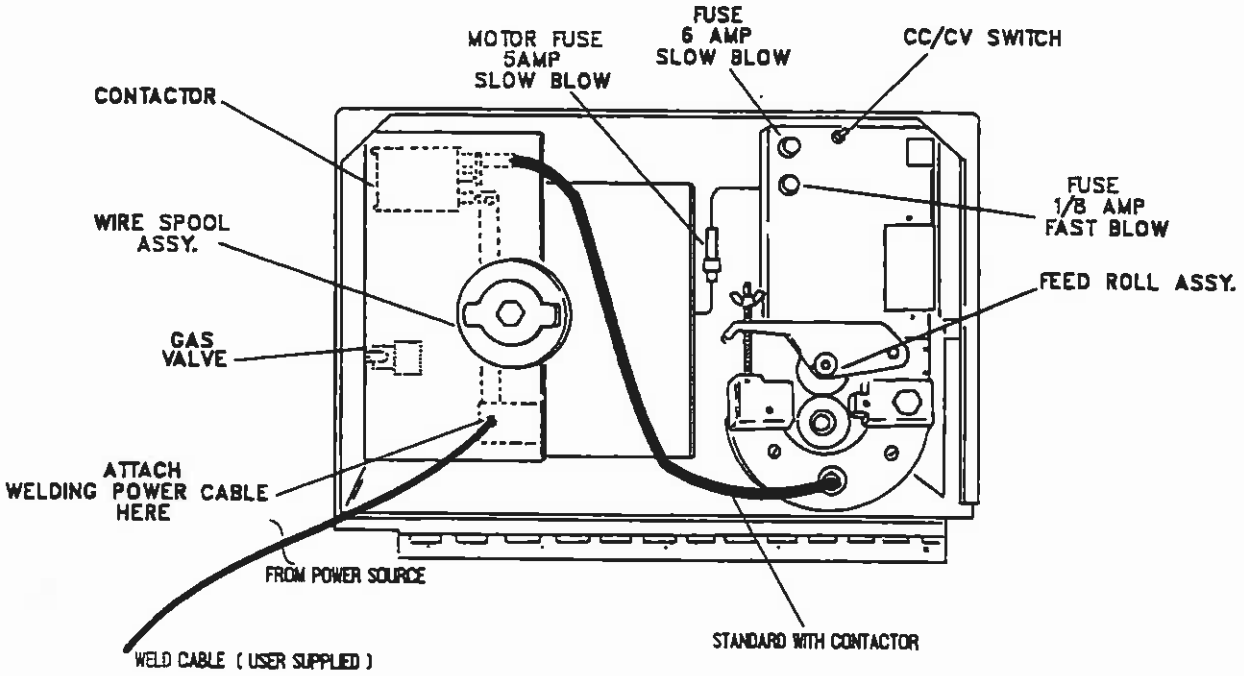

Figure 3, Internal Components (Feedhead Side)

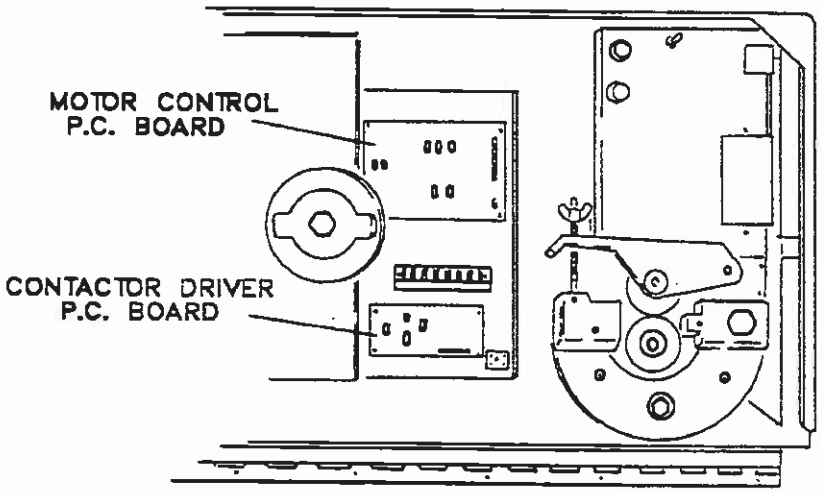

Figure 4, Internal Components (PC Board Side)

LOCATION

Take care in selecting an installation site. Avoid locations exposed to high humidity, dust, high ambient temperature, or corrosive fumes. Moisture can condense on electrical components, causing corrosion or shorting of circuits. Dirt on components helps retain moisture, increasing wear on moving parts.

CONNECTIONS

1. Make the proper welding cable connections between the wire feeder terminal (electrode) to power source and work connection to power source. See Figure 3. Connect feeder work lead (Figure 1) to work.

2. Attach the gun and cable to the wire feeder at the welding gun cable connector (See Figure 1).

INSTALLATION OF WELDING WIRE SPOOL

See Drawings & Part Lists Chapter, Figure 16.

NOTE

The Wire Spool Hub (83) supplied with the unit is provided for mounting a 30-pound spool of wire. An optional adapter is available allowing a 10-pound spool of wire to be used.

1. Remove Wire Spool Hub Nut (79) by turning counterclockwise.

2. Slide the spool of wire over the hub (83), making sure that the alignment pin on the hub enters the hole in the backside of the wire spool.

3. Replace the Hub Nut (79) and turn clockwise to a snug position.

NOTE

Install the spool of wire so that it feeds from the bottom of the roll into the wire feedhead.

ADJUSTMENT OF SPOOL TENSION

Adjust the wire spool tension so that it will feed freely into the feedhead. It must not "coast" when wire feeding stops. Tighten or loosen the Hub Tension Screw (77) accordingly. (See exploded view in Drawings & Parts Lists Chapter).

THREADING WIRE INTO FEEDHEAD

Refer to Figure 5

CAUTION

Use care when handling the spooled wire as it tends to "unravel" when loosened from the spool. Grasp the end of the wire firmly, and don't let it get away from you. Make sure the end of the wire is straight and free of burrs.

1. Place end of the wire into the input wire guide (See Figure 5). Feed it through the guide and over the drive roll groove.

NOTE

Place the drive roll pressure arm in the "UP" position (as shown in Figure 5) when feeding the wire into the feedhead.

2. Pass the wire into the liner spring in the cable assembly.

3. Close the drive roll pressure arm, and lock in position with the wing nut.

4. Turn the welding machine ON, and set the Wire Feed Speed Control to "5." See Figure 1. Remove contact tip from welding gun. Press the gun switch until wire feeds out past the gun nozzle. Place contact tip over the wire and screw into place and tighten. Cut wire off at about 1/4 inch (6 mm) from the nozzle.

DRIVE ROLL SELECTION

For the following Feed Rolls and Groove Types see Figure 6 and Table 1.

Type 1 Drive Rolls consist of two separate rolls with different knurlings on the edges. They feed hard or tubular wire. The two rolls are assembled with markings on the outside. To change wire diameter, hard or tubular wire, remove Shaft Nut and Drive Roll assembly. Remove three screws which hold the rolls together. Reassemble with the wire diameter to be fed marking on the outside of the roll.

Type 2 Drive Rolls consist of two separate rolls with smooth edges. They feed hard wire. The rolls are assembled with wire diameter markings on the outside. To feed soft wire, remove Shaft Nut and Drive Roll Assembly. Remove three screws which hold the rolls together. Reassemble with markings on the outside.

Type 3 Drive Rolls are smooth "V", one-piece rolls to feed hard wire. See markings on the outside of the roll for particular wire being used.

See Reference Table

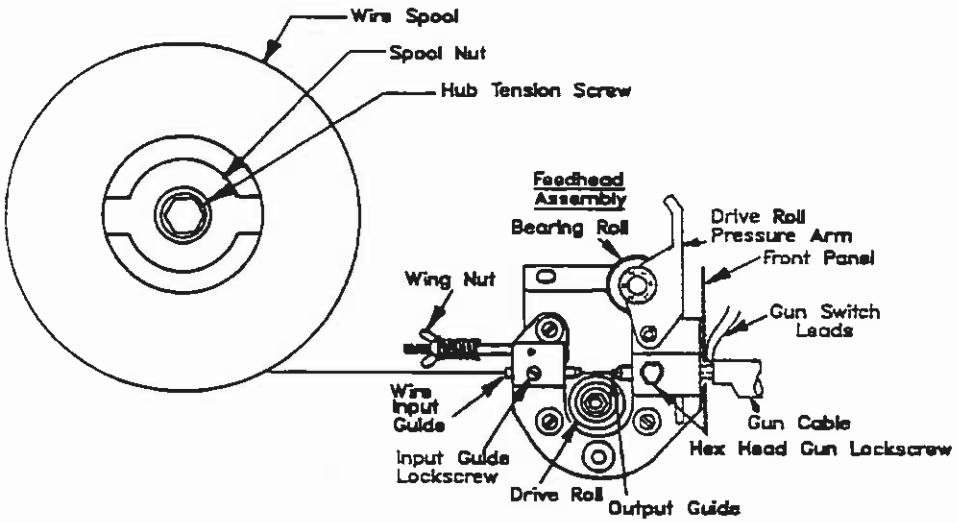

Figure 5, Feedhead Assembly

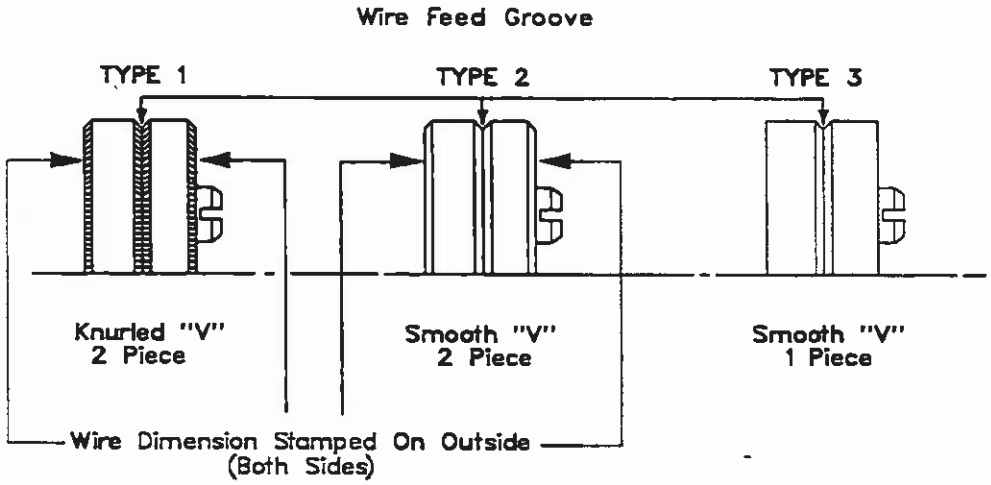

Figure 6, Feed Roll Assembly

Table 1, Hefty CC/CV, for Figure 6

Feed rolls kits include: 1 feed roll, 1 input guide, and 1 output guide (if necessary).

* Wire Size & ** Type				Type 1	Type 2	Type 3
.030(.76),	.035(.89),	.045(1.1)	H/T	605105-001	-------	-------
	.024(.65)	.030(.76)	H	-------	605105-003	-------
.052(1.3) H		.068(1.2)	T	605105-002	-------	-------
.035(.89)	3/64(1.2)		S	-------	605105-004	-------
		.035(.89)	S	-------	605105-005	-------
		3/64(1.2)	S	-------	605105-006	-------
		.035(.89)	H	-------	-------	605105-007
		.045(1.1)	H	-------	-------	605105-008
1/16(1.6)		5/64(2.0)	T	605105-009	-------	-------

* IN (MM) **H = HARDWIRE (SOLID) T = TUBULAR WIRE S = SOFTWIRE (ALUMINUM)

PREWELDING CHECKS

Follow all installation instructions for the welding machine (power source) and the welding gun and cable, before attempting to operate the PDVS Wire Feeder.

1. Connect the feeder to the power source and the work cables from power source to work, and from feeder to work. Turn on the power source.

2. Select CC/CV characteristic on motor control circuit and set switch accordingly.

3. Set power source voltage for CV or current for CC.

4. Set control on feeder to the 3 position on the dial.

NOTE

When using a CV power source, increasing wire feed speed will increase welding current.
When using a CC power source, increasing wire feed speed will decrease arc voltage.

WELDING

1. Position the gun above the workpiece. With the gun in the proper position and eyes fully protected, pull the gun switch. This will cause an arc to be initiated.

NOTE

Please refer to Welding Procedures.

2. When the weld is completed, pull the gun away from the work and release the gun trigger.

3. When finished welding, turn the power source and feeder off.

THEORY OF OPERATION

Refer to Connection Diagram Figure 1

With the wire feeder connected to the welding electrode and the work terminal, turn the power source and wire feeder on. Power is supplied into bridge rectifier CR1. Power on the output side of the CR1 is fed to the motor control board with the proper polarity independent of the welding polarity.

When the welding gun switch (S2) is closed, it energizes the proper components on the Motor Control and Contactor Driver PC Boards. This causes the wire feed motor to run, gas valve to open and the contactor to close making the welding electrode hot. When the gun switch is opened, the contactor opens making the electrode cold and the gas valve closes. It also removes power from the motor and shorts the armature to provide dynamic braking on the motor.

When the CC/CV switch (S3) is open, IR compensation, used on the motor control circuit, is not active.

Terminal strip (TB1) is used to connect various options to the feeder.

Switch S1 is used to turn the power into the feeder on or off.

Resistor R1 is the control potentiometer for the unit which varies the output speed.

The motor control circuit on this feeder is a DC to DC converter circuit. It uses the power source output voltage and changes it to the proper DC voltage required to operate the motor. The motor is part of the operating circuit, and the circuit will not operate properly if the motor is removed.

The circuit is designed for continuous operation when the input voltage is 30 volts or below. Many CC power sources have an open circuit voltage of 60 to 100 volts. Under these input conditions, the circuit will operate and the motor will run.

This condition may exist for a period long enough to feed wire through the gun when wire spools are changed, etc. The motor must NEVER be allowed to operate with open circuit voltage for prolonged periods of time.

The Contactor (K1) is provided power from the Contactor Driver board. The circuit board uses the output voltage of the bridge rectifier CR1 and converts this to a 12 V DC voltage.

OPTIONS

1. Voltmeter and inches per minute kits are available for this unit. **PowCon P/N 605106-001**

2. Inch/Purge Feature: This option provides an Inch and Purge Switch on the front panel to inch the wire feed motor and to operate the gas valve to purge the gas line.
PowCon P/N 605107-001

3. MIG torches, several styles and capacities.

WELDING PROCEDURES

GENERAL

Two different welding processes are covered in this section. They are:

GAS METAL ARC WELDING (GMAW)

This is an electric arc welding process which fuses together the parts by heating them with an arc between a solid, continuous, consumable electrode and the work. Shielding is obtained from an externally supplied gas or gas mixture. The process is normally applied semiautomatically. However, it may be operated automatically and can be machine operated. The process can be used to weld thin and fairly thick steels and some nonferrous metals in all positions.

FLUX-CORED ARC WELDING (FCAW)

This is an electric arc welding process which fuses together the parts by heating them with an arc between a continuous flux filled electrode wire and the work.

Shielding is obtained through decomposition of the flux within the tubular wire. Additional shielding may or may not be obtained from an externally supplied gas or gas mixture. The process is normally applied semiautomatically, but can be applied automatically or by machine. It is commonly used to weld medium to thick steels using large diameter electrodes in the flat and horizontal position, and small electrode diameters in all positions. The process is used to a lesser degree for welding stainless steel and for overlay work.

WELD STARTING PROCEDURE

Follow these instructions only after referring to the Safety Instructions chapter of this manual, and instructions in the Installation Chapter.

CHECK LIST BEFORE STARTING

POLARITY (DCEP - Direct Current Electrode Positive) or (DCEN - Direct Current Electrode Negative)

Wire Feed Speed (1 to 10)

Gas Flow Rate (15 to 25 CFH)

Electrode Wire Stickout - See Figure 13

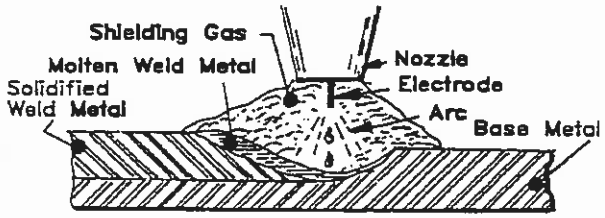

Figure 7, GMAW Process

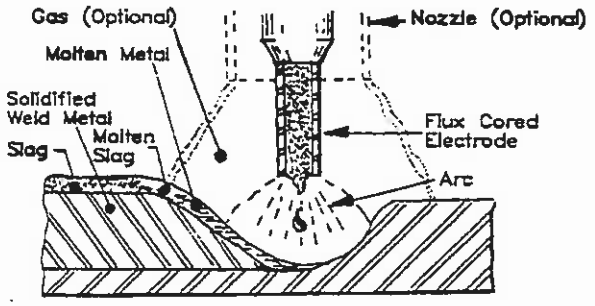

Figure 8, FCAW Process

WELDING TECHNIQUES

Data on the various types of welding wire (electrodes) and which wire is best suited for various kinds of metal will be found in this section.

WELDING GUN POSITIONS

The welding gun should be held at an angle to the weld joint. See paragraph 3 in Secondary Adjustable Variables section following, and also see Figures 9, 10, 11, 12, 13, 14, and 15.

Hold the gun so the welding seam is viewed at all times. Always wear the welding helmet with proper filter lenses.

CAUTION

Do not pull the welding gun back when the welding arc is established. This will create excessive wire extension (stickout) and make a very poor weld.

MIG WELDING (GMAW) VARIABLES

The items following describe the welding variables in short-arc welding of 24 gauge to 1/4 inch mild sheet or plate.

PRESELECTED VARIABLES

Preselected variables depend upon the following:

a. type of material being welded

b. the thickness of the material

c. the welding position

d. the deposition rate

e. the mechanical properties

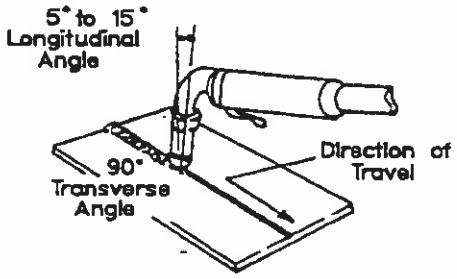

Figure 9, Butt and Horizontal Welds

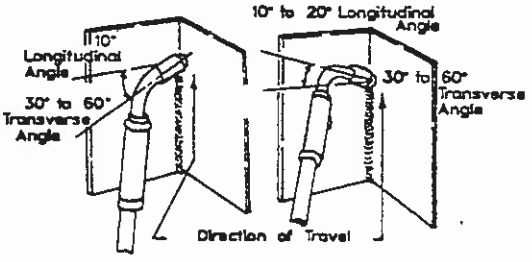

Figure 10, Vertical Fillet Welds

These preselected variables are:

1. Type of electrode wire
2. Size of electrode wire
3. Type of gas (not applicable to self-shielding FCAW)
4. Gas flow rate (not applicable to self-shielding FCAW)

Tables 2, 3, and 4 are references for the new MIG welding process user.

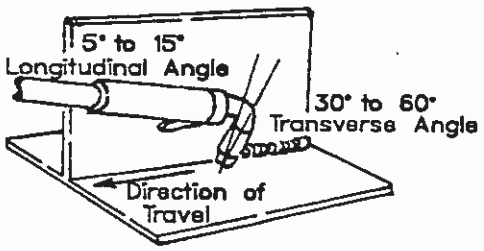

Figure 11, Horizontal Fillet Weld

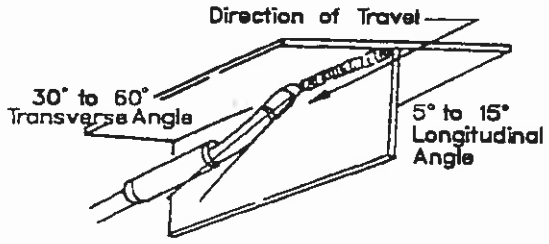

Figure 12, Overhead Weld

PRIMARY ADJUSTABLE VARIABLES

These control the process after preselected variables have been found. They control the penetration, bead width, bead height, arc stability, deposition rate, and weld soundness. They are:

1. Arc voltage
2. Welding current (wire feed speed)
3. Travel speed

SECONDARY ADJUSTABLE VARIABLES

These variables cause changes in primary adjustable variables which in turn cause the desired change in the bead formation.

They are:

1. Stickout (distance between the end of the contact tube (tip) and the end of the electrode wire.) See Figure 13. Maintain about 3/8" (9.5 mm) stickout.

2. Wire Feed Speed. Increase in wire feed speed increases weld current. Decrease in wire feed speed decreases weld current.

3. Nozzle Angle. Refers to the position of the welding gun in relation to the joint, as shown in Figures 10 thru 12, 14, and 15. The transverse angle is usually one-half the included angle between plates forming the joint. The longitudinal angle is the angle between the center line of the welding gun and a line perpendicular to the axis of the weld.

The longitudinal angle is generally called the nozzle angle, and is shown in Figure 15 as either trailing (pulling) or leading (pushing). Whether the operator is left-handed or right-handed has to be considered to realize the effects of each angle in relation to the direction of travel.

ESTABLISHING THE ARC AND MAKING WELD BEADS

Before attempting to weld on a finished piece of work, practice welds on sample metal of the same material as that of the finished piece.

The easiest welding procedure to experiment with in MIG welding is the flat position. The equipment is capable of flat, vertical, and overhead positions.

For practicing MIG welding, secure some pieces of 10, 11, or 12 gauge mild steel plate 6 inches X 6 inches, .035 inch E70S-3 electrode wire and CO2 Shielding Gas supply.

PREWELD PROCEDURE

1. Review standard safe practice procedures in ventilation, eye and face protection, fire, compressed gas and preventive maintenance. See Safety Instructions chapter included with this manual.

2. Check the Operation Chapter of this manual for details on equipment.

3. Set the Wire Feed Speed Control on about the number 3 setting. Readjust as necessary.

4. Adjust the gas flow rate to about 20 cubic feet per hour.

5. Recess the co ct tip from the front edge of the nozzle from 0 to about 1/8 inch.

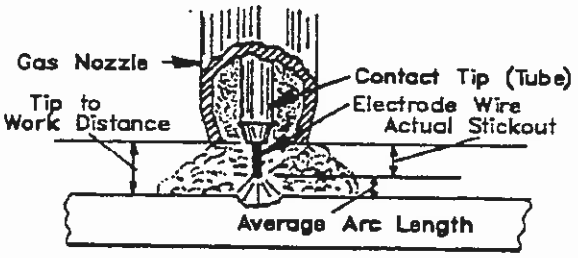

Figure 13, Electrode Stickout

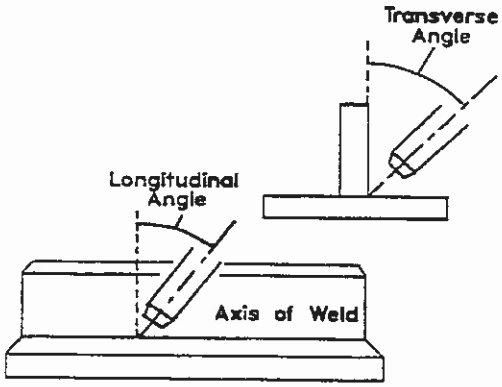

Figure 14, Transverse and Longitudinal Nozzle Angles

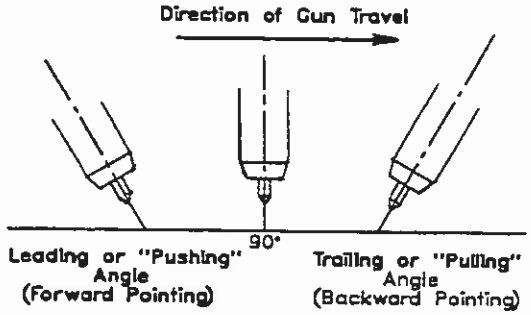

Figure 15, Nozzle Angle, Right-Handed Operator

WELDING PROCEDURE

1. Maintain the tip-to-work distance (stickout) at 5/16 to 3/8 inch (8 to 9 mm) at all times. See Figure 13.

2. For transverse and longitudinal nozzle angles, see welding gun positions.

3. Hold the gun about 3/8 inch from the work. Lower the helmet by shaking the head. Squeeze the trigger to start the wire feeding and establish the arc.

NOTE

Practice the habit of shaking the helmet down. Since one hand must hold the gun, the other is often needed to hold pieces to be tacked or positioned.

4. Make a single downhand (pulling) stringer weld bead.

5. Practice welding beads. Start at one edge and weld across the plate to the opposite edge.

NOTE

When the equipment is properly adjusted, a rapidly crackling or hissing sound of the arc is a good indicator of correct arc length.

6. Practice the following:

a. stopping in the middle of the plate

b. restarting into the existing crater

c. continuing the weld bead across the plate

NOTE

When the gun trigger is released after welding, the electrode forms a ball on the end. Correct this by cutting the ball off with wire cutting pliers.

REFERENCE TABLES

The following tables are provided for an aid to the user of the MIG or FLUX CORED Welding Mode.

Table 2

Welding Electrode Selection	
AWS Class	**Description and Application**
E71T-3	(AWS E71T-GS) A good general purpose self shielded flux Cored wire suited to a broad line of general applications including galvanized and sheet metal. A good all position wire.
E71T-1	(AWS E71T-1) A specially designed gas shielded (CO_2) flux cored wire for all position welding. Good arc makes it well suited for most applications.
ER70S-3	(AWS ER70S-3) A general purpose solid wire for CO_2 welding suited to most applications where clean well fitted joints are available. Good welder appeal on light gauge material makes this an ideal wire.
ER70S-6	(AWS ER70S-6) A unique solid wire with powerful deoxidizers for CO_2 welding where poor fit up, rusty or oily material may be used. Recommended for general shop fabrication.
ER80S-D2	(AWS ER80S-D2) Solid wire recommended for welding pipe, where porosity is a problem, or to counter high sulphur or carbon content of the base metal. It can be used with CO_2, Argon and CO_2, or Argon-Oxygen mixture. It is high strength wire, providing x-ray quality weld deposit.

Table 3

Type of Gas	Typical Mixtures	Primary Uses
Argon		Non-ferrous Metals
Helium		Aluminum, Magnesium and Copper Alloys
Carbon Dioxide		Mild and Low Alloy Steel
Argon - Helium	20 - 80% He	Aluminum, Magnesium, Copper and Nickel Alloys
Argon - Oxygen	95%Ar - 5% O_2	Stainless Steel Mild and Low Alloy Steel
Argon - Carbon Dioxide	75% Ar - 25% CO_2	Mild and Low Alloy Steels
Helium - Argon - Carbon Dioxide	90%He - 7 - 1/2% Ar - 2 - 1/2 CO_2 (Tri-Mix)	Stainless Steel Low Alloy Steels

Table 4
Welding Process Adjustments

Change Required	Welding Variable	Arc Voltage	Welding Current (See footnote)	Travel Speed	Nozzle Angle	Stick-Out or Tip-To-Work Distance	Wire Size	Gas Type
Deeper Penetration			[1]Increase		[3]Trailing Max. 25	[2]Decrease	[5]Smaller*	[4]CO_2
Shallower Penetration			[1]Decrease		[3]Leading	[2]Increase	[5]Larger*	[4]$AR+CO_2$
Bead Height and Bead Width	Larger Bead		[1]Increase	[2]Decrease		[3]Increase*		
	Smaller Bead		[1]Decrease	[2]Increase		[3]Decrease*		
	Higher Narrower Bead	[1]Decrease			[2]Trailing	[3]Increase		
	Flatter Wider Bead	[1]Increase			[2]90 or Leading	[3]Decrease		
Faster Deposition Rate			[1]Increase			[2]Increase*	[3]Smaller	
Slower Deposition Rate			[1]Decrease			[2]Decrease*	[3]Larger	

KEY: (1) First Choice, (2) Second Choice, (3) Third Choice, (4) Fourth Choice, (5) Fifth Choice

NOTE: Same adjustment is required for wire feed speed.

* When these variables are changed, the wire feed speed must be adjusted so the welding current remains constant. See deposition rate of welding variables section. This change is especially helpful on materials 20 gage and smaller in thickness.

CLEANING OF THE UNIT

Periodically remove a side panel of the cabinet, and blow out the interior. Use clean, dry, compressed air of not more than 25 psi (172 kPa) pressure. Do not strike any of the components with the air hose nozzle.

CLEANING OF THE DRIVE ROLLS

Clean the groove on the drive roll frequently. This cleaning operation can be done by using a small wire brush. To clean the wire groove, loosen the wing nut (refer to Figure 5) and lift the drive roll pressure arm. Remove all wire from the feedhead. Wipe off the top bearing roll.

FEEDHEAD MAINTENANCE

The only point of maintenance in the feedhead assembly is the motor brushes. Inspect these about every 300 hours of operation. When the brushes are worn to about 1/8 inch (3.2 mm), new brushes should be installed. (Refer to the Drawings & Parts Lists Chapter for brush part numbers.)

CAUTION

Neglect in brush maintenance may cause damage to commutator in the motor if allowed to wear away completely.

TROUBLESHOOTING

The following chart contains information which can be used to diagnose and correct unsatisfactory operation or failure of the various components of the wire feeder. Each sympton of trouble is followed by a list of probable causes and the procedure necessary to correct the problem.

Table 5, TROUBLESHOOTING GUIDE

TROUBLE	POSSIBLE CAUSE	REMEDY
Wire does not feed, open-circuit voltage is normal.	Feeder switch not on, or defective.	Check and correct.
	Feeder fuse or motor fuse open.	Check and replace.
	Work lead disconnected.	Check and connect.
	Cables from Power Sources improperly connected.	Check and connect.
	Defective gun switch.	Check for proper operation.
	Feed rolls not tight.	Tighten rolls
	Defective feeder PC Board	Replace.
Erratic weld output	Ground clamp loose at work connection.	Check ground clamp and secure.
	Dirty gun liner.	Check and replace if necessary.
	Incorrect voltage/current and feeder settings.	Readjust as necessary.
	Improper wire for gasless welding.	Change to proper wire.
Wire feed motor operates, but wire does not feed.	Too little pressure on wire feed roll.	Increase pressure adjustment.
	Incorrect wire groove.	Check wire size stamped on outside of feed roll. Match to wire size. See Figure 6.
	Wire spool tension too great.	Loosen adjusting screw.
	Restriction in gun or cable assembly.	Examine cable, gun, and current contact tube (tip) for damage and correct size. Make sure correct contact tube and liner is being used.

Welding current or voltage not stable.	Wire slipping in rolls. Restriction in gun or cable assembly. Wrong size liner or contact tube. Incorrect voltage adjustment for selected wire speed on the welding machine. Loose connection on the welding leads or work table.	Readjust pressure on drive roll pressure arm. See Welding Gun Operations Manual. Match liner and contact tube to electrode wire size. Readjust. See Welding Process Adjustments Table 4. Check and tighten all connections.
Wire wraps around the drive roll.	Too much feed roll pressure. Incorrect liner or contact tube.	Decrease pressure adjustment on the drive roll pressure arm. Make sure that liner and/or contact tube is correct for the size of wire being fed.
No speed control.	Broken or loose wires in wire feed control circuit. Faulty PC Board Faulty wire feed speed control potentiomenter.	Correct by checking all connections. Replace. Replace.
Welding wire feeds, but no arc can be established.	Loose or broken wires to contactor or contactor driver board. Defective contactor contacts. Defective contactor coil. Faulty contactor driver board.	Check wires and connections. Replace contacts. Replace contactor. Replace.
Welding wire feeds, but no gas flow.	Gas solenoid valve failed. Loose or broken wires to gas valve solenoid. Gas tank valve not open or flowmeter not adjusted. Empty gas tank. Restricted gas line. Faulty contactor driver board. Wrong voltage gas valve.	Replace. Check all connections. Check valve and flowmeter. Replace. Check gas hose between flowmeter and wire feeder, and gas hose in gun and cable assembly. Replace. Replace with correct gas valve.

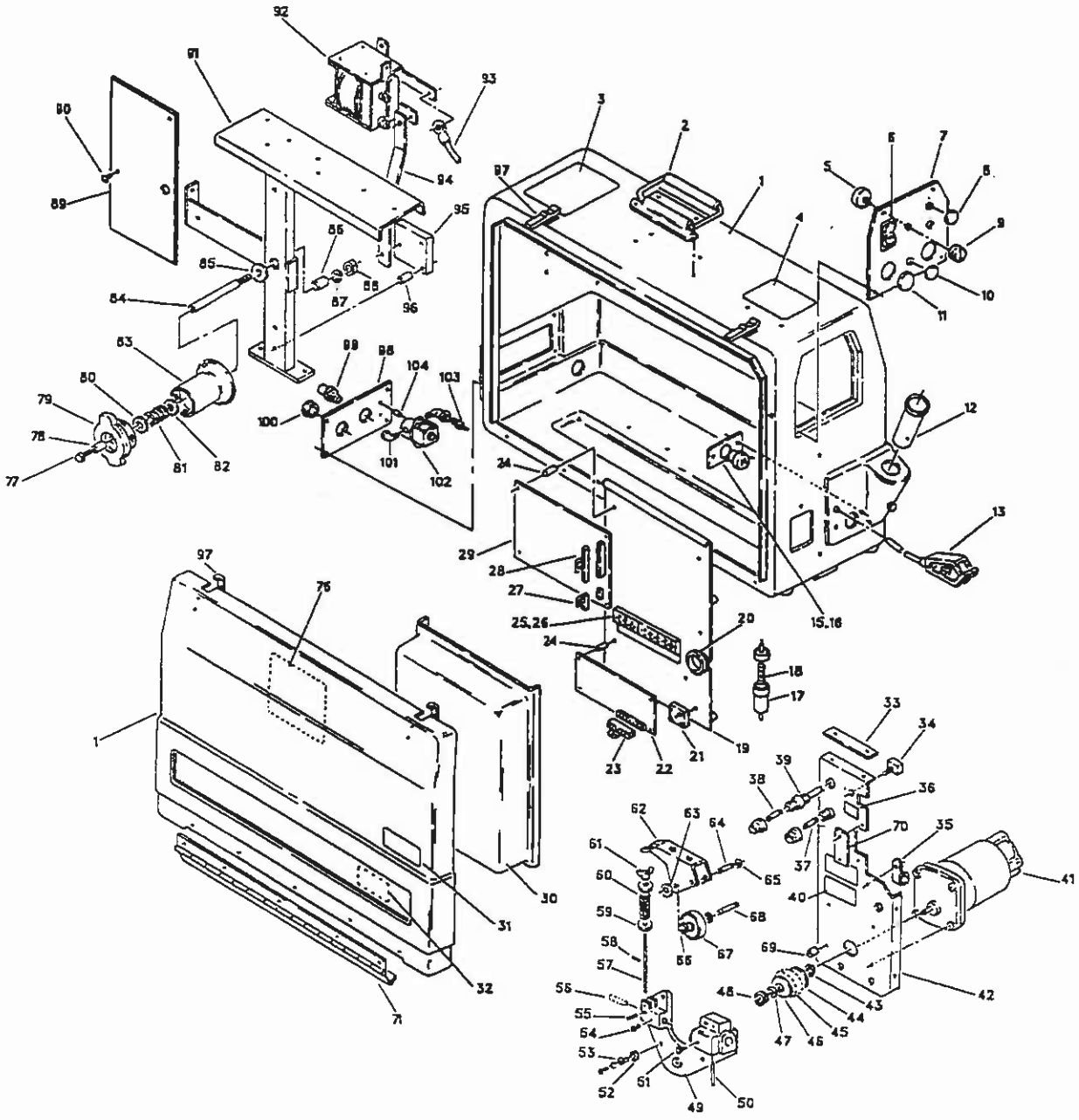

Figure 16, Case