SVM 3045
Rev.00 05-2014

PF40

For use with machines having code number: 50265

SERVICE MANUAL

LINCOLN ELECTRIC EUROPE
www.lincolnelectric.eu

INDEX OF CONTENTS

TECHNICAL SPECIFICATIONS AND ACCESSORIES

NAME			INDEX
PF40			K14106-1
INPUT			
Input Voltage U_1	Input Amperes I_1		EMC Class
40Vdc	4A		A
RATED OUTPUT			
Duty Cycle 40°C (based on a 10 min. period)			Output Current
100%			385A
60%			500A
OUTPUT RANGE			
Welding Current Range			Peak Open Circuit Voltage
5 ÷ 500A			113Vdc or Vac peak
DIMENSION			
Weight	Height	Width	Length
17 kg	460 mm	300 mm	640 mm

WIRE FEED SPEED RANGE / WIRE DIAMETER					
WFS RANGE	Drive roll	Drive roll diameter	Solid wires	Aluminum wires	Cored wires
1 ÷ 22 m/min	4	Ø37	0.8 ÷ 1.6 mm	1.0 ÷ 1.6 mm	0.9 ÷ 1.6 mm

Protection Rating	Maximum gas pressure	Operating Temperature	Storage Temperature
IP23	0,5MPa (5 bar)	from -10°C to +40°C	from -25°C to 55°C

Accessories

K14120-1	KIT - Remote control Kit for PF 40 and 42.
K14126-1	RC 42 - remote control for PF 40 and 42
K14127-1	Cart for PF40/42/44/46.
K14111-1	KIT - Gas Flow Regulator.
K14121-1	Replaceable Front Panel with User Interface, A+.
K14122-1	Replaceable Front Panel with User Interface, B.
K14123-1	Replaceable Front Panel with User Interface, B+.
K14124-1	Case of remote control (PENDANT).
K14132-1	5-PIN/12-PIN adapter.
K14131-1	ArcLink® "T" Connector Kit.
K14128-1	KIT – Lifting Eye.
K14042-1	Adapter for spool type S200.
K10158-1	Adapter for spool type B300.
K363P	Adapter for spool type Readi-Reel®.
K10349-PG-xxM	Source/wire feeder cable (gas). Available in 5, 10 or 15m (Speedtec, Power Wave S350, S500 CE).
K10349-PGW-xxM	Source/wire feeder cable (gas and water). Available in 5, 10 or 15m. (Speedtec, Power Wave S350, S500 CE).
K10348-PG-xxM	Source/wire feeder cable (gas). Available in 5, 10 or 15m (Power Wave 455M, Power Wave 455M/STT, Power Wave 405M).
K10348-PGW-xxM	Source/wire feeder cable (gas and water). Available in 5, 10 or 15m (Power Wave 455M, Power Wave 455M/STT, Power Wave 405M).

Drive rolls to 4 driven rolls	
	Solid wires:
KP14017-0.8	V0.6 / V0.8
KP14017-1.0	V0.8 / V1.0
KP14017-1.2	V1.0 / V1.2
KP14017-1.6	V1.2 / V1.6
	Aluminum wires:
KP14017-1.2A	U1.0 / U1.2
KP14017-1.6A	U1.2 / U1.6
	Cored wires:
KP14017-1.1R	VK0.9 / VK1.1
KP14017-1.6R	VK1.2 / VK1.6

LINC GUN™	
K10413-36	Gas cooled gun LG 360 G (335A 60%) – 3m, 4m, 5m.
K10413-42	Gas cooled gun LG 420 G (380A 60%) – 3m, 4m, 5m.
K10413-410	Water cooled gun LG 410 W (350A 100%) - 3m, 4m, 5m.
K10413-500	Water cooled gun LG 500 W (450A 100%) - 3m, 4m, 5m.

SAFETY

WARNING

This equipment must be used by qualified personnel. Be sure that all installation, operation, maintenance and repair procedures are performed only by qualified person. Read and understand this manual before operating this equipment. Failure to follow the instructions in this manual could cause serious personal injury, loss of life, or damage to this equipment. Read and understand the following explanations of the warning symbols. Lincoln Electric is not responsible for damages caused by improper installation, improper care or abnormal operation.

	WARNING: This symbol indicates that instructions must be followed to avoid serious personal injury, loss of life, or damage to this equipment. Protect yourself and others from possible serious injury or death.
	READ AND UNDERSTAND INSTRUCTIONS: Read and understand this manual before operating this equipment. Arc welding can be hazardous. Failure to follow the instructions in this manual could cause serious personal injury, loss of life, or damage to this equipment.
	ELECTRIC SHOCK CAN KILL: Welding equipment generates high voltages. Do not touch the electrode, work clamp, or connected work pieces when this equipment is on. Insulate yourself from the electrode, work clamp, and connected work pieces.
	ELECTRICALLY POWERED EQUIPMENT: Turn off input power using the disconnect switch at the fuse box before working on this equipment. Ground this equipment in accordance with local electrical regulations.
	ELECTRICALLY POWERED EQUIPMENT: Regularly inspect the input, electrode, and work clamp cables. If any insulation damage exists replace the cable immediately. Do not place the electrode holder directly on the welding table or any other surface in contact with the work clamp to avoid the risk of accidental arc ignition.
	ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS: Electric current flowing through any conductor creates electric and magnetic fields (EMF). EMF fields may interfere with some pacemakers, and welders having a pacemaker shall consult their physician before operating this equipment.
	CE COMPLIANCE: This equipment complies with the European Community Directives.
	ARTIFICIAL OPTICAL RADIATION: According with the requirements in 2006/25/EC Directive and EN 12198 Standard, the equipment is a category 2. It makes mandatory the adoption of Personal Protective Equipments (PPE) having filter with a protection degree up to a maximum of 15, as required by EN169 Standard.
	FUMES AND GASES CAN BE DANGEROUS: Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. To avoid these dangers the operator must use enough ventilation or exhaust to keep fumes and gases away from the breathing zone.
	ARC RAYS CAN BURN: Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing. Use suitable clothing made from durable flame-resistant material to protect you skin and that of your helpers. Protect other nearby personnel with suitable, non-flammable screening and warn them not to watch the arc nor expose themselves to the arc.
	WELDING SPARKS CAN CAUSE FIRE OR EXPLOSION: Remove fire hazards from the welding area and have a fire extinguisher readily available. Welding sparks and hot materials from the welding process can easily go through small cracks and openings to adjacent areas. Do not weld on any tanks, drums, containers, or material until the proper steps have been taken to insure that no flammable or toxic vapors will be present. Never operate this equipment when flammable gases, vapors or liquid combustibles are present.
	WELDED MATERIALS CAN BURN: Welding generates a large amount of heat. Hot surfaces and materials in work area can cause serious burns. Use gloves and pliers when touching or moving materials in the work area.
	SAFETY MARK: This equipment is suitable for supplying power for welding operations carried out in an environment with increased hazard of electric shock.

	CYLINDER MAY EXPLODE IF DAMAGED: Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. Always keep cylinders in an upright position securely chained to a fixed support. Do not move or transport gas cylinders with the protection cap removed. Do not allow the electrode, electrode holder, work clamp or any other electrically live part to touch a gas cylinder. Gas cylinders must be located away from areas where they may be subjected to physical damage or the welding process including sparks and heat sources.
	MOVING PARTS ARE DANGEROUS: There are moving mechanical parts in this machine, which can cause serious injury. Keep your hands, body and clothing away from those parts during machine starting, operating and servicing.

The manufacturer reserves the right to make changes and/or improvements in design without upgrade at the same time the operator's manual**.**

Introduction

PF40 is digital wire feeder which has been designed to work with all Lincoln Electric power sources using ArcLink® protocol to communication.
Digital wire feeder allows the welding:
GMAW (MIG/MAG) – non-synergic process only.

Recommended equipment, which can be bought by user, was mentioned in the chapter "Accessories".

Installation and Operator Instructions

Read this entire section before installation or operation of the machine.

Location and Environment

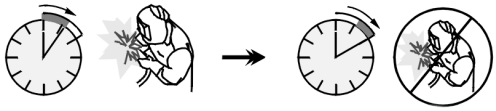
This machine will operate in harsh environments. However, it is important that simple preventative measures are followed to assure long life and reliable operation.

- Do not place or operate this machine on a surface with an incline greater than 15° from horizontal.
- Do not use this machine for pipe thawing.
- This machine must be located where there is free circulation of clean air without restrictions for air movement.
- Dirt and dust that can be drawn into the machine should be kept to a minimum.
- This machine has a protection rating of IP23. Keep it dry when possible and do not place it on wet ground or in puddles.
- Locate the machine away from radio controlled machinery. Normal operation may adversely affect the operation of nearby radio controlled machinery, which may result in injury or equipment damage. Read the section on electromagnetic compatibility in this manual.
- Do not operate in areas with an ambient temperature greater than 40°C.

Duty cycle and Overheating

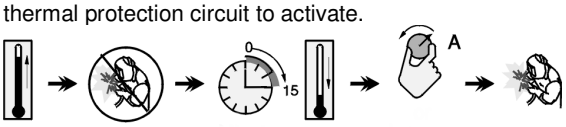
The duty cycle of a welding machine is the percentage of time in a 10 minute cycle at which the welder can operate the machine at rated welding current.

Example: 60% duty cycle



Welding for 6 minutes. Break for 4 minutes.

Excessive extension of the duty cycle will cause the thermal protection circuit to activate.



Minutes or decrease Duty Cycle

Input Supply Connection

Check the input voltage, phase, and frequency of the power source that will be connected to this wire feeder. The allowable input voltage source is indicated on the rating plate of the wire feeder. Verify the connection of grounding wires from the power source to the input source.

Controls and Operational Features

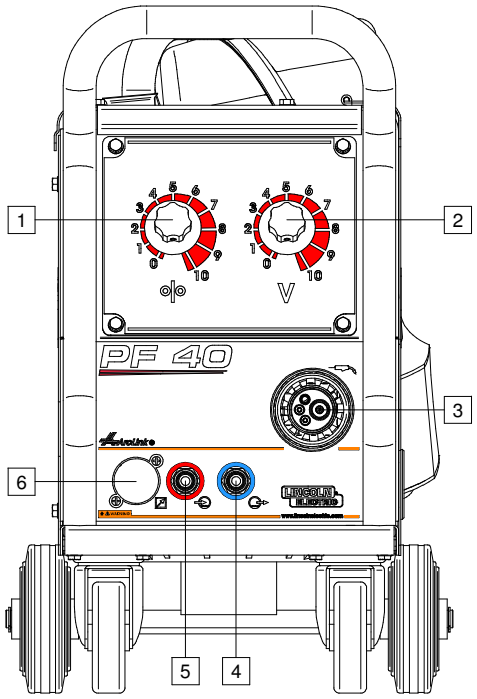


Figure 1

1. Wire Feed Speed Control (WFS): Value in percentage of nominal value wire feed speed (also during welding).
2. Welding Load Voltage Control: The welding load voltage and set by this control (also during welding).
3. EURO Socket: For connecting a welding gun (for GMAW, FCAW-GS, FCAW-SS).
4. Quick Connect Coupling: Coolant outlet (supplies cool coolant to the gun).
5. Quick Connect Coupling: Coolant inlet (takes warm coolant from the gun).

WARNING

Maximum coolant pressure is 5 bar.

6. Remote Control Connector Plug (optional): To install Remote Control Kit. It can be purchased separately. See "Accessories" chapter.

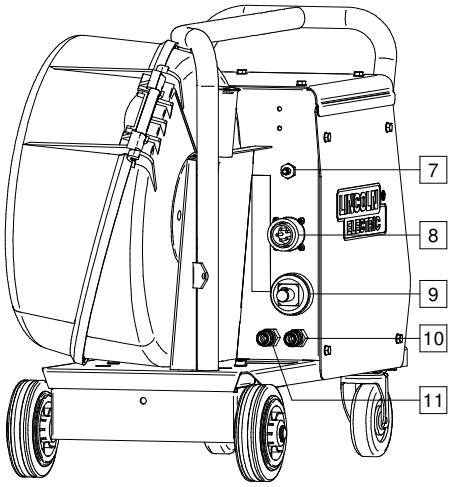


Figure 2.

7. Gas Connector: Connection for gas line.

WARNING

The welding machine supports all suitable shielding gases at a maximum pressure of 5,0 bar.

8. Control Receptacle: 5 pins receptacle for wire feeder connection (ArcLink® protocol).
9. Current Socket: Input power connection.
10. Quick Connect Coupling: Coolant outlet (takes warm coolant from welding machines to cooler.)
11. Quick Connect Coupling: Coolant inlet (supplies cool coolant from cooler to the welding machines).

WARNING

Maximum coolant pressure is 5 bar.

To ensure failure-free work and right flow of coolant , use only coolant that is recommended by the manufacturer of welding gun or cooler.

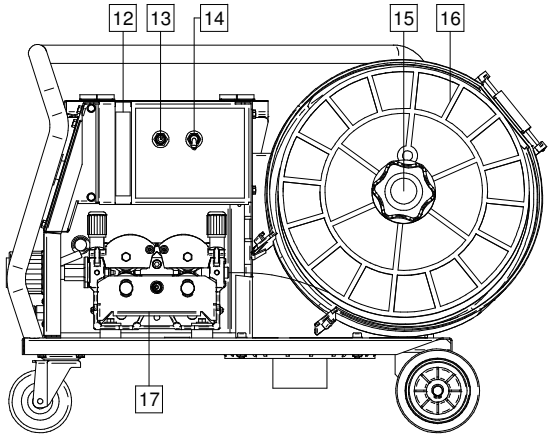
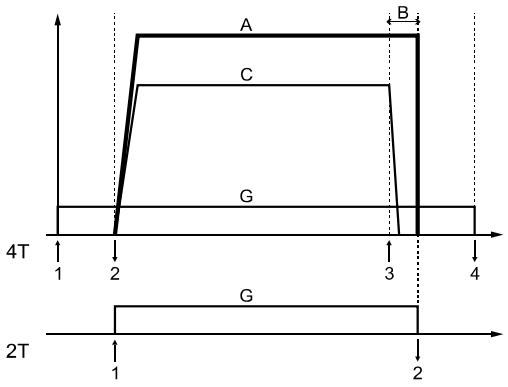


Figure 3.

12. Gas Flow Regulator Plug: Gas Flow Regulator can be purchased separately. See "Accessories" chapter.

13. Cold Inch / Gas Purge Switch: This switch enables wire feeding or gas flow without turning on output voltage.

14. Gun Mode Switch: It enables selection of 2-step or 4-step gun mode. The functionality of 2T/4T mode is shown in the Figure 4.



↑	Trigger pressed
↓	Trigger released
A	Welding current
B	Burnback time (fixed)
C	WFS
G	Gas

Figure 4.

15. Wire Spool Support: Maximum 15kg spools. Accepts plastic, steel and fiber spools onto 51mm spindle. Also accepts Readi-Reel® type spools onto included spindle adapter.

⚠ WARNING

Be sure that wire spool case has to be completely closed during welding.

16. Spooled Wire: The machine does not include a spooled wire.

17. Wire Drive: 4-Roll wire drive.

⚠ WARNING

The wire drive door and wire spool case have to be completely closed during welding.

⚠ WARNING

Not use handle to move the machine during work. See "Accessories" chapter.

Wire Spool Loading

Wire spool type S300 and BS300 can be installed on the wire spool support without adapter.
Wire spool type S200, B300 or Readi-Reel® can be installed, but the applicable adapter must be purchased. The applicable adapter can be purchased separately(see "Accessories" chapter).

Wire Spool Type S300 & BS300 Loading

⚠ WARNING

Turn the input power OFF at the welding power source before installation or changing a wire spool.

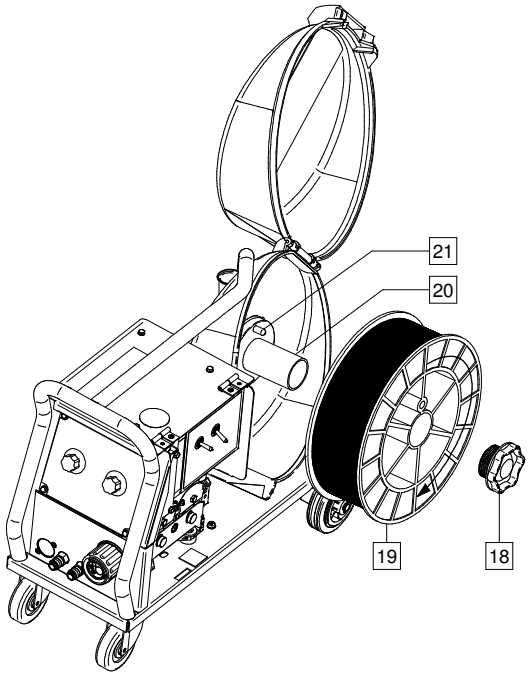


Figure 5.

- Turn the input power OFF.
- Open the spool wire case.
- Unscrew the Locking Nut [18] and remove it from the Spindle [20].
- Place the spool type S300 or BS300 [19] on the Spindle [20] making certain the Spindle Brake Pin [21] is put in the hole in back side of spool type S300 or SB300.

⚠ WARNING

Position the spool type S300 or SB300 so that it will rotate in a direction when feeding so as to be de-reeled from bottom of the spool.

- Re-install the locking nut [18]. Make sure that the locking nut is tightened.

Wire Spool Type S200 Loading

⚠ WARNING

Turn the input power OFF at the welding power source before installation or changing a wire spool.

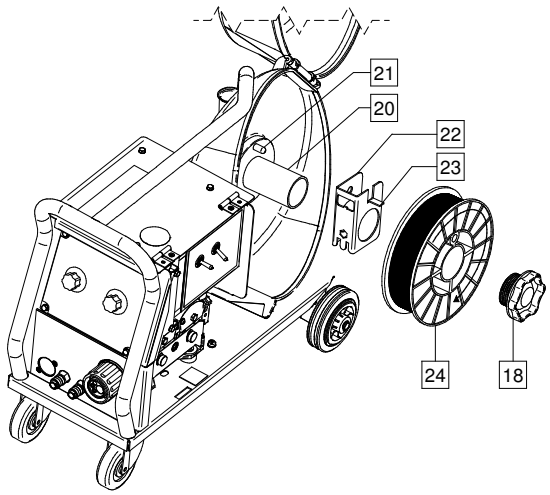


Figure 6.

- Turn the input power OFF.
- Open the spool wire case.
- Unscrew the Locking Nut [18] and remove it from the Spindle [20].
- Place the adapter of spool type S200 [22] on the spindle [20] making certain the spindle brake pin [21] is put in the hole in back side of the adapter [22]. The adapter of spool type S200 can be purchased separately (see "Accessories" chapter).
- Place the spool type S200 [24] on the spindle [20] making certain that the adapter brake pin [23] is put in the hole in the back side of the spool.

⚠ WARNING

Position the spool type S200 so that it will rotate in a direction when feeding so as to be de-reeled from bottom of the spool.

- Re-install the locking nut [18]. Make sure that the locking nut is tightened.

Wire Spool Type B300 Loading

⚠ WARNING

Turn the input power OFF at the welding power source before installation or changing a wire spool.

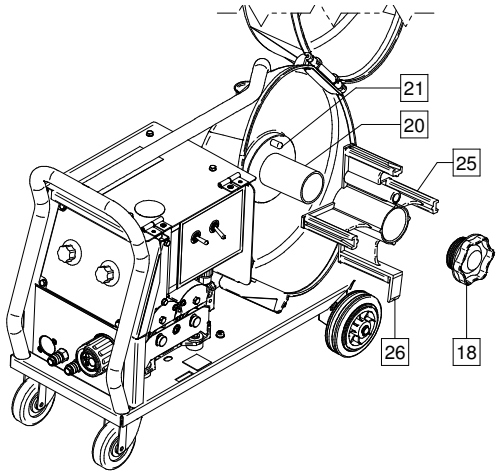


Figure 7.

- Turn the input power OFF.
- Open the spool wire case.
- Unscrew the Locking Nut [18] and remove it from the spindle [20].
- Place the adapter of spool type B300 [25] on the spindle [20].Make certain that the spindle brake pin [21] is put in the hole in the back side of the adapter. The adapter of spool type B300 can be purchased separately (see "Accessories" chapter).
- Re-install the locking nut [18]. Make sure that the locking nut is tightened.

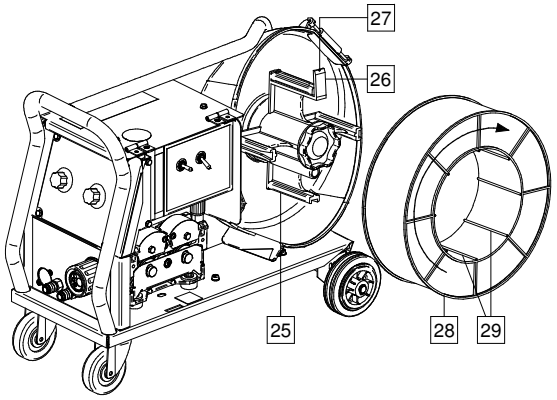


Figure 8.

- Rotate the spindle and adapter so the retaining spring [26] is at the 12 o'clock position.
- Place the spool type B300 [28] on the adapter [25]. Set one of the B300 inside cage wires [29] on the slot [27] in the retaining spring tab [26] and slide the spool onto the adapter.

⚠ WARNING

Position the spool type B300 so that it will rotate in a direction when feeding so as to be de-reeled from bottom of the spool.

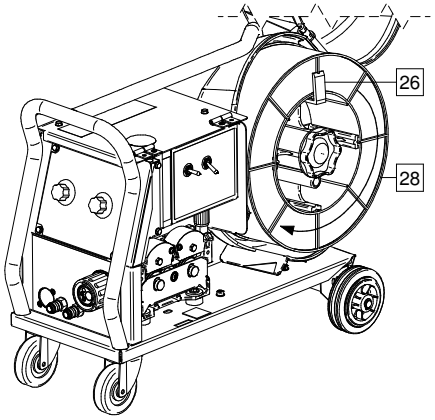


Figure 9.

Wire Spool Type Readi-Reel® Loading

⚠ WARNING

Turn the input power OFF at the welding power source before installation or changing a wire spool.

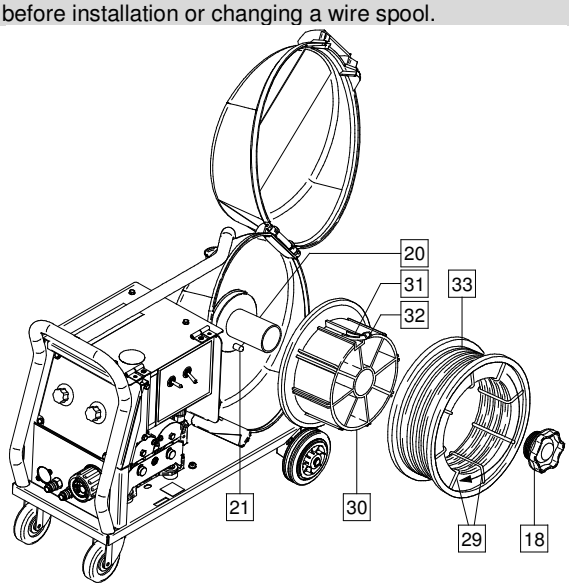


Figure 10.

- Turn the input power OFF.
- Open the spool wire case.
- Unscrew the locking nut [18] and remove it from the spindle [20].
- Place the adapter of spool type Readi-Reel® [30] on the spindle [20].Make certain that the spindle brake pin [21] is put in the hole in the back side of the adapter [30]. The adapter of spool type Readi-Reel® can be purchased separately (see "Accessories" chapter).
- Re-install the locking nut [18]. Make sure that the locking nut is tightened.
- Rotate the spindle and adapter so the retaining spring [31] is at the 12 o'clock position.
- Place the spool type Readi-Reel® [33] on the adapter [30]. Set one of the Readi-Reel® inside cage wires [29] on the slot [32] in the retaining spring tab [31].

⚠ WARNING

Position the spool type Readi-Reel® so that it will rotate in a direction when feeding so as to be de-reeled from bottom of the spool.

Loading the Electrode Wire

- Turn the input power OFF.
- Open the spool wire case.
- Unscrew the locking nut of the sleeve.
- Load the spooled wire on the sleeve such that the spool turns clockwise when the wire is fed into the wire feeder.
- Make sure that the spindle brake pin [21] goes into the fitting hole on the spool.
- Screw in the locking nut of the sleeve.
- Open the wire drive door.
- Put on the wire roll using the correct groove corresponding to the wire diameter.
- Free the end of the wire and cut off the bent end making sure it has no burr.

⚠ WARNING

Sharp end of the wire can hurt.

- Rotate the wire spool clockwise and thread the end of the wire into the wire feeder as far as the Euro Socket.
- Adjust force of pressure roll of the wire feeder properly.

Adjustments of Brake Torque of Sleeve

To avoid spontaneous unrolling of the welding wire the sleeve is fitted with a brake.
Adjustment is carried by rotation of its screw M10, which is placed inside of the sleeve frame after unscrewing the locking nut of the sleeve.

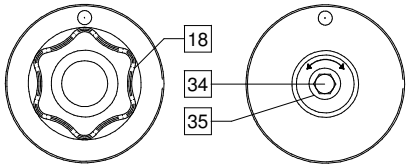


Figure 11.

18. Locking Nut.
34. Adjusting Screw M10.
35. Pressing Spring.

Turning the screw M10 clockwise increases the spring tension and you can increase the brake torque

Turning the screw M10 anticlockwise decreases the spring tension and you can decrease the brake torque.

After finishing of adjustment, you should screw in the locking nut again.

Adjusting Pressure Roll Force

The pressure arm controls the amount of force the drive rolls exert on the wire.
Pressure force is adjusted by turning the adjustment nut clockwise to increase force, counterclockwise to decrease force. Proper adjustment of pressure arm gives the best welding performance.

⚠ WARNING

If the roll pressure is too low the roll will slide on the wire. If the roll pressure is set too high the wire may be deformed, which will cause feeding problems in the welding gun. The pressure force should be set properly. Decrease the pressure force slowly until the wire just begins to slide on the drive roll and then increase the force slightly by turning of the adjustment nut by one turn.

Inserting Electrode Wire into Welding Gun

- Turn the input power OFF.
- Depending on welding process, connect the proper gun to the Euro Socket, the rated parameters of the gun and of the welding machine should be matched.
- Remote the nozzle from the gun and contact tip or protection cap and contact tip. Next, straighten the gun out flat.
- Insert the wire through the guide tube, over the roller and through the guide tube of Euro Socket into liner of gun. The wire can be pushed into the liner manually for a few centimetres, and should feed easily and without any force.

⚠ WARNING

If force is required it is likely that the wire has missed the liner of gun.

- Turn the input power ON.
- Depress the gun trigger to feed the wire through the gun liner until the wire comes out of the threaded end. Or the Cold Inch / Gas Purge Switch [13] can be used – keep in "Cold Inch" position until the wire comes out of the threaded end.
- When trigger or the Cold Inch / Gas Purge Switch [13] is released spool of wire should not unwind.
- Adjust wire spool brake accordingly.
- Turn the welding machine off.
- Install a proper contact tip.
- Depending on the welding process and the type of the gun, install the nozzle (GMAW process, FCAW-GS process) or protection cap (FCAW-SS process).

⚠ WARNING

Take precaution to keep eyes and hands away from the end of the gun while the wire is being come out of the threated end.

Changing Driving Rolls

⚠ WARNING

Turn the input power OFF at the welding power source before installation or changing drive rolls and/or guides.

PF40 is equipped with drive roll V1.0/V1.2 for steel wire.

For others wires sizes, is available the proper drive rolls kit (see "Accessories" chapter) and follow instructions:

- Turn the input power OFF.
- Release the pressure roll levers [36].
- Unscrew the fastening caps [37].
- Open the protection cover [38].
- Change the drive rolls [39] with the compatible ones corresponding to the used wire.

⚠ WARNING

Be sure that the gun liner and contact tip are also sized to match the selected wire size.

⚠ WARNING

For wires with the diameter larger than 1.6mm, the following parts are to be changed:

- The guide tube of the feeding console [40] and [41].
- The guide tube of the Euro Socket [42].

- Replace and tighten the protection cover [38] to the drive rolls.
- Screw fastening caps [37].
- Manually feed the wire from the wire reel, the wire through the guide tubes, over the roller and guide tube of Euro Socket into liner of gun.
- Lock the pressure roll levers [36].

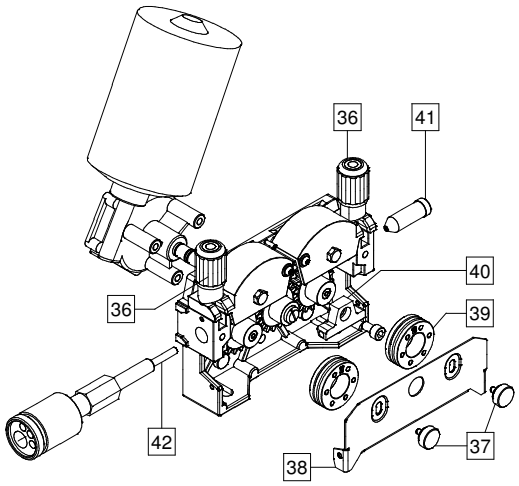


Figure 12.

Gas Connection

⚠ WARNING

- CYLINDER may explode if damaged.
- Always fix the gas cylinder securely in an upright position, against a cylinder wall rack or purpose-made cylinder cart.
- Keep cylinder away from areas where it may be damaged, heated, or electrical circuits to prevent possible explosion or fire.
- Keep cylinder away from welding or other live electrical circuits.
- Never lift welder with cylinder attached.
- Never allow welding electrode to touch cylinder.
- Build up of shielding gas may harm health or kill. Use in a well-ventilated area to avoid gas accumulation.
- Close the gas cylinder valves thoroughly when not in use to avoid leaks.

⚠ WARNING

The welding machine supports all suitable shielding gases at a maximum pressure of 5,0 bar.

⚠ WARNING

Before use, make sure that the gas cylinder contains gas suitable for the intended purpose.

- Turn off input power at the welding power source.
- Install a proper gas flow regulator to the gas cylinder.
- Connect the gas hose to the regulator using the hose clamp.
- The other end of gas hose connect to the Gas Connector [7] located on the rear panel of the machine.
- Turn on input power at the welding power source.
- Turn to open the gas cylinder valve.
- Adjust the shielding gas flow of the gas regulator.
- Check gas flow with Gas Purge Switch [13].

⚠ WARNING

To weld GMAW process with CO_2 shielding gas, CO_2 gas heater should be used.

Welding GMAW, FCAW-GS and FCAW-SS Process

PF40 can be used to welding GMAW process.
PF40 does not include the gun necessary for GMAW welding. Depending on the welding process can be purchased separately (see "Accessories" chapter).

Preparation the Machine for Welding GMAW, FCAW-GS and FCAW-SS Process.

Procedure of begin welding of GMAW or FCAW-SS process:

- Connect Lincoln Electric power sources using ArcLink® protocol to communication to **PF40.**
- Turn on input power at the welding power source and wait until a power source will be communicated with **PF40**.
- Turn off input power at the welding power source.
- Place the machine conveniently near the work area in a location to minimize exposure to weld spatter and to avoid sharp bends in the gun cable.
- Determine the wire polarity for the wire to be used. Consult the wire data for this information.
- Connect output the gun to GMAW process to Euro Socket [3].
- Connect the work lead to the proper output socket the power source.
- Connect the work lead to the welding piece with the work clamp.
- Install the proper wire.
- Install the proper drive roll.
- Manually push the wire into the gun's liner.
- Make a sure that the gas shield has been connected.
- Turn on input power at the welding power source.
- Insert the wire into the welding gun.

⚠ WARNING

Keep the gun cable as straight as possible when loading electrode through cable.

⚠ WARNING

Never use defected gun.

- Check gas flow with Gas Purge Switch [13]
- Close the wire drive door.
- Close the spool wire case.
- The welding machine is now ready to weld.

⚠ WARNING

The wire drive door and wire spool case have to be completely closed during welding.

⚠ WARNING

Keep the gun cable as straight as possible when welding or loading electrode through cable.

⚠ WARNING

Do not kink or pull cable around sharp corners.

- By applying the principle of occupational health and safety at welding, welding can be begun.

Electromagnetic Compatibility (EMC)

01/11

This machine has been designed in accordance with all relevant directives and standards. However, it may still generate electromagnetic disturbances that can affect other systems like telecommunications (telephone, radio, and television) or other safety systems. These disturbances can cause safety problems in the affected systems. Read and understand this section to eliminate or reduce the amount of electromagnetic disturbance generated by this machine.

This machine has been designed to operate in an industrial area. To operate in a domestic area it is necessary to observe particular precautions to eliminate possible electromagnetic disturbances. The operator must install and operate this equipment as described in this manual. If any electromagnetic disturbances are detected the operator must put in place corrective actions to eliminate these disturbances with, if necessary, assistance from Lincoln Electric.

Before installing the machine, the operator must check the work area for any devices that may malfunction because of electromagnetic disturbances. Consider the following.

- Input and output cables, control cables, and telephone cables that are in or adjacent to the work area and the machine.
- Radio and/or television transmitters and receivers. Computers or computer controlled equipment.
- Safety and control equipment for industrial processes. Equipment for calibration and measurement.
- Personal medical devices like pacemakers and hearing aids.
- Check the electromagnetic immunity for equipment operating in or near the work area. The operator must be sure that all equipment in the area is compatible. This may require additional protection measures.
- The dimensions of the work area to consider will depend on the construction of the area and other activities that are taking place.

Consider the following guidelines to reduce electromagnetic emissions from the machine.

- Connect the machine to the input supply according to this manual. If disturbances occur if may be necessary to take additional precautions such as filtering the input supply.
- The output cables should be kept as short as possible and should be positioned together. If possible connect the work piece to ground in order to reduce the electromagnetic emissions. The operator must check that connecting the work piece to ground does not cause problems or unsafe operating conditions for personnel and equipment.
- Shielding of cables in the work area can reduce electromagnetic emissions. This may be necessary for special applications.

⚠ WARNING

EMC classification of this product is class A in accordance with electromagnetic compatibility standard EN 60974-10 and therefore the product is designed to be used in an industrial environment only.

⚠ WARNING

The Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated disturbances.

MAINTENANCE

⚠ WARNING

For any repair operations, modifications or maintenance, it is recommended to contact the nearest Technical Service Center or Lincoln Electric. Repairs and modifications performed by unauthorized service or personnel will cause the manufacturer's warranty to become null and void.

Any noticeable damage should be reported immediately and repaired.

Routine maintenance (everyday)

- Check condition of insulation and connections of the work leads and insulation of power lead. If any insulation damage exists replace the lead immediately.
- Remove the spatters from the welding gun nozzle. Spatters could interfere with the shielding gas flow to the arc.
- Check the welding gun condition: replace it, if necessary.
- Check condition and operation of the cooling fan. Keep clean its airflow slots.

Periodic maintenance (every 200 working hours but at least once a year)

Perform the routine maintenance and, in addition:

- Keep the machine clean. Using a dry (and low pressure) airflow, remove the dust from the external case and from the cabinet inside.
- If it is required, clean and tighten all weld terminals.

The frequency of the maintenance operations may vary in accordance with the working environment where the machine is placed.

⚠ WARNING

Do not touch electrically live parts.

⚠ WARNING

Before the case of machine will be removed, the machine has to be turned off and the power lead has to be disconnected from mains socket.

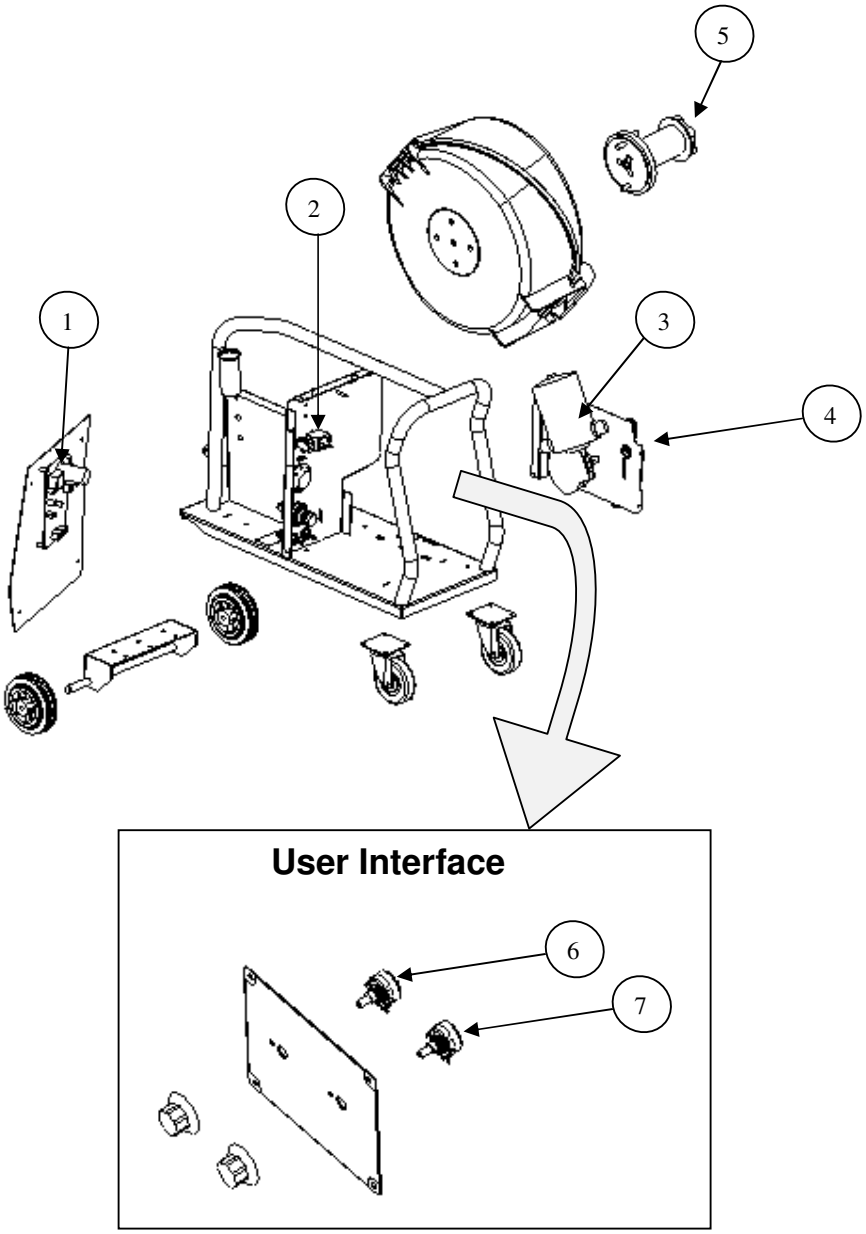
⚠ WARNING

Mains supply network must be disconnected from the machine before each maintenance and service. After each repair, perform proper tests to ensure safety.

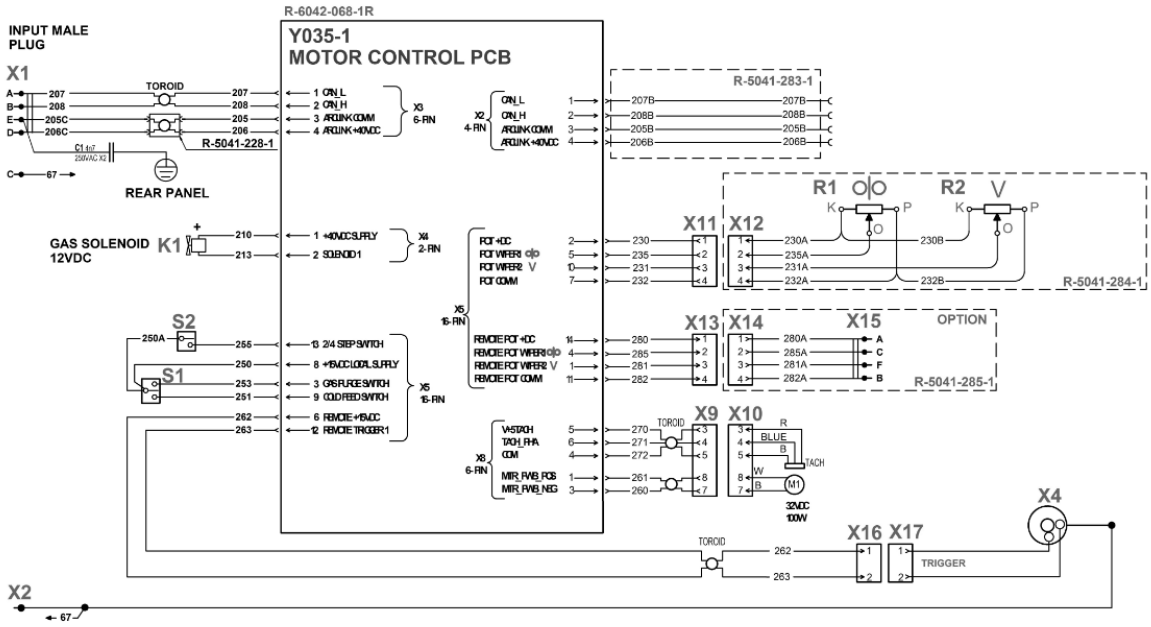
MAJOR COMPONENTS LOCATION

PF40

1. Motor Board
2. Gas Solenoid
3. Motor
4. Wire Drive
5. Reel Hub
6. WFS potentiometer (R1)
7. Voltage potentiometer (R2)



PF40 - SCHEMATIC DIAGRAM



GENERAL DESCRIPTION

The PF40 is a basic function four rolls, digitally controlled, wire feeder that operates on 40 VDC input power. PF40 supports only mode „5", and it has limited functions: only 2/4 stroke, gas purge, cold inch. Most starting parameters are fixed and included in the welding software.
Network communications, PC board input power, and arc voltage feedback is received and transmitted through the input male plug X1.

MOTOR CONTROL BOARD

The motor control board processes the information it receives from the various user operated switches and potentiometers, like the gun trigger, 2-step/4-step, cold inch, gas purge, WFS, Voltage and sends the signals to energize the active components such as the solenoid and wire drive motor.
The tach feedback signal is also processed by this board which regulates the motor supply voltage to maintain the required wire feed speed.

TROUBLESHOOTING AND REPAIR SECTION

- How to use troubleshooting Guide
- Troubleshooting Guide
- Motor Control Board test
- Gas Solenoid test
- Wire Drive Motor test
- Wire Drive Motor Tachimeter test

HOW TO USE TROUBLESHOOTING GUIDE

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

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

Step 1. LOCATE PROBLEM (SYMPTOM). Look under the column labeled “PROBLEMS”. This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into three main categories: Output Problems, Function Problems, and LED Function Problems.

Step 2. PERFORM EXTERNAL TESTS. The second column, labeled “CHECKS”, lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. PERFORM COMPONENT TESTS. The last column, labeled “RECOMMENDED COURSE OF ACTION ” lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

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

WARNING

ELECTRIC SHOCK can kill

- Have an electrician install and service this equipment
- Turn the input power off at the fuse box before working on equipment
- Do not touch electrically hot parts
- Prior to performing preventive maintenance, perform the following capacitor discharge procedure to avoid electric shock

---

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

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board toassure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock.
4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

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

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.
   - If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks, and terminal strips.
   - If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.
6. Always indicate that this procedure was followed when warranty reports are to be submitted.

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

TROUBLESHOOTING

!! WARNING !! **BEFORE CONNECT POWER SUPPLY, MAKE A CAREFUL VISUAL INSPECTION INSIDE THE MACHINE , CHECK ALL THE BOARDS AND HARNESS.**

PROBLEMS / SYMPTOMS	CHECKS / ERROR DESCRIPTION	RECOMMENDED COURSE OF ACTION
A VISUAL DAMAGE IS EVIDENT WHEN YOU OPEN THE COVER	----------	• REPLACE THE BROKEN PART AND PERFORM THE TESTS FOR THE OTHER MACHINE COMPONENTS
NO WIRE FEED AND SOLENOID	• MAKE SURE THAT THE PF40 RECEIVES THE 40VDC POWER SUPPLY • THE GUN TRIGGER MAY BE DEFECT	• PERFORME THE MOTOR BOARD TEST • CHECK AND REPLACE THE GUN TRIGGER IF NECESSARY
NO CONTROL OF WIRE FEED SPEED	• THE TACHIMETER MAY BE FAULTY • THE WFS POTENTIOMETER MAY BE FAULTY • THE MOTOR BOARD MAY BE FAULTY	• PERFORM THE TACHIMETER TEST • PERFORM THE WFS POTENTIOMETER TEST • PERFORM THE MOTOR BOARD TEST AND REPLACE IF DEFECT
THERE IS NO WELDING OUTPUT WHEN THE GUN TRIGGER IS PRESSED. THE WIRE FEEDS NORMALLY AND THE GAS SOLENOID IS ACTIVATED PROPERLY	• THE ARC LINK CABLES BETWEEN POWER FEED AND POWER SOURCE MAY BE DEFECT. • THE MOTOR BOARD MAY BE FAULTY • THE POWER SOURCE MAY BE DEFECT	• CHECK STATUS LED ON POWER SOURCE FOR COMMUNICATION ERROR • CHECK THE ARCLINK CABLES FOR GOOD CONTINUITY • REPLACE THE MOTOR BOARD • PERFORM THE POWER SOURCE TESTS
THE WELDING VOLTAGE IS NOT CHANGING WHILE TURNING THE VOLTAGE POTENTIOMETER	• THE VOLTAGE POTENTIOMETER MAY BE FAULTY • THE MOTOR BOARD MAY BE FAULTY • THE POWER SOURCE MAY BE DEFECT	• PERFORM THE VOLTAGE POTENTIOMETER TEST • CHECK THE POWER SOURCE WITH ANOTHER POWER FEED • PERFORM THE POWER SOURCE TEST
WITH TRIGGER PRESSED THE ROLLS DO NOT TURN BUT GAS SOLENOID IS WORKING PROPERLY	• LOOSE OR FAULTY MOTOR CONNECTION MAY BE PRESENT • THE MOTOR BOARD MAY BE FAULTY (NO POWER TO THE MOTOR)	• CHECK LEADS 261 AND 260 CONNECTIONS FROM MOTOR BOARD CONNECTOR X8 PIN 1 AND 3 TO MOTOR X10 CONNECTOR PIN 7 AND 8 • PERFORM THE MOTOR BOARD X8 CONNECTOR TEST
WFS IS ALWAYS MAXIMUM AND NO REGULATION IS POSSIBLE	• TACHIMETER MAY BE FAULTY	• PERFORME THE THACHIMETER TEST
NO WIRE FEEDING BUT THE DRIVE ROLLS ARE TURNING	• THE DRIVE ROLLS PRESSURE MAY BE NOT CORRECT • THE DRIVE ROLLS OR WIRE GUIDE MAY BE NOT CORRECTLY INSTALLED • A MECHANICAL RESCTRICTION MAY BE PRESENT INSIDE THE TORCH • THE SPOOL BRAKE TORQUE MAY BE TOO MUCH	• CHECK THE DRIVE ROLLS FOR CORRECT PRESSURE • CHECK THE DRIVE ROLLS AND WIRE GUIDE FOR CORRECT INSTALLATION • CHECK THE TORCH LINER, REPLACE IF NECESSARY • CHECK THE SPOOL BRAKE TORQUE
THE GAS SOLENOID IS NOT ACTIVATED WHEN TRIGGER IS PRESSED, BUT ROLLS ARE TURNING	• THE GAS SOLENOID MAY BE FAULTY • THE MOTOR BOARD MAY BE FAULTY (NO POWER TO THE GAS SOLENOID)	• PERFORM THE GAS SOLENOID TEST • PERFORM THE MOTOR BOARD X4 CONNECTOR TEST
THE COLD INCH/GAS PURGE SWITCH DOES NOT ENABLE THE WIRE DRIVE MOTOR BUT WIRE DRIVE MOTOR IS ACTIVATED WHEN GUN TRIGGER IS PRESSED	• A MECHANICAL DAMAGE ON THE COLD INCH/PURGE SWITCH MAY BE PRESENT • CHECK FOR LOOSE OR FAULTY LEAD CONNECTIONS BETWEEN THE COLD INCH/PURGE SWITCH AND MOTOR BOARD X5 CONNECTOR	• REPLACE THE COLD INCH/PURGE SWITCH IF NECESSARY • IF THE MECHANICAL PROBLEMS AND ALL CONNECTIONS ARE OK, THE MOTOR BOARD IS DEFECT; REPLACE IT.

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

CASE COVER REMOVAL PROCEDURE

WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.
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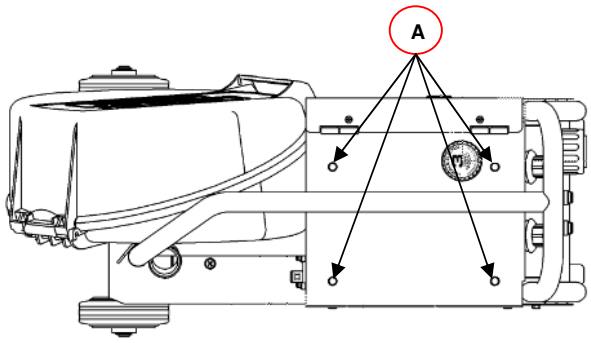
DESCRIPTION

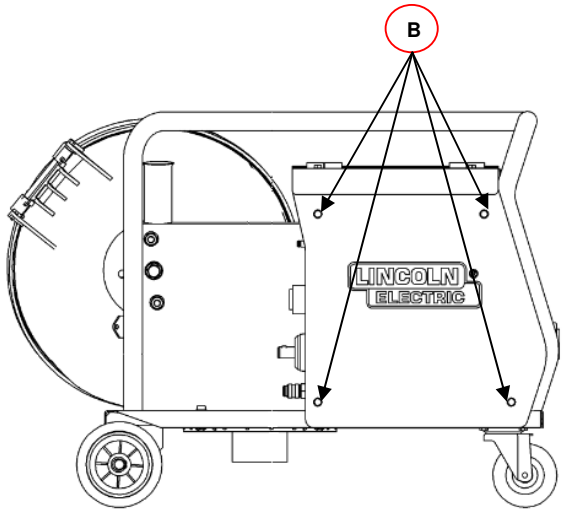
This procedure will aid the technician in the removal and replacement of the case sheet metal cover .

MATERIALS NEEDED

8 mm nut driver

PF40 - CASE COVER REMOVAL





Procedure:

1. Turn the power source ON/OFF switch to OFF position.
2. **Disconnect Input Power from the power source !**
3. Using the 8mm nut driver, remove the 4 screws (**A**) from the top of the Feeder cover.
4. Remove carefully the top cover together with the right feeder door.
5. Using the 8 mm nut driver remove the 4 screw (**B**) from the left side Feeder panel.
6. Be careful, do not pull too much the left side panel; the motor control boars is installed on the internal side of this panel.

MOTOR CONTROL BOARD TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

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TEST DESCRIPTION

This test will determine if the motor control board is receiving the correct voltage and if it is working properly

MATERIALS NEEDED

Multimeter
Power Feed Wiring diagram

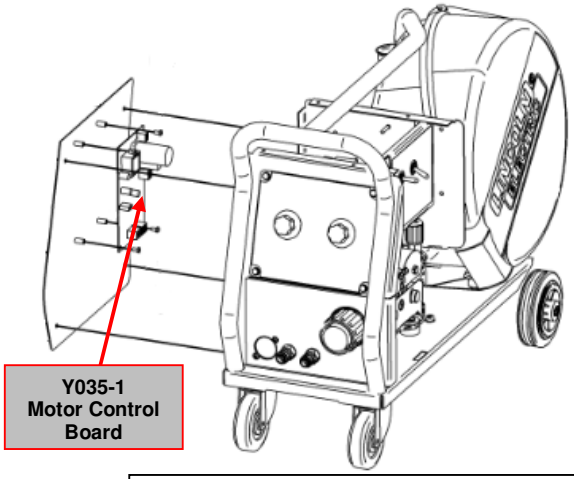


Figure 1 - Motor control board location

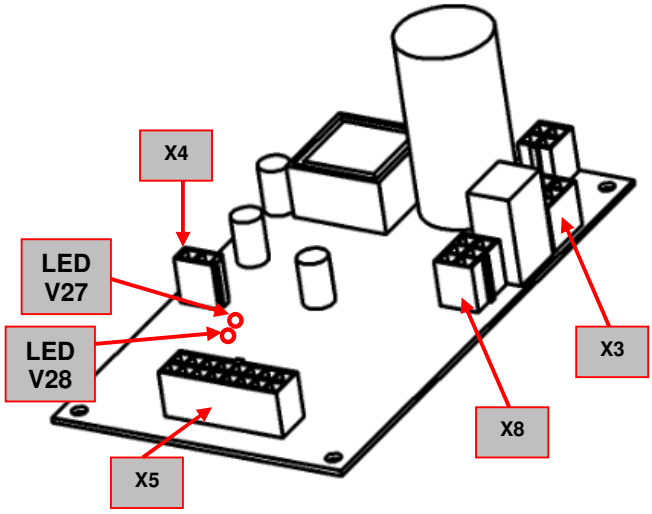
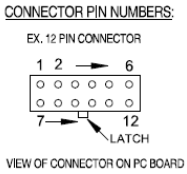


Figure 1a – Y035-1 Test point locations

TEST PROCEDURE



⚠ **Use always electrically insulate gloves during this test procedure**

1. Remove input power from the wire feed unit.
2. Perform the wire feeder case removal procedure.
3. Located the Motor Control Board. See **Figure 1**. Do not remove the plugs from the Motor Control Board.
4. Visually check for burned or damaged components. If any components are physically damaged the motor control board has to be replaced
5. Apply the correct input power to the wire feeder connecting it through control cable to the power source.
6. Using the multimeter perform the tests as indicated in **Test Table 1**. See **Figure 1a** for correct test points location.

Test table 1 – Motor Control Board test

Test Points	*Expected reading*	*PCB LEDs status and color*	*Note*
X3 pin 4(+) to pin 3(-)	40VDC	-	+40VDC power supply from power source
X5 pin 2(+) to pin 7(-)	3VDC	-	WFS and Voltage potentiometers supply
X5 pin 5(+) to pin 7(-)	From 0VDC to 3VDC	-	WFS pot. wiper voltage. Expected reading depend upon the WFS potentiometer setting
X5 pin 10(+) to pin 7(-)	From 0VDC to 3VDC	-	Voltage pot wiper voltage. Expected reading depend upon the Voltage potentiometer setting
X4 pin 2(+) to pin 1(-)	0VDC = Gas solenoid OFF 7,5VDC = Gas solenoid ON	-	Press the gun trigger or purge switch to test the gas solenoid power supply. Note: solenoid is supplied with a PWM signal
X8 pin1(+) to pin 3(-)	From 2VDC to 30VDC	-	Press the gun trigger for this test. Expected reading dependent upon WFS potentiometer setting
X8 pin 5(+) to pin 4(-)	+5VDC	-	Tachimeter voltage supply
X8 pin 6(+) to pin 4(-)	Approx. 2,5VDC when motor is running	-	Press the gun trigger to do this test
X8 pin 6(+) to pin 4(-)	0VDC or 5VDC Depend upon where the motor is stopped	-	With motor not running.
-	-	LED - **V27** Red	Lights on when wire drive motor is supplied
-	-	LED – **V28** Green	Arclink connection state. Normal status is steady green. If blinking all the time it means, no communication or connection with the power source. (Blinking during start-up is normal)

GAS SOLENOID TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

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TEST DESCRIPTION

This test will help determine if the gas solenoid is working properly.

MATERIALS NEEDED

Multimeter
Power Feed Wiring diagram

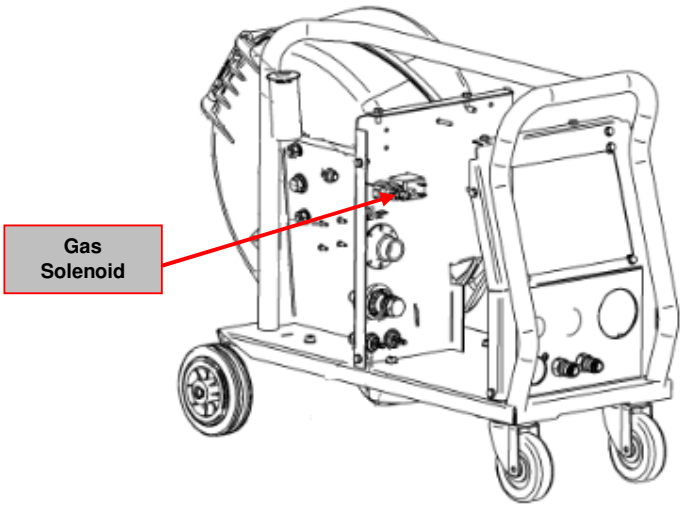

Figure 2 – Gas solenoid location

TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**

1. Remove input power from the wire feed unit.
2. Perform the wire feeder case removal procedure.
3. Located the Gas Solenoid. See **Figure 2**.
4. Apply the correct input power to the wire feeder connecting it through control cable to the power source.
5. Whit the gun trigger pressed check the supply voltage at gas solenoid terminals (wire 210 and 213). Normal voltage is 7,5VDC. Gas solenoid is supplied with a PWM signal. If the voltage is present but the gas solenoid is not activated, the gas solenoid may be faulty. Correct coil resistance with wire 210 and 213 disconnected is 14 Ohms +/- 10%
6. If Voltage is not present check first for loose or faulty wires connections between gas solenoid and plug **X4**. See wire feeder wiring diagram. If connections are good, the Motor Control board may be faulty.

WIRE DRIVE MOTOR TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

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TEST DESCRIPTION

This test will help determine if the wire drive motor receives the correct voltage and if it is capable of working properly.

MATERIALS NEEDED

Multimeter
Power Feed Wiring diagram

WIRE DRIVE MOTOR TEST

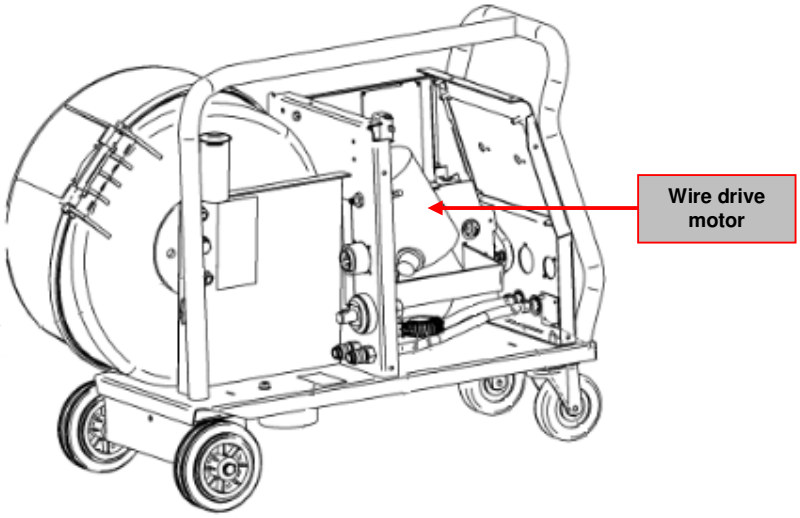


Figure 3 – Wire drive motor location

TEST PROCEDURE

Use always electrically insulate gloves during this test procedure

1. Remove input power from the wire feed unit.
2. Perform the wire feeder case removal procedure.
3. Located the wire drive motor. See **Figure 3**.
4. Apply the correct input power to the wire feeder connecting it through control cable to the power source.
5. Press the gun trigger and with the motor running check at connector **X10** between pin 7 and pin 8, see wiring diagram, for approximately 2VDC to 30VDC. Reading depends upon WFS potentiometer position on user interface panel.
6. If Voltage is not presend check first for loose or faulty wires connections between motor control board plug **X8** and connector **X10**. See wire feeder wiring diagram. If connections are good, the Motor Control board may be faulty.
7. If voltage is present but the wire drive motor does not run, the motor may be faulty.
8. If changing the WFS potentiometer setting on user interface the motor does not change the speed, perform the motor control board test and tachimeter test.

WIRE DRIVE MOTOR TACHIMETER TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

……

TEST DESCRIPTION

This test will help determine if the tachimeter is correctly supplied by the motor control board and if the tachimeter is sending the correct feedback to the motor control board.

MATERIALS NEEDED

Multimeter
Power Feed Wiring diagram

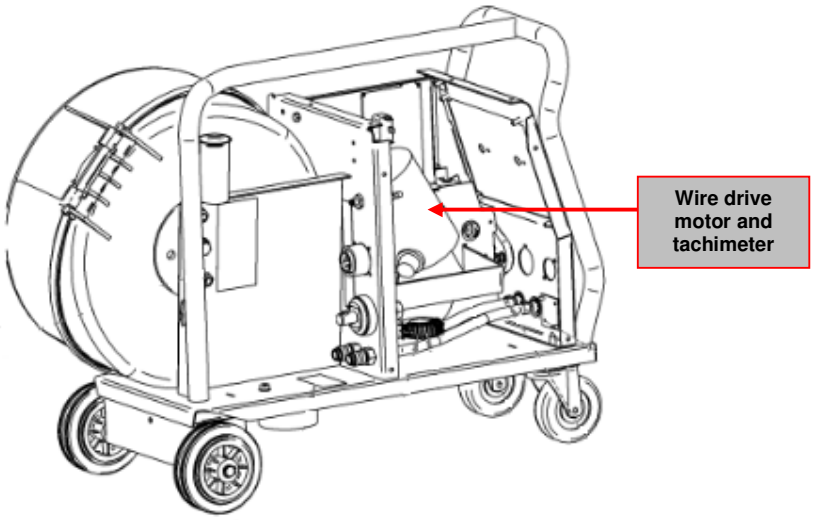


Figure 4 – Wire drive motor and tachimeter location

TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**

1. Remove input power from the wire feed unit.
2. Perform the wire feeder case removal procedure.
3. Located the wire drive motor. See **Figure 4**.
4. Apply the correct input power to the wire feeder connecting it through control cable to the power source.
5. Check at connector **X10** between pin 3 and pin 5, see wiring diagram, for approximately 5 VDC. If the 5VDC are missing check for loose or faulty connection between connector **X10** and plug **X8** on Motor Control board. If connection are good, may be the Motor Control board is faulty.
6. With the trigger pressed and the motor running check at connector **X10** the tachimeter feedback voltage between pin 4 and pin 5. Normal feedback value should be about 2,5VDC. If the correct 5 VDC supply are present but the voltage feedback is missing, the tachimeter is faulty.
7. Take note that with the motor not running the tachimeter voltage feedback may be 0VDC or 5VDC depending the position where the tachimeter magnet, mounted on the motor axle, has stopped.

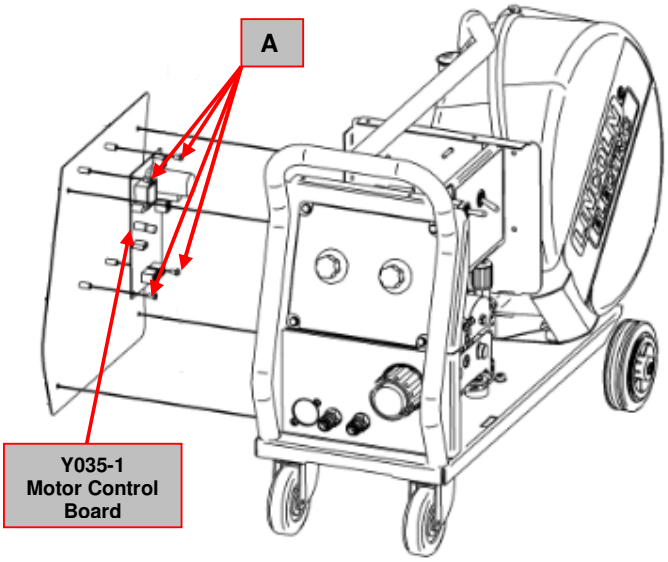


Figure 5

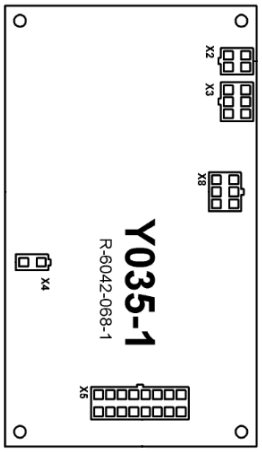


Figure 6 – plugs locations

REMOVAL PROCEDURE

Necessary tools:

- Phillips screwdriver PH02

1. Remove main input power from the Wire Feeder.
2. Perform the wire feeder case removal procedure.
3. Locate the Motor Control board. See **Figure 5**
4. Unplug the connectors **X2, X3, X4, X5** and **X8** from the motor control board. See **Figure 6** for plugs locations.
5. Using Phillips screwdriver PH02 remove the 4 screws (**A**) from the motor board corners.
6. Carefully remove the Motor Control board from wire feeder left side panel.
7. **For the new Motor Control board re-assembly operations,** make the previous steps in the reverse order

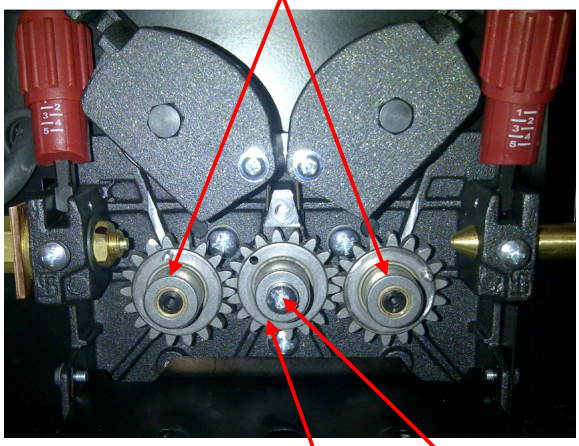


Figure 7

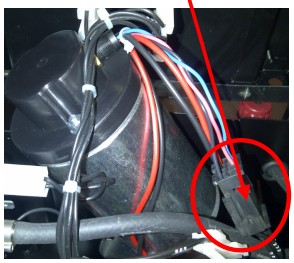


Figure 8

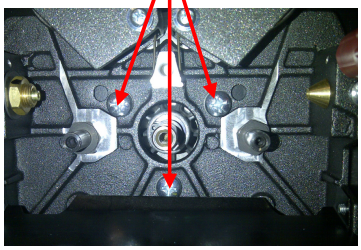


Figure 9

REMOVAL PROCEDURE

Necessary tools:

- Phillips screwdriver PH02

1. Remove main input power from the Wire Feeder.
2. Perform the wire feeder case removal procedure.
3. Remove the drive rolls from the wire drive
4. Remove the rolls gear wheels (**A**). See **Figure 7**.
5. Using the Phillips PH02 screwdriver remove the screw (**B**). See **Figure 7**.
6. Remove the motor gear wheel (**C**). See **Figure 7**.
7. Unplug motor connectors **X9**/**X10**. See **Figure 8**.
8. Using the Phillips PH02 screwdriver remove the 3 screws (**D**), that are fixing the motor to the wire drive. See **Figure 9**.
9. Remove carefully the motor from the Wire Feeder, paying attention to the metal panel that is installed between the motor and the wire drive plate.
10. **For the new Motor re-assembly operations,** make the previous steps in the reverse order

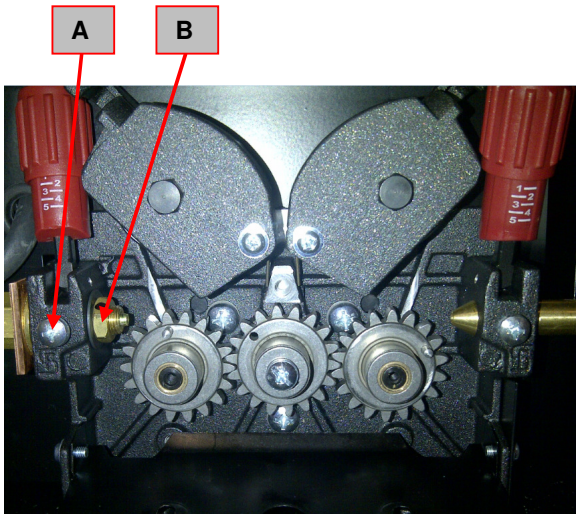


Figure 10

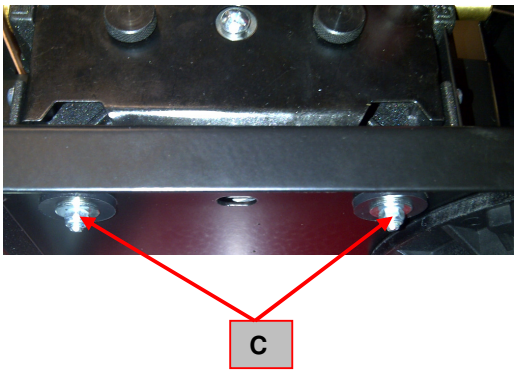


Figure 11

REMOVAL PROCEDURE

Necessary tools:

- Phillips screwdriver PH02
- 8mm nut driver/wrench
- 14mm wrench

1. Remove main input power from the Wire Feeder.
2. Perform the wire feeder case removal procedure.
3. Perform the wire drive motor removal procedure following the instructions provided in the previous page.
4. Using the phillips screwdriver remove the screw (**A**).See **Figure 10**.
5. Using the 14mm wrench remove the nut (**B**) and washer. See **Figure 10**.
6. Using the 8 mm nut driver remove the 2 nuts (**C**), the related 2 screws and washers. See **Figure 11.**
7. Remove the wire drive plate taking care of the plastic insulators that insulate the wire drive plate from the feeder bottom panel.
8. Carefully remove the wire drive plate from the wire feeder, paying attention to the metal panel that is installed between the motor and the wire drive plate.
9. **For the new wire drive plate re-assembly operations,** make the previous steps in the reverse order

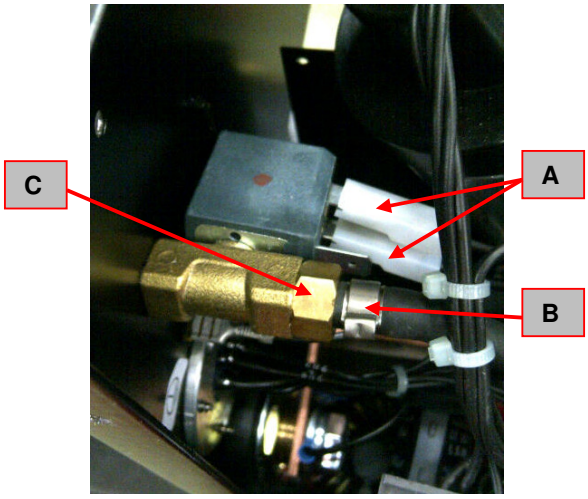


Figure 12

Figure 13

REMOVAL PROCEDURE

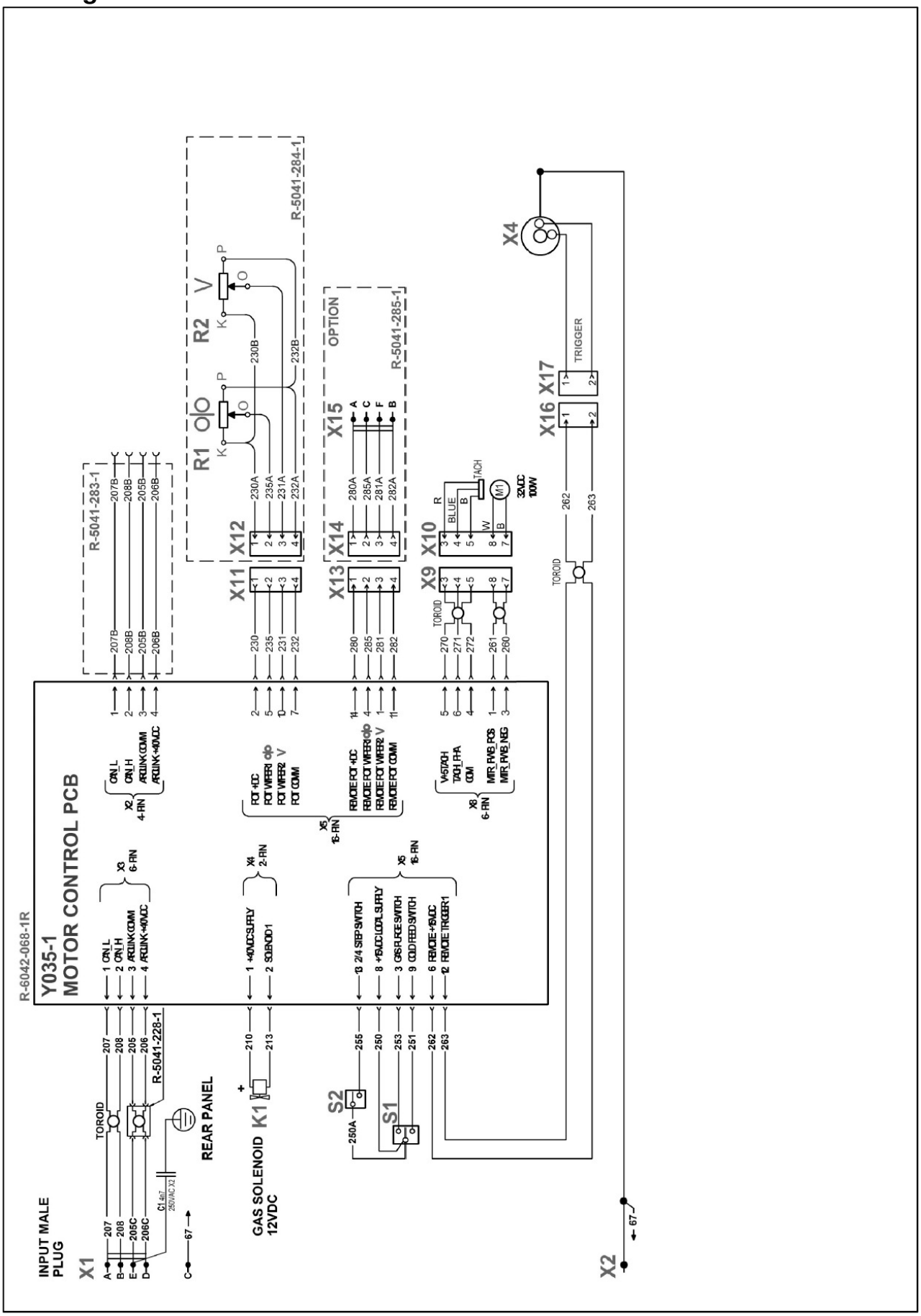
Necessary tools:

- 14mm wrench
- Pincers
- Spare metal clip 10,5 GER (part number 0656-790-105R)
- Threadlocker liquid

1. Remove main input power from the Wire Feeder.
2. Perform the wire feeder case removal procedure.
3. Disconnect the two gas valve supply leads n° 201 and 213 (**A**).
4. Using the pincers remove the metal clip (**B**) and using the 14mm wrench unscrew the couple (**C**). See **Figure 12.**
5. Using the 14 mm wrench remove the quick connect coupling (**D**), see **Figure 13,** and remove the gas valve from the wire feeder.
6. **For the new gas valve re-assembly operations,** make the previous steps in the reverse order, using treadlocker liquid on couple thread (**C**) and quick connect coupling thread (**D**).

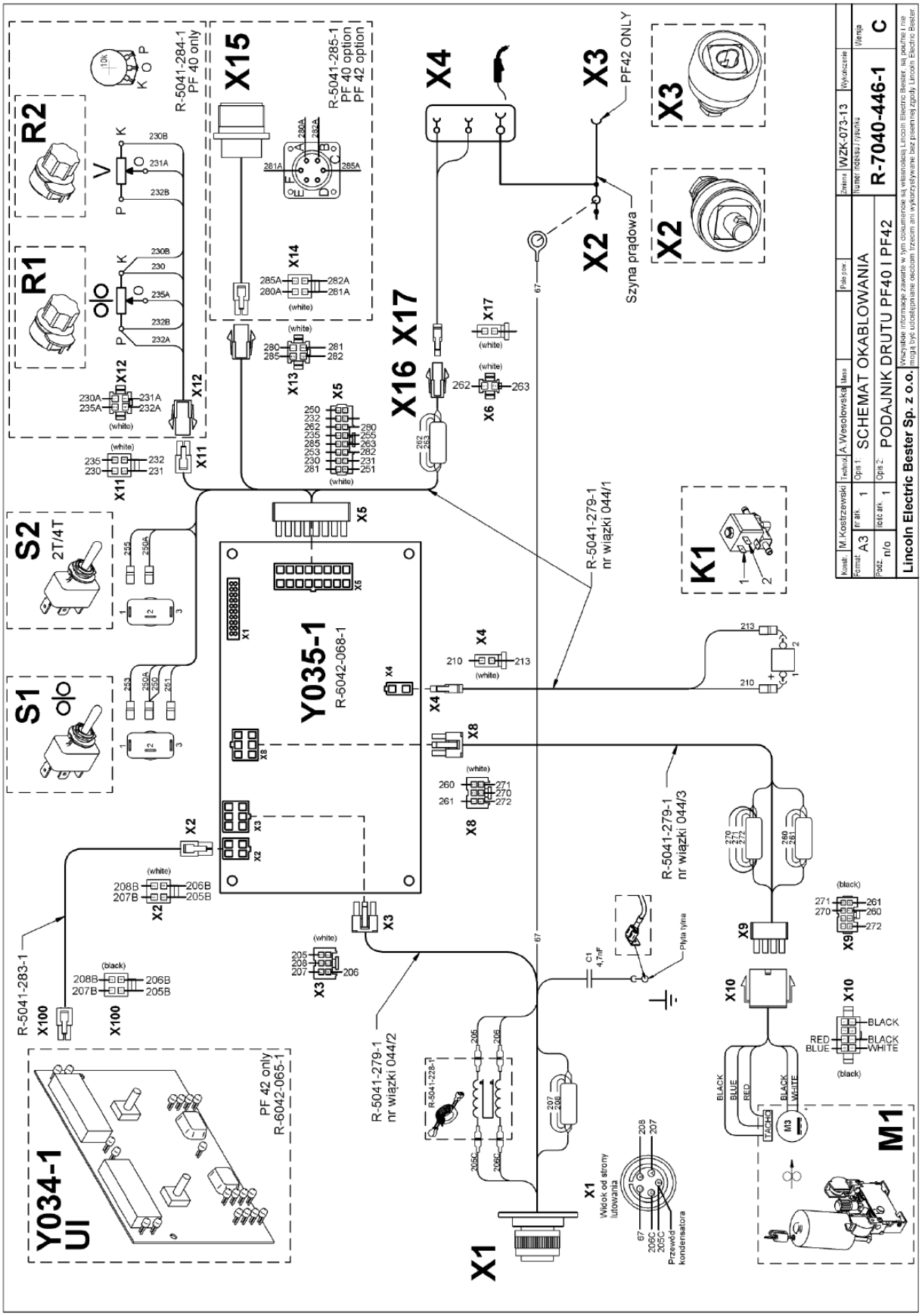
ELECTRICAL SCHEMATICS

Block Diagram : PF40



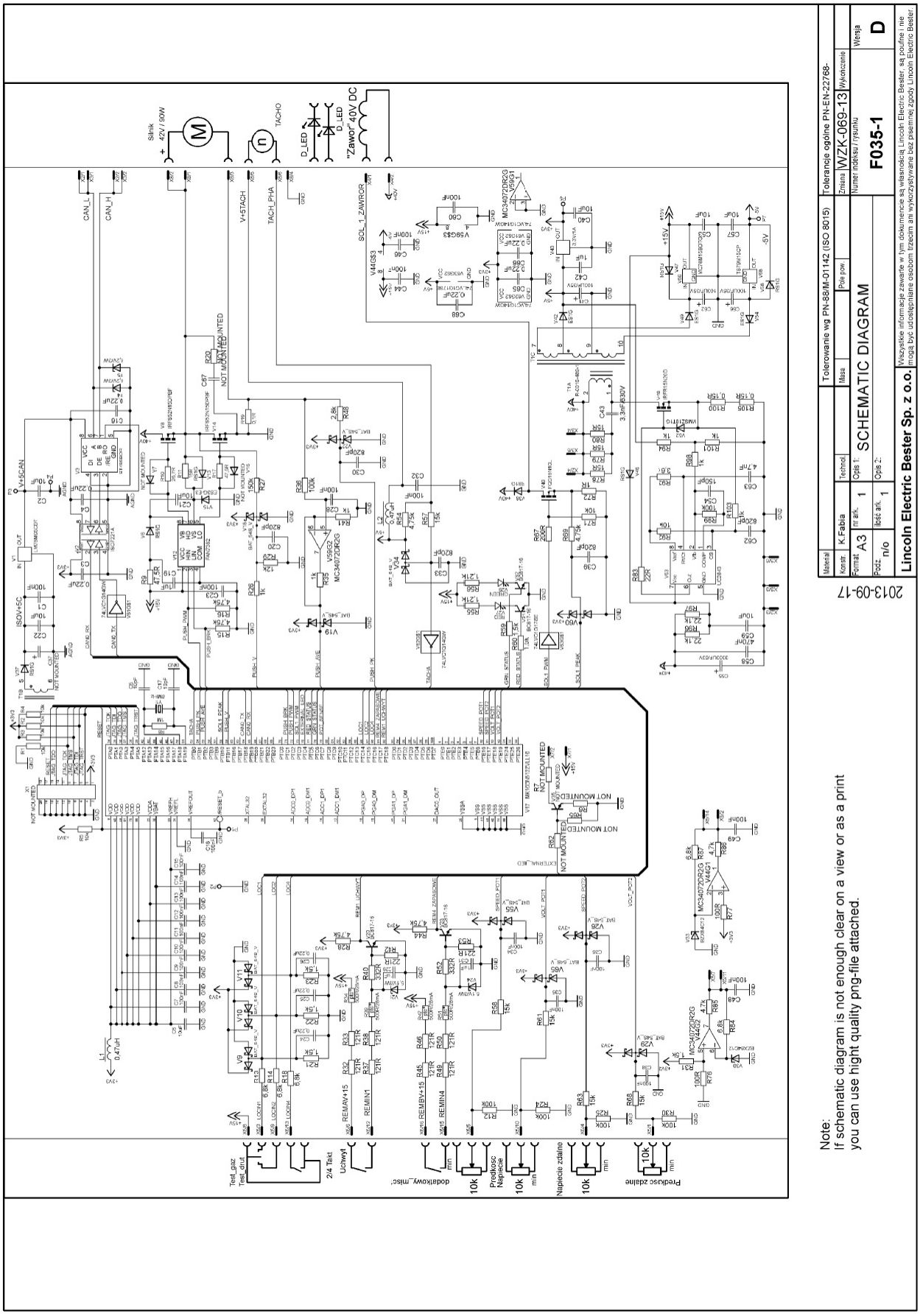
ELECTRICAL DIAGRAMS

Wiring Diagram : PF40



ELECTRICAL DIAGRAMS

MOTOR CONTROL BOARD Y035-1 SCHEMATIC



NOTE