Automatic Iso-Flo®
Voltage-Block System

Part 106 589C
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Section 1

Safety
Section 1  
Safety

1. Introduction

This section contains general safety instructions for using your Nordson equipment. Task- and equipment-specific warnings are included in other sections of this manual where appropriate. Note all warnings and follow all instructions carefully. Failure to do so may result in personal injury, death, or property damage.

To use this equipment safely,

• read and become familiar with the general safety instructions provided in this section of the manual before installing, operating, maintaining, or repairing this equipment.

• read and carefully follow the instructions given throughout this manual for performing specific tasks and working with specific equipment.

• store this manual within easy reach of personnel installing, operating, maintaining, or repairing this equipment.

• follow all applicable safety procedures required by your company, industry standards, and government or other regulatory agencies. Refer to the National Fire Protection Association (NFPA) standard 33 and to federal, state, regulatory agency, and local codes for rules and regulations covering installation and operation of spray systems.

• obtain and read Material Safety Data Sheets (MSDS) for all materials used.

2. Safety Symbols

Become familiar with the safety symbols presented in this section. These symbols will alert you to safety hazards and conditions that may result in personal injury, death, or property and equipment damage.

WARNING: Failure to observe this warning may result in personal injury, death, or equipment damage.
2. Safety Symbols (contd.)

WARNING: Risk of electrical shock. Failure to observe this warning may result in personal injury, death, or equipment damage.

WARNING: Disconnect equipment from line voltage. Failure to observe this warning may result in personal injury, death, or equipment damage.

WARNING: Risk of explosion or fire. Fire, open flames, and smoking prohibited.

WARNING: Wear protective clothing, safety goggles, and approved respiratory protection. Failure to observe may result in serious injury.

WARNING: Hot! Risk of burns. Wear heat-protective clothing, safety goggles with side shields and/or heat-protective gloves depending on the symbol shown.

WARNING: System or material pressurized. Relieve pressure. Failure to observe this warning may result in serious injury or death.

WARNING: Injection. Do not point this device at yourself or other personnel. Failure to observe this warning may result in serious injury or death.
2. Safety Symbols (contd.)

CAUTION: Failure to observe may result in equipment damage.

CAUTION: Hot surface. Failure to observe may result in burns.

3. Qualified Personnel

“Qualified personnel” is defined here as individuals who thoroughly understand the equipment and its safe operation, maintenance, and repair. Qualified personnel are physically capable of performing the required tasks, familiar with all relevant safety rules and regulations, and have been trained to safely install, operate, maintain, and repair the equipment. It is the responsibility of the company operating this equipment to see that its personnel meet these requirements.

4. Intended Use

WARNING: Use of this equipment in ways other than described in this manual may result in personal injury, death, or property and equipment damage. Use this equipment only as described in this manual.

Nordson Corporation cannot be responsible for injuries or damages resulting from nonstandard, unintended applications of its equipment. This equipment is designed and intended only for the purpose described in this manual. Uses not described in this manual are considered unintended uses and may result in serious personal injury, death, or property damage. Unintended uses may result from taking the following actions:

- making changes to equipment that have not been recommended or described in this manual or using parts that are not genuine Nordson replacement parts
- failing to make sure that auxiliary equipment complies with approval agency requirements, local codes, and all applicable safety standards
- using materials or auxiliary equipment that are inappropriate or incompatible with your Nordson equipment
- allowing unqualified personnel to perform any task
Read the installation section of all system component manuals before installing your Nordson equipment. A thorough understanding of system components and their requirements will help you to install this equipment safely and efficiently.

**WARNING:** Failure to follow these safety procedures can result in personal injury or death.

- Allow only qualified personnel to install Nordson equipment.
- Use only approved equipment. Using unapproved equipment in an approved system may void agency approvals.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Follow all instructions for installing components and accessories.
- Install all electrical, pneumatic, gas, and hydraulic connections to local code.
- Install locking, manual, shutoff valves in the air supply lines to the system. This allows you to relieve air pressure and lock out the pneumatic system before undertaking maintenance and repairs.
- Install a locking disconnect switch or breaker in the service line ahead of any electrical equipment.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current demand. All wiring must meet local codes.
- Ground all electrically conductive equipment. Ungrounded conductive equipment can store a static charge which could ignite a fire or cause an explosion if a hot spark is discharged.
- Route electrical wiring, electrostatic cables, and air hoses and tubing along a protected path. Make sure they will not be damaged. Do not bend electrostatic cables around a radius of less than 6 in. (152 mm).
- Install safety interlocks and approved, fast-acting fire detection systems. These shut down the spray system and any flammable liquid supply if a ventilation or electrical problem occurs, a fire is detected, or other emergency situation develops.
5. **Installation (contd.)**

- Make sure the spray area floor is conductive to ground and that the operator’s platform is grounded.

- Use only designated lifting points or lugs to lift and move heavy equipment. Always balance and block loads when lifting to prevent shifting. Lifting devices must be inspected, certified, and rated for a greater weight than the equipment being lifted.

- Do not use unapproved fluid hoses. Solvents may cause them to deteriorate rapidly which may allow flammable or pressurized material to escape.

- Protect components from damage, wear, and harsh environmental conditions.

- Allow ample room for maintenance, material supply container drop-off and loading, panel accessibility, and cover removal.

- Protect equipment with safety devices as specified by applicable safety regulations.

- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning.

6. **Operation**

Only qualified personnel, physically capable of operating the equipment and with no impairments to their judgement or reaction times, should operate this equipment.

Read all component manuals before operating this equipment. A thorough understanding of system components and their operation will help you operate the system safely and efficiently.

- Use this equipment only in the environments for which it is rated. Do not operate this equipment in humid, flammable, or explosive environments unless it has been rated for safe operation in these environments.

- Before starting this equipment, check all safety interlocks, fire-detection systems, and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the system if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks, locked-out electrical disconnects, or pneumatic valves.
Know where EMERGENCY STOP buttons, shutoff valves, and fire extinguishers are located. Make sure they work. If a component malfunctions, shut down and lock out the equipment immediately.

Before operating, make sure all conductive equipment, objects being sprayed, and fluid containers are connected to a true earth ground.

Never operate equipment with a known malfunction or leak.

Never point handguns or applicator nozzles at yourself or other persons.

Never touch exposed electrical connections on equipment while the power is ON.

Do not operate the equipment at pressures higher than the rated maximum working pressure of any component in the system.

Shut off moving equipment before taking measurements or inspecting workpieces.

Know the pinch points, temperatures, pressures, and material composition for all equipment that you are working with. Recognize potential hazards associated with these and exercise appropriate caution.

Wear shoes with conductive soles, such as leather, or use grounding straps to maintain a connection to ground when working with or around electrostatic equipment.

Do not wear or carry metallic objects (jewelry or tools) while working with or around electrostatic equipment. Ungrounded metal can store a static charge and cause harmful shocks.

Maintain skin-to-metal contact between your hand and the gun handle to prevent shocks while operating manual electrostatic spray guns. If wearing gloves, cut away the palm or fingers.

Shut off electrostatic power supplies and ground gun electrodes before making adjustments to powder spray guns.

If you notice electrical arcing in a spray area, shut down the system immediately. An arc can cause a fire or explosion.

Keep parts of the body or loose clothing away from rotating parts. Remove personal jewelry and cover or tie back long hair.
6. **Operation** (contd.)

- Wear National Institute of Occupational Safety and Health (NIOSH) approved respirators while operating spray equipment and when performing maintenance and cleaning tasks.

- Wear eye protection when operating spray equipment.

- Wear gloves and protective clothing to protect your skin from materials.

- Keep paint pumps, pressure pots, and containers of flammable coating materials or solvents far enough away from spray booths to prevent their inclusion in a booth fire.

- Do not smoke in the spray area. A lit cigarette could ignite a fire or cause an explosion.

- Treat all high-pressure fittings and hoses as if they could leak. High-pressure compressed air can be injected under the skin and cause serious injury or death.

- Do not use materials that will corrode the equipment.

- Do not attempt to operate electrical equipment if standing water is present.

- Wash exposed skin frequently with soap and water, especially before eating or drinking. Do not use solvents to remove coating materials from your skin.

7. **Less-Obvious Dangers**

Operators should also be aware of less-obvious dangers in the workplace that often cannot be completely eliminated:

- exposed surfaces on the equipment which may be hot or have sharp edges and cannot be practically safeguarded

- electrical equipment which may remain energized after the equipment has been shut off

- vapors and materials which may cause allergic reactions or other health problems

- automatic hydraulic, pneumatic equipment, or mechanical parts that may move without warning

- unguarded, moving mechanical assemblies
8. **Action in the Event of a System or Component Malfunction**

Do not operate a system that contains malfunctioning components. If a component malfunctions, turn the system OFF immediately.

- Disconnect and lock out electrical power. Close and lock out hydraulic and pneumatic shutoff valves and relieve pressures.

- Allow only qualified personnel to make repairs. Repair or replace the malfunctioning component according to instructions provided in its manual.

9. **Maintenance and Repair**

Allow only qualified personnel to perform maintenance, troubleshooting, and repair tasks. Only persons who are properly trained and familiar with Nordson equipment are permitted to service this equipment.

- Always wear appropriate protective clothing and use safety devices when working on this equipment.

- Follow the recommended maintenance procedures in your equipment manuals.

- Do not service or adjust any equipment unless another person trained in first aid and CPR is present.

- Disconnect, lock out, and tag electrical power at a disconnect or breaker in the service line ahead of electrical equipment before servicing.

- Relieve air and fluid pressures before servicing equipment. Follow the specific instructions in this manual.

- Use only genuine Nordson replacement parts. Using unapproved parts or making unapproved modifications to equipment may void agency approvals and create safety hazards.

**WARNING:** Note the flash point of the cleaning solvent used. Only use controlled methods and equipment, such as temperature-controlled or explosion-protected heaters, to heat cleaning solvent. Observe explosion-prevention regulations and follow applicable safety instructions.

- Refer to the MSDS before using solvents to clean this equipment. The MSDS will provide use, storage, and disposal information about the solvent. Read this information carefully and follow instructions.
9. **Maintenance and Repair**

(Continued)

- Never use an open flame to clean the unit or components of the unit.
- Do not store flammable materials in the spray area or room. Keep paint pumps, pressure pots, and containers of flammable coating materials or solvents far enough away from spray booths to prevent their inclusion in a booth fire. If a fire or explosion occurs, flammable materials in the area will increase the chances and the extent of personal injuries and property damage.
- Make sure that the room where you are working is sufficiently ventilated. Avoid breathing vapors over prolonged periods of time.
- Check interlock systems periodically to ensure their effectiveness.

**WARNING:** Operating faulty or electrostatic equipment is hazardous and can cause electrocution, fire, or explosion. Make resistance checks part of your periodic maintenance program.

- Check all ground connections periodically with a megohm meter. Resistance to ground must not exceed one megohm. If sparks or arcing occur, shut down the system immediately.
- Connect all disconnected equipment ground cables and wires after servicing the equipment. Ground all conductive equipment.

**WARNING:** Service lines connected to panel disconnect switches will still be energized unless power is shut off at another disconnect ahead of the panel. Make sure the power is off before servicing. Wait 5 minutes for capacitors to discharge after shutting off the electrical power.

- Turn off the electrostatic power supply and ground the gun electrode before adjusting or cleaning the nozzles, fluid tips, or air caps.
- If a “power on” test is required, perform the test carefully and then shut off and lock out power as soon as the test is over.
- Never troubleshoot the power supply without first disconnecting all external power supplies and discharging the high-voltage capacitors with an insulated screwdriver.
- Ground electrodes and electrostatic cable ends before touching them.
9. **Maintenance and Repair**

(contd.)

- Do not attempt to service electrical equipment if there is standing water present. Do not service electrical equipment in a high-humidity environment.

- Use tools with insulated handles when working with electrical equipment.

- Keep high-voltage connection points clean and insulated with dielectric grease or oil.

- Do not attempt to service a moving piece of equipment. Shut off the equipment and lock out power. Secure equipment to prevent uncontrolled movement.

10. **Material and Solvent Precautions**

**WARNING:** Hot! Risk of burns. Wear heat-protective clothing, eye protection with side shields and/or heat-protective gloves.

Heated materials may cause severe burns on contact. Remember that some materials, even solid materials, may retain heat for some time. If you are burned by a heated material, immediately cool the affected skin with lots of cool, clean water. Do not try to remove hot, melted material from the skin. Seek immediate medical attention.

High-pressure fluids, unless they are safely contained, are extremely hazardous. A jet of high-pressure fluid can act like a knife or needle, penetrate skin and muscle, and inject itself into your body. Injected fluids can cause toxic poisoning.

Do not treat an injection injury as minor. Seek medical care immediately. Inform the medical staff at the hospital that you have an injection injury and identify the fluid that was injected. If possible, give the doctor copies of the MSDS for the injected fluid and for any additives, such as solvents, that are in the injected fluid.

Also, Nordson recommends that you carry a National Safety Equipment Manufacturers Association (NSEMA) wallet card to give to emergency medical staff in the event of an injection injury. These cards are supplied with the equipment. Additional cards are available free from Nordson Corporation.
**WARNING:** Injection hazard. Do not go near a known leak in a hose or fitting, and stay clear of all spray nozzles or orifices. Do not point an applicator at yourself or other personnel. The high-pressure fluid stream can penetrate skin and inject fluid into the body causing serious injury or death.

To prevent an injection injury, take some basic safety precautions when operating your equipment.

- Always handle spray applicators carefully. Do not point a pressurized gun at yourself or other personnel.

- Never place hands, fingers, or other parts of your body directly over a spray nozzle or in front of a leak in a high-pressure system.

- Never “back-flush” the nozzles. Blocking a nozzle causes the high-pressure fluid to reverse direction and can lead to an injection injury.

- Always relieve system pressure before servicing equipment. Trigger all applicators and bleed off system pressure.

Halogenated hydrocarbon solvents can cause an explosion when used with aluminum components in a pressurized fluid pumping system (pumps, heaters, filters, valves, spray guns, and tanks). The explosion could cause serious bodily injury, death, or substantial property damage. No available stabilizers will prevent this violent reaction from happening.

**WARNING:** Never use halogenated hydrocarbon solvents to clean aluminum parts or to flush any system. Cleaning agents, coatings and paints, or adhesives may contain halogenated hydrocarbon solvents. Obtain and read the MSDS for each material and solvent being used.

- Use nonhalogenated solvents.

- Contact your solvent supplier to determine whether your existing materials and solvents contain halogenated hydrocarbons or to obtain a suitable, nonhalogenated hydrocarbon solvent for cleaning and flushing your system.
10. Material and Solvent Precautions (contd.)

- See Table 1-1. Check the labels on your solvent containers. Halogenated hydrocarbon solvents can be recognized if any of the following elements are listed in the name of the product or as an ingredient:

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flourine</td>
<td>F</td>
<td>“Flouro-”</td>
</tr>
<tr>
<td>Chlorine</td>
<td>Cl</td>
<td>“Chloro-”</td>
</tr>
<tr>
<td>Bromine</td>
<td>Br</td>
<td>“Bromo-”</td>
</tr>
<tr>
<td>Iodine</td>
<td>I</td>
<td>“Iodo-”</td>
</tr>
</tbody>
</table>

If you are now using halogenated hydrocarbon solvents in pressurized systems with aluminum components, perform the following steps:

- Pump the system empty, shut off the pumps, and relieve the system pressure.

- Disassemble and inspect the system components. Replace any damaged or corroded parts.

- Thoroughly clean all noncorroded parts with nonhalogenated hydrocarbon.

- Contact your coatings, solvent, or adhesive supplier for a nonhalogenated solvent to thoroughly flush the entire system before operating it.

- If you must continue to use halogenated hydrocarbon solvents, consult your Nordson representative about compatible Nordson components.
### 10. Material and Solvent Precautions (contd.)

#### Table 1-1 Solvents Containing Halogenated Fluids

<table>
<thead>
<tr>
<th>Chlorinated Solvents</th>
<th>Iodinated Solvents</th>
<th>Brominated Solvents</th>
<th>Fluorocarbon Solvents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Tetrachloride</td>
<td>Ethyl Iodide</td>
<td>Ethylene Dibromide</td>
<td>Dichlorofluoromethane</td>
</tr>
<tr>
<td>Chloroform</td>
<td>Methyl Iodide</td>
<td>Methyl Bromide</td>
<td>Trichlorofluoromethane</td>
</tr>
<tr>
<td>Ethylene Dichloride</td>
<td>N-butyl Iodide</td>
<td>Methylene Chlorobromide</td>
<td>Freon</td>
</tr>
<tr>
<td>Methylene Chloride</td>
<td>Propyl Iodide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-1-1 Trichloroethane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monochlorobenzene</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orthodichlorobenzene</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perchloroethylene</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trichloroethylene</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 11. Disposal

Dispose of equipment and materials used in operation and cleaning according to your local regulations.
Section 2

Description
Section 2
Description

1. Introduction

The Automatic Iso-Flo Voltage-Block system is used in electrostatic waterborne coating systems equipped with one to six automatic spray device(s). While the operator is spraying, the Iso-Flo system:

- delivers pressurized coating material to the system on demand
- electrically isolates the charged spray device and fluid path from the grounded coating material supply

**WARNING:** Operating the system with more than six automatic spray devices connected to it may be unsafe and voids the warranty. If this occurs, Nordson Corporation will not be responsible for the performance or life of the system.

2. Description

The Automatic Iso-Flo Voltage-Block system is installed between the coating material kitchen or supply pump and the spray device(s). This permits charged coating material to flow to the spray device(s), but blocks voltage from grounding at the kitchen or pump.

Coating material can be charged in one of three ways:

- at the spray device, with voltage supplied by an internal power supply (integral power supply [IPS] spray devices)
- at the spray device, with voltage supplied by a power supply through a cable to the device
- at the Iso-Flo system, with voltage supplied by a power supply through a cable to the system

The Iso-Flo system does not require electricity or external controls. Compressed air powers the Iso-Flo unit and it operates automatically in response to fluid flow.
The Automatic Iso-Flo system consists of one water shuttle and two coating material shuttles. The Iso-Flo system operates much like two pumps feeding a common line — when one pump is filling, the other is supplying.

Each pump independently connects to the coating material supply, fills with coating material, and then reconnects to the spray device. A single synchronization valve (sync valve) ensures the two pumps work together so flow to the spray device(s) is not interrupted.

Figure 2-1 is an internal view of an Automatic Iso-Flo Voltage-Block system cabinet. Table 2-1 lists the major components and describes their function.
2. Description (contd.)

Fig. 2-1 Automatic Iso-Flo Voltage-Block system cabinet interior
2. **Description** (contd.)

<table>
<thead>
<tr>
<th>Component</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Coating material shuttle</td>
<td>Makes or breaks the fluid connection to the spray device(s) in response to a signal from the sync valve.</td>
</tr>
<tr>
<td>2. Water shuttle</td>
<td>Grounds out the electrostatics when the cabinet door is opened. Returns coating material to the supply or dump pail for recirculation or color changes. Also can be used as a cup flush for a rotary atomizer.</td>
</tr>
<tr>
<td>3. Male coupling</td>
<td>Connects to the female coupling when the shuttle is closed to transfer coating material to the pump.</td>
</tr>
<tr>
<td>4. Female coupling</td>
<td>Connects to the male coupling when the shuttle is closed to transfer coating material to the pump.</td>
</tr>
<tr>
<td>5. Dummy coupling</td>
<td>Stops the coating material from exiting the system.</td>
</tr>
<tr>
<td>6. Ground clamp stud</td>
<td>Attaches the electrostatic cable to the isolated side of the Iso-Flo system.</td>
</tr>
<tr>
<td>7. Iso-Flo pump</td>
<td>Supplies coating material to the spray device(s). Single-stage, air-operated, 1:1 fluid-to-air ratio.</td>
</tr>
<tr>
<td>8. Sync Valve</td>
<td>Ensures the two Iso-Flo pumps work together so fluid flow to the spray device(s) is not interrupted.</td>
</tr>
<tr>
<td>9. Lubricator</td>
<td>Mixes lubricant with working air to the pump. Lubricant prevents the pump seals from wearing prematurely, and keeps the pump working smoothly.</td>
</tr>
<tr>
<td>10. Door Interlock Valve</td>
<td>Prevents electrical shock. When the door is opened, this valve exhausts pilot air to the pilot valve, which closes the shuttle and grounds the fluid path.</td>
</tr>
</tbody>
</table>

3. **How the Iso-Flo System Works**

Figure 2-2 illustrates system operation.

When operating, the spray devices are automatically supplied with coating material from either of two piston pumps. While one pump supplies coating material, the other pump fills so that it is ready when the first pump is empty. There is a brief overlap where both pumps are supplying coating material to the spray devices before switching from a nearly empty pump to a full pump.
Machine Cycle Description

The following steps describe a machine cycle that begins with one pump nearly empty and the other pump ready to go on-line.

1. As the right pump (13) fills, the pump rod closes the upper limit valve (11).

2. An air signal switches the four-way valve (14), sending the right shuttle (10) down.

3. The right pump (13) pressurizes and exerts full-fluid pressure against the closed side of the sync valve (7).

4. The left pump (17) continues to supply coating material to the spray devices. When the left pump is nearly empty (17), the lower limit valve (18) is released.

5. The left shuttle (6) disconnects from the on-line side and goes up to refill, while the left pump (17) exhausts to the atmosphere.

6. The left pump (17) fills while the right pump (13) supplies the spray devices.

7. The cycle repeats throughout production.

Water Shuttle

See Figure 2-2. As part of the Iso-Flo system, the water shuttle performs the following functions:

- grounds out the electrostatics when the Iso-Flo cabinet door is opened

- returns coating material to the supply or dump pail

- isolates an optional water line to the rotary atomizers for flushing cups during short breaks in production

When the cabinet door is opened, the door valve (1) actuates the pilot of a four-way valve on the water shuttle (20) causing it to close. This grounds out the electrostatics and eliminates any shock hazard.

Closing the water shuttle also closes:

- the fluid coupling that returns coating material to the supply (2) or dump pail

- the coupling that sends water through the optional water line (3)
Fig. 2-2  Automatic Iso-Flo system schematic

1. Door valve grounding device
2. Coating material return line
3. Flush water in line
4. Dump container line
5. Main air line
6. Coating material shuttle (left)
7. Sync valve
8. Coating material out to spray device
9. Coating material supply in
10. Coating material shuttle (right)
11. Upper limit valve (right)
12. Lower limit valve (right)
13. Pump (right)
14. 4-way valve (right)
15. Main operating 4-way valve
16. 4-way valve (left)
17. Pump (left)
18. Lower limit valve (left)
19. Upper limit valve (left)
20. Water shuttle
4. Specifications and Operating Requirements

Table 2-2 provides the specifications and operating requirements for the Automatic Iso-Flo Voltage-Block system.

<table>
<thead>
<tr>
<th>Specifications and Operating Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
</tr>
<tr>
<td>60 x 40 x 25 in. (152.4 x 101.6 x 63.5 cm) H x W x D</td>
</tr>
<tr>
<td>Air input pressure</td>
</tr>
<tr>
<td>80–120 psi (5.5–8.3 bar), 2 SCFM (0.9 liters/sec)</td>
</tr>
<tr>
<td>Fluid input pressure</td>
</tr>
<tr>
<td>80–150 psi (5.5–10.3 bar)</td>
</tr>
<tr>
<td>Electrostatic voltage</td>
</tr>
<tr>
<td>Up to 115 kV (60 kV is the optimum input)</td>
</tr>
<tr>
<td>Flow/pressure to spray device</td>
</tr>
<tr>
<td>Up to 80 oz (2.36 liters) per minute at 60 psi total at 20 seconds Zahn 2, ambient temperature</td>
</tr>
<tr>
<td>Recommended fluid pressure into unit</td>
</tr>
<tr>
<td>100 to 150 psi (6.8 to 10.3 bar)</td>
</tr>
</tbody>
</table>
Section 3

Installation
Section 3
Installation

WARNING: Allow only qualified personnel to perform the following tasks. Observe and follow the safety instructions in this document and all other related documentation.

1. Introduction

Installation procedures can vary, depending on the following factors:

- where the coating material is charged, either
  - inside the cabinet or
  - at the spray device
- how the power supply is controlled if coating material is charged inside the cabinet
- how atomizing air pressure is regulated, either
  - at the spray device or
  - with a separate regulator installed either inside or outside the cabinet

2. Mounting and Connections

The Automatic Iso-Flo Voltage-Block system is mounted in a free-standing cabinet. Locate the cabinet as close to the spray device(s) as possible to minimize hose lengths.

All air, fluid, and cable connections are made through fittings and holes in the rear of the cabinet.

Port Connections

There are two optional ports on the rear of the cabinet labeled WATER INLET and DUMP (CIRCULATION). These ports and their possible uses are described next.
**WATER INLET Port**

This port can be used for an additional water line to the spray device(s). A fluid hose connected to the water shuttle passes through the WATER OUTLET (1) and can be connected directly to the spray device(s). This allows fluid to flow to the spray device(s) when the water shuttle closes, such as when the cabinet door is opened. Typically, this extra line is used to carry water to the spray device(s) for flushing the cup of a rotary atomizer during short breaks in production.

*NOTE:* The water inlet and the input hoses are both grounded. The fluid from the water shuttle to the spray device is charged.

**DUMP (CIRCULATE) Port**

This port returns coating material to the coating material supply after it circulates through the Iso-Flo system whenever the water shuttle is closed. The Iso-Flo system continues to operate as if it were supplying the spray device(s), but instead the fluid is diverted back to the coating material supply. The following are typical uses for this port:

- circulating coating material during breaks in production, particularly if the material contains heavy pigments or needs to be heated
- dumping and saving coating material prior to a color change
- returning waste water for disposal during flushing

**WARNING:** To prevent electrical shock, use the recommended types of fluid hoses.

**Recommended Hoses**

When installing the Iso-Flo system, use one of the following types of fluid hoses:

- any conventional hose with an outer covering that has enough dielectric strength to handle 115 kV.
- any special hose constructed of a material with enough dielectric strength to handle 115 kV (for example, the Nordson thick-wall PTFE hose).
3. **Installation Instructions**

To install the Iso-Flo system, see Figures 2-1 and 3-1 and use the following steps:

1. Clamp the cabinet ground to a true earth ground (for example, a grounded cold water pipe).

   **WARNING:** Risk of electrical shock. Failure to connect a ground strap may result in personal injury, death, or equipment damage.

2. Connect a fluid supply hose to the 3/8-in. NPTF fitting outside the hole labeled PAINT INLET (5).

3. Through the hole labeled COMPRESSED AIR (7), connect an air-supply hose to the 3/8-tube push-on air hose.

4. Route a fluid hose through the hole labeled PAINT OUTLET (2).

5. Connect the hose to the spray device(s) and to the 3/8-in. threaded port on the sync valve.

6. If charging the coating material at the Iso-Flo system, route the electrostatic cable from the power supply through the high-voltage cable access (6) into the cabinet. Connect the electrostatic cable to the 1/2-in. grounding clamp stud on the shuttle pneumatic valves.

7. Connect a return hose to the DUMP circulation (4) 3/8-in NPTF fitting. The hose can connect to a waste container or the return of the pump.

8. Connect a water line to the WATER inlet (3) 3/8-in. NPTF fitting.

**NOTE:** If you are using more than three automatic spray devices, an additional power supply may be required.
Fig. 3-1  Automatic Iso-Flo unit connection points

1. Water outlet
2. Fluid outlet
3. Water inlet
4. Dump circulate outlet
5. Fluid inlet
6. High-voltage cable access
7. Compressed air inlet
8. Fluid filter and teed circuit (optional)
Section 4

Operation
Section 4
Operation

1. Introduction

This section contains the preparation, adjustment, operation, and maintenance instructions for the Automatic Iso-Flo Voltage-Block system.

2. Preparing the Lubrication System

On initial start-up, fill the lubricator with lubricant and adjust the flow rate of the Automatic Iso-Flo Voltage-Block system.

System Lubricant

Nordson type Q solvent is normally used as a lubricant. It is shipped in concentrated form and must be mixed with 10 gallons of water before use. Refer to the Parts section of this manual for the type Q solvent part number.

NOTE: Do not use the mixing directions provided on the container label. Failure to follow the proper mixing instructions (noted above) could cause polymerization of the Q solvent concentrate, resulting in clogging of components.

Filling Lubricator and Adjusting Flow Rate

See Figure 4-1. When filling the lubricator and adjusting the flow rate, use the following steps:

1. Unscrew the filler caps (2) from the top of the lubricators.

2. Turn the lubricant adjustment knob (3) counter-clockwise until completely open.

3. Start the system and then adjust the lubricators (use the lubricant adjustment knob (3)) to deliver ten drops of lubricant for each spray cycle. Use the lubricator sight glass (1) to monitor the flow rate.

NOTE: When first filled, the lubricators may not prime and begin delivering lubricant to the pump air for several operating cycles.

WARNING: Allow only qualified personnel to perform the following tasks. Observe and follow the safety instructions in this document and all other related documentation.
Before putting a new system into service, flush it with a cleaning solution that is compatible with the system equipment and coating material you will be using. Flushing removes oils, metal filings, and other contaminants left from the manufacturing and installation process.

**WARNING:** Always shut off electrostatic voltage before opening the cabinet door. Failure to observe this warning could result in personal injury or death.

To perform the new system flush, use the following steps:

1. Shut off the electrostatic power supply.

2. Trigger the spray device into the spray booth or a grounded waste container.
3. **New System Flush (contd.)**

3. Turn on the compressed air to the Iso-Flo system and set the air pressure to 80–120 psi (5.5–8 bar).

4. Supply cleaning solution to the Iso-Flo system and set the fluid pressure to the maximum available (up to 150 psi or 10.3 bar).

5. Open the door and press the door interlock valve (see Figure 2-1). This causes the Iso-Flo system pump to fill with cleaning solution.

6. Turn off the spray device and open the dump circulate valve to allow cleaning solution to flush the line.

7. Release the door interlock valve. The system air pressure forces the cleaning solution out of the Iso-Flo system pumps and subsequently out of the hose.

8. Repeat steps 6–8 several times to make sure the system is flushed thoroughly. Continue flushing until the cleaning solution and any remaining air have been purged from the system.

9. Shut the drain valve and close the cabinet door.

---

4. **Filling the System**

When you add coating material to a system for the first time, or you change coating material, make sure you remove cleaning solution and air from the system. Excessive dilution or entrapped air can ruin up to two gallons of coating material.

To remove cleaning solution and air from the system, do the following:

1. Set system up for normal spraying with the actual coating material you will be using.

2. Trigger the spray device into the spray booth or grounded waste container.

3. Repeat steps 6–9 in *New System Flush*.

**NOTE:** To short-stroke the Iso-Flo pumps, manually trip the upper limit valve actuators when the pump rods raise about one-inch.

---

5. **Heating the Coating Material**

The Iso-Flo system can be used with any conventional coating material heater, even electrical resistance types. Because the heater is used on the input, or grounded side, the coating material is heated before it enters the Iso-Flo system. This means freshly heated coating material flows continuously into the Iso-Flo system while you are spraying.
5. **Heating the Coating Material** *(cont'd.)*

If the water shuttle is set up to circulate back to the coating material supply pumps, the material can continue flowing into the Iso-Flo system when the trigger signal stops (even for short periods).

**NOTE:** The maximum coating material temperature for an Automatic Iso-Flo system is 140 °F (60 °C).

6. **Daily Operation**

Startup and shutdown procedures can vary, depending on your safety regulations and system requirements. If the solids will not settle or the coating material will not cure in the system, you can leave your system full of coating material overnight.

**WARNING:** All conductive equipment in the spray area must be connected to a true earth ground. Check the Iso-Flo cabinet ground to make sure all internal and external connections are clean and secure. Failure to observe could result in property damage, personal injury, or death.

**Startup**

For daily startup, use the following steps. This procedure assumes the system was left full of coating material after the last shutdown.

1. Make sure the electrostatic voltage is off.
2. Open the cabinet door.
3. Check the lubricant level inside the Iso-Flo system. Refill the lubricators, as required.
4. Empty excess lubricant from the filter bowls, as required.
5. Turn on the compressed air to the Iso-Flo system.
6. Set the fluid pressure to a maximum of 150 psi (10.3 bar).
7. Close the door and adjust the fluid pressure.
8. Turn on the electrostatic power supply or the spray-device control unit.
9. The Iso-Flo system is now ready for spraying.

**NOTE:** During short breaks in production (for example, lunch breaks), shut off the electrostatic voltage, but leave on the air supply. This keeps the shuttle closed and prevents coating material from drying on the couplings.
**Shutdown**

For daily shutdown, use the following steps:

1. Shut off the electrostatic power supply or spray-device control unit.
2. Open the door to ground the system and then close the door.
3. Shut off compressed air to the system and reduce the fluid input supply pressure to 0.
4. Trigger the spray device to relieve fluid and compressed air pressure.
5. Open the cabinet door and clean the male and female couplings with a compatible cleaning solution.
6. Close the cabinet door.

**System Flush**

When changing coating material or cleaning the system, use the following steps:

1. Turn off the electrostatic power supply or spray device.
2. Reduce the fluid input supply pressure to 0.
3. Open the cabinet door. Trigger the spray device into the spray booth or a grounded waste container to expel any remaining coating material.
4. Supply cleaning solution to the Iso-Flo system and set the compressed air pressure to the maximum available (up to 120 psi or 10.3 bar).
5. Push the door interlock valve. Allow the system pump to fill with several inches of cleaning solution, as indicated by the rise of the pump rod. Then, manually trip the upper limit valve to stop the filling.
6. Release the door interlock valve and trigger the spray device into the spray booth or a grounded waste container. This flushes the system pump(s), hose(s), and spray device(s).
7. Repeat steps 5 and 6 until the cleaning solution runs clear. Continue flushing until the cleaning solution and any remaining air have been purged from the system.
8. Push the door interlock valve. Allow the Iso-Flo pump(s) to fill with several inches of coating material, as indicated by the rise of the pump rod. Then, manually trip the upper limit valve to stop the filling.
**System Flush (contd)**

9. Release the door interlock valve and trigger the spray device(s). The new coating material will flush any remaining cleaning solution out of the pump(s), hose(s), and spray device(s).

10. Close the cabinet door and reset all the operational parameters to the normal settings.

11. Turn on all equipment, including the power supply.

12. Start applying the new coating material.

**Material Changes**

Material changes in the basic system do not require any additional hardware. You can flush the Iso-Flo system for material changes in one of the following two ways:

- operate the system normally using compatible cleaning solution instead of coating material

- manually trip or short-stroke the limit valves, as described in the following steps:

  1. Turn off the electrostatic power supply.
  
  2. Open the cabinet door.
  
  3. Open the drain valve so the pumps can begin to cycle.
  
  4. When the empty pump has filled with two inches of cleaning solution, manually trip its upper limit valve. This signals the pump to wait until the other pump empties and actuates the sync valve to allow the pumps to begin cycling back and forth (short-stroke).
  
  5. As the second pump fills, manually trip its upper limit valve. Continue to alternate back and forth between pumps.
  
  6. After several short-strokes, close the cabinet doors.
  
  7. Close the drain valve and trigger the spray device(s) to remove any remaining cleaning solution from the Iso-Flo system.
  
  8. Fill with new coating material.
  
  9. Turn on the electrostatic power supply and begin spraying.

**NOTE:** A mixture of compressed air and cleaning solution removes the coating material from the internal wall of hoses and equipment faster than cleaning solution alone. Using air also causes the Iso-Flo system to cycle faster, further speeding the flushing process. A final air purge pushes out the last traces of dirty cleaning solution.
7. **Long-Term Shutdown**

When shutting the system down for an extended period, use the following steps:

1. Turn off the electrostatic power supply.
2. Flush the system with compatible cleaning solution using steps 1–7 in System Flush.
3. Relieve the compressed air and fluid pressure. Drain the system completely.
4. Open the cabinet door and clean the male and female couplings, the exterior of all cabinet components, and the cabinet with compatible cleaning solution.
5. Check the lubricant level and refill the lubricators, as required.
6. Empty and clean excess lubricant from the filter bowls, as required.
7. Close the cabinet door.

8. **Maintenance**

The Iso-Flo system requires minimal routine maintenance. To keep the system operating at maximum efficiency, perform the following procedures.

**Daily**

For daily maintenance, follow these steps:

1. Turn off the electrostatic power supply.
2. Open the cabinet door to ground the system, and then close the door.
3. Relieve the compressed air pressure.
4. Open the cabinet door and clean the couplings with a compatible cleaning solution to prevent coating material build-up.
5. Check the lubricant level and refill the lubricators, as required.
6. Empty and clean excess lubricant from the filter bowls, as required.
7. Close the cabinet door.
Weekly

For weekly maintenance, follow these steps:

1. Turn off the electrostatic power supply.

2. Open the cabinet door to ground the system, and then close the door.

3. Relieve the compressed air pressure.

4. Flush the system with a compatible cleaning solution, as needed.

5. Clean the couplings with a compatible cleaning solution and then lightly coat the female coupling shafts with O-ring grease. Use a stiff brush to work the grease through the springs.

6. Check the lubricator level and refill if necessary. Refer to Preparing the Lubrication System earlier in this section.

Spray Pump Seals

Piston seals on the spray pumps are wear items that require periodic replacement depending on the abrasiveness of the coating material. Replace these seals when

- air bubbles occur between the coating material and the spray device, or

- there is coating material in the lubricator filter bowls

For more information on replacing the seals, refer to the Repair section of this manual.
Section 5

Troubleshooting
Section 5
Troubleshooting

WARNING: Allow only qualified personnel to perform the following tasks. Follow the safety instructions in this document and all other related documentation.

WARNING: Turn off the electrostatic voltage before opening the Iso-Flo cabinet door. Failure to observe this warning could result in personal injury or death.

This section contains troubleshooting procedures. These procedures cover only the most common problems that you may encounter. If you cannot solve the problem with the information given here, contact your local Nordson representative for help.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Coating material does not flow when spray device is triggered</td>
<td>5-2</td>
</tr>
<tr>
<td>2. Coating material flow is poor or erratic</td>
<td>5-2</td>
</tr>
<tr>
<td>3. Coating material is thin or watery at start up</td>
<td>5-2</td>
</tr>
<tr>
<td>4. No electrostatic voltage, or the electrostatic voltage is low or erratic</td>
<td>5-3</td>
</tr>
<tr>
<td>5. Lubricator filter contains coating material</td>
<td>5-3</td>
</tr>
<tr>
<td>6. Pump is making noise</td>
<td>5-3</td>
</tr>
<tr>
<td>7. Shuttle couplings leaking</td>
<td>5-3</td>
</tr>
</tbody>
</table>
The following table provides general information for troubleshooting the Iso-Flo system.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Coating material does not flow when spray device is triggered</td>
<td>System air pressure is too low</td>
<td>Check and adjust system air pressure to a minimum of 80 psi (5.5 bar).</td>
</tr>
<tr>
<td></td>
<td>Fluid hose from the Iso-Flo pump to the spray device is clogged, or the fluid hose from the shuttle to the Iso-Flo pump is clogged</td>
<td>Check for blockage in fluid hose. Clean or replace fluid hose(s), as needed.</td>
</tr>
<tr>
<td></td>
<td>Spray device is clogged</td>
<td>Check for blockage in the input hose, the filter, or both. Clean or replace, as needed.</td>
</tr>
<tr>
<td>2. Coating material flow is poor or erratic</td>
<td>Spray device flow control valve is almost or all the way closed. (Applies only to spray devices with integral flow control valve.)</td>
<td>Open the spray device valve.</td>
</tr>
<tr>
<td></td>
<td>System air pressure is too low to operate pump</td>
<td>Adjust system air pressure to as high as possible. (80–150 psi or 5.5–10.3 bar).</td>
</tr>
<tr>
<td></td>
<td>Fluid hose from the pump to the spray device is blocked</td>
<td>Adjust fluid output pressure. If fluid output pressure is not the problem, clean or replace fluid hose.</td>
</tr>
<tr>
<td>3. Coating material is thin or watery at start up</td>
<td>System is not completely purged of cleaning solution</td>
<td>Turn off electrostatic voltage, open cabinet door, and trigger the spray device. Continue spraying until the pump empties completely. If necessary, increase system air pressure.</td>
</tr>
</tbody>
</table>
## 2. Troubleshooting Procedures (cont’d.)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. No electrostatic voltage, or the electrostatic voltage is low or erratic</td>
<td>Water in compressed air is making the air lines conductive</td>
<td>Filter and dry air before it enters the Iso-Flo system.</td>
</tr>
<tr>
<td></td>
<td>Coating material hose is grounding out</td>
<td>Inspect hose and repair or replace as necessary.</td>
</tr>
<tr>
<td></td>
<td>Defective electrostatic power supply, electrostatic cable, cable connection, or control circuit</td>
<td>Check electrical equipment and repair or replace, as necessary.</td>
</tr>
<tr>
<td></td>
<td>System is grounding out because door valve is not actuated</td>
<td>Make sure the door closes tightly. If necessary, adjust the door valve.</td>
</tr>
<tr>
<td>5. Lubricator filter contains coating material</td>
<td>Pump seals are worn, coating material is leaking</td>
<td>Replace or repair pump seals.</td>
</tr>
<tr>
<td>6. Pump is making noise</td>
<td>Air in fluid lines</td>
<td>Turn off electrostatic voltage, open cabinet door, and trigger spray device into the spray booth or a grounded waste container to purge air.</td>
</tr>
<tr>
<td>7. Shuttle couplings leaking</td>
<td>Female coupling shaft is dry</td>
<td>Grease spring and shaft with O-ring lubricant and a stiff brush.</td>
</tr>
<tr>
<td></td>
<td>Male coupling ball and seat not sealing due to contamination</td>
<td>Flush with cleaning solution. Disassemble coupling and clean, if necessary.</td>
</tr>
<tr>
<td></td>
<td>Dried coating material is on the sealing surfaces of couplings</td>
<td>Clean couplings with a compatible cleaning solution. If necessary, disassemble couplings and clean.</td>
</tr>
<tr>
<td></td>
<td>Coupling O-rings damaged or out of grooves</td>
<td>Disassemble couplings and repair.</td>
</tr>
</tbody>
</table>
Section 6

Repair
Section 6
Repair

1. Introduction

This section provides an overview of the repair or replacement of the male and female couplings and the pump seals.

2. Coupling Repair

The male and female couplings are repairable using the coupling repair kits listed in the Parts section of this manual. Only the parts included in the repair kit and the safety pin in the male coupling are replaceable. If other parts of a coupling are damaged, replace the entire coupling assembly. Instructions are included with the kits.

3. Pump Seal Replacement

Pumps have few wear parts and should operate for long periods between rebuilds. Pumps should be rebuilt when either:

- air bubbles appear in coating material even though air has been purged from the system
- coating material appears in filter bowl attached to the lubricator

Premature seal wear can indicate incompatibility with the coating material. Consult the manufacturer to obtain information about the composition of the coating material being sprayed.

In most cases, you can restore a leaking pump to like new condition by replacing worn piston seals. Nordson offers a seal kit that includes both piston seals, as well as replacement O-rings for the cylinder head gaskets.

WARNING: Do not use a seal that gets damaged or rolls in installation. Any slivers of seal material that remain after an installation indicate that the seal is damaged.

If you need to replace the pump seals, refer to the Pump Seal Replacement manual for instructions.
Section 7

Parts
Section 7
Parts

1. Introduction

To order parts, call the Nordson Customer Service Center or your local Nordson representative. Use this five-column parts list, and the accompanying illustration, to describe and locate parts correctly.

Using the Illustrated Parts List

Numbers in the Item column correspond to numbers that identify parts in illustrations following each parts list. The code NS (not shown) indicates that a listed part is not illustrated. A dash (—) is used when the part number applies to all parts in the illustration.

The six-digit number in the Part column is the Nordson Corporation part number. A series of dashes in this column (- - - - - -) means the part cannot be ordered separately.

The Description column gives the part name, as well as its dimensions and other characteristics when appropriate. Indentions show the relationships between assemblies, subassemblies, and parts.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>000 000</td>
<td>Assembly</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>000 000</td>
<td>Subassembly</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>000 000</td>
<td>Part</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

- If you order the assembly, items 1 and 2 will be included.
- If you order item 1, item 2 will be included.
- If you order item 2, you will receive item 2 only.

The number in the Quantity column is the quantity required per unit, assembly, or subassembly. The code AR (As Required) is used if the part number is a bulk item ordered in quantities or if the quantity per assembly depends on the product version or model.

Letters in the Note column refer to notes at the end of each parts list. Notes contain important information about usage and ordering. Special attention should be given to notes.
This section lists the parts for the Iso-Flo system, assemblies, and hardware.

### System Assemblies and Miscellaneous Hardware

See Figure 7-1.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>155 740</td>
<td>Iso-Flo, Automatic</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>973 266</td>
<td>• Tee, pipe, hydraulic, (\frac{3}{8}) in., SS, pass</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>240 976</td>
<td>• Clamp, ground with wire</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>973 523</td>
<td>• Coupling, pipe, hydraulic, (\frac{3}{8}) in., SS</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>973 116</td>
<td>• Nipple, extra heavy, 0.375 x 4.50 in., SS</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>155 742</td>
<td>• Hose, paint inlet, w/fittings</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>984 171</td>
<td>• Nut, hex, jam, (\frac{1}{2}-20), steel, zinc</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>• Cabinet, module</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>-</td>
<td>• Shuttle, paint, module</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>981 436</td>
<td>• Screw, socket, (\frac{5}{16})-18 x 2 in., bl</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>155 743</td>
<td>• Shuttle, water, module</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>157 063</td>
<td>• Hose, paint, w/fittings</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>-</td>
<td>• Pump, parallel, module</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>147 867</td>
<td>• Clamp, nylon, (\frac{5}{8}) in.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>147 866</td>
<td>• Strap, nylon, perforated, (\frac{5}{8}) in.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>157 065</td>
<td>• Hose, sync valve, w/fittings</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>157 064</td>
<td>• Hose, water, w/fittings</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>131 001</td>
<td>• Spacer, 0.50 x 0.26 x 0.75 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>981 244</td>
<td>• Screw, (\frac{1}{4})-20, sl, zinc</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NS</td>
<td>973 615</td>
<td>• Tee, branch, (\frac{1}{4})-in. tube x (\frac{1}{8})-in. NPT, plastic</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NS</td>
<td>972 119</td>
<td>• Elbow, male, (\frac{1}{4})-in. tube x (\frac{1}{8})-in. NPT</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NS</td>
<td>900 556</td>
<td>• Tubing, nylon, 0.250 x 0.035 in</td>
<td>AR</td>
<td></td>
</tr>
</tbody>
</table>

### Notes

**A:** See Figure 7-5 for parts breakdown.

**B:** See Figure 7-4 for parts breakdown.

**C:** See Figure 7-3 for parts breakdown.

**D:** See Figure 7-2 for parts breakdown.

**AR:** As Required

**NS:** Not Shown
System Assemblies and Miscellaneous Hardware
(contd)

Fig. 7-1  Unit assemblies and miscellaneous hardware
Pump and Lubricator Assembly

See Figure 7-2.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>184 743</td>
<td>Pump and lubricator</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>901 379</td>
<td>Filter vent, 3/8. NPT</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>901 378</td>
<td>Actuator, cam follower, 11925</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>972 119</td>
<td>Valve, air operated, MJV-3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>901 385</td>
<td>Valve, air operated, MJVO-3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>973 278</td>
<td>Elbow, male, 1/4-in. tube x 1/8-in. NPT</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>973 262</td>
<td>Bushing, pipe, hydraulic, 3/4 in. x 1/4 in., steel, zinc</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Collar, clamp</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>981 512</td>
<td>Screw, skt set, 10-32 x 0.500-in., cup, zinc</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Post, switch</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>981 161</td>
<td>Screw, pan, 10-32 x 0.375-in., sl, bl</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>983 124</td>
<td>Washer, lock, e, internal, #10, steel, zinc</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>130 339</td>
<td>Pump, modification, 6 x 6 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>900 556</td>
<td>Tubing, nylon, 0.250-in. OD x 0.035-in. wall thickness</td>
<td>5</td>
<td>A</td>
</tr>
</tbody>
</table>

NOTE A: 1-inch increments
Fig. 7-2  Pump and lubricator assembly
Water Shuttle Assembly

See Figure 7-3.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>- - - -</td>
<td>Shuttle, water</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>- - - -</td>
<td>• Block, slider</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>971 266</td>
<td>• Elbow, male, 1/4-in. tube x 1/4-in. NPT</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>900 556</td>
<td>• Tubing, nylon, 0.250 x 0.035 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>139 386</td>
<td>• Cylinder, air, 12 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>973 180</td>
<td>• Elbow, pipe, hydraulic, 90, 3/8 in., SS</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>245 679</td>
<td>• Fitting, 3/8 in., w/O-ring</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>- - - -</td>
<td>• Block, slide, top</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>130 307</td>
<td>• Coupling, female</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>9</td>
<td>130 309</td>
<td>• Coupling, male</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>10</td>
<td>139 388</td>
<td>• Guide, cup</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>941 200</td>
<td>• O-ring, hotpaint, 1.000 x 1.188 x 0.094 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>986 334</td>
<td>• Retaining ring, internal, 100, invert</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>901 381</td>
<td>• Bearing, nylon, 0.755 x 1.004 x 1.00 in.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>- - - -</td>
<td>• Rod, guide, 19-1/2 in.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>- - - -</td>
<td>• Block, slide, bottom</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>984 177</td>
<td>• Nut, nylon 1/2-13</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>973 372</td>
<td>• Bushing, pipe, hyd, 1/4 x 1/8 in., steel, zinc</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>973 007</td>
<td>• Nipple, steel, sched 40, 1/8 x 2 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>901 089</td>
<td>• Valve, air, operated FV-4P</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>973 615</td>
<td>• Tee, branch, 1/4-in. tube x 1/8-in. NPT, plastic.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>139 391</td>
<td>• Actuator, MPA-7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>939 127</td>
<td>• Clamp, ground</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>973 000</td>
<td>• Nipple, steel, sched 40, 0.125. x 0.75-in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>901 063</td>
<td>• Valve, shuttle</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>972 119</td>
<td>• Elbow, male, 1/4-in. tube x 1/8-in. NPT</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

NOTE A: For parts breakdown, refer to Male Couplings and Female Couplings parts.
Fig. 7-3  Water shuttle assembly
## Paint Shuttle Assembly

See Figure 7-4.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>147 046</td>
<td>• Block, slider</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>139 391</td>
<td>• Actuator, MPA-7</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>148 936</td>
<td>• Valve, air, MJV-4D</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>972 119</td>
<td>• Elbow, male, 1/4-in. tube x 1/8-in. NPT</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>900 556</td>
<td>• Tubing, nylon, 0.250 x 0.35 in.</td>
<td>AR</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>971 266</td>
<td>• Elbow, male, 1/4-in. tube x 1/4-in. NPT</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>148 456</td>
<td>• Cylinder, O-ring piston, single rod</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>973 259</td>
<td>• Tee, pipe, street, 1/8 x 1/8 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>973 564</td>
<td>• Nipple, hex, 1/4 x 1/8 x 1.88 in., steel, zinc</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>245 679</td>
<td>• Fitting, 3/8 in., w/O-ring</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>130 307</td>
<td>• Coupling, female</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>12</td>
<td>986 334</td>
<td>• Rod, shuttle, 21.5 in.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>901 381</td>
<td>• Retaining ring, internal, 100, invert</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>941 200</td>
<td>• O-ring, hotpaint, 1.000 x 1.188 x 0.094 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>130 309</td>
<td>• Coupling, male</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>16</td>
<td>139 388</td>
<td>• Guide, cup</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>984 177</td>
<td>• Nut, nylon 1/2-13</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE A**: For parts breakdown, refer to Male Couplings and Female Couplings parts.

**AR**: As Required
Paint Shuttle Assembly (contd)

Fig. 7-4 Paint shuttle assembly
## Sync Valve

See Figure 7-5.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>155 742</td>
<td>Sync valve module</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>148 174</td>
<td>• Valve, air operated, three-way</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>972 089</td>
<td>• Connector F, SAE/MS, Buna-N, 9/16-18, SS</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>972 088</td>
<td>• Connector, SAE/MS, Buna, 9/16-18, SS</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>939 127</td>
<td>• Clamp, ground</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>972 119</td>
<td>• Elbow, male, 1/4-in. tube x 1/8-in. NPT</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>973 615</td>
<td>• Tee, branch, 1/4-in. tube x 1/8-in. NPT, PLST</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>973 007</td>
<td>• Nipple, steel, sched 40, 0.125 x 2.00 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>245 679</td>
<td>• Fitting, 3/8 in., w/O-ring</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>973 197</td>
<td>• Tee, male branch, auto, 3/8 in., SS</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>148 936</td>
<td>• Valve, air, MJV-4D</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>139 391</td>
<td>• Actuator, MPA-7</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE A:** See Figure 7-5 for parts breakdown.

---

**Fig. 7-5** Sync valve module
**Air-Operated Valve**

See Figure 7-6.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>148 174</td>
<td>Valve, air-operated, three-way</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>130 345</td>
<td>• Valve, air-operated, color change</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>130 348</td>
<td>• Retainer, seal</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>973 423</td>
<td>• Plug, pipe, skt, std, 3/8, sstl</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>940 170</td>
<td>• O-ring, hotpaint, 0.688 x 0.813 x 0.063 in.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>942 112</td>
<td>• O-ring, hotpaint, 0.250 x 0.500 x 0.125 in.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>- - - - -</td>
<td>• Manifold, three-way valve, Iso-Flo, SS</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>981 131</td>
<td>• Screw, hex head, 10-32 x 0.625 in., zinc</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 7-6**  Air-operated valve
### Male Couplings

See Figure 7-7.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>130 309</td>
<td>Coupling, male</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>942 112</td>
<td>O-ring, hotpaint, 0.250 x 0.500 x 0.125 in.</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>130 343</td>
<td>Washer, flat, 0.625 x 0.390 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>940 150</td>
<td>O-ring, hotpaint, 0.563 x 0.688 x 0.063 in.</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>5</td>
<td>900 046</td>
<td>Ball, 302/316 SS, 0.343-in. dia., 100</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>130 323</td>
<td>Spring, compression, 1.750 x 0.360 OD x 0.040 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>139 389</td>
<td>Pin, valve, safety</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>987 070</td>
<td>Spring, compression, 0.750 x 0.240 OD x 0.026 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>983 025</td>
<td>Washer, flat, 0.375 x 0.187 in., MS, SS</td>
<td>1</td>
<td>B</td>
</tr>
<tr>
<td>10</td>
<td>- - - - -</td>
<td>Adapter, male</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>945 017</td>
<td>O-ring, hotpaint, 3/8-in. tube</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>983 260</td>
<td>Washer, nylon, 0.312 x 0.151 x 0.062 in., nylon</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>983 026</td>
<td>Washer, flat, 0.312 x 0.156 in. MS, SS</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>986 116</td>
<td>Retaining ring, ext., 15</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE A:** Noted parts are available in the Male and Female Coupling Repair Kit, part 139 401.

**B:** This washer was used on earlier versions of the male coupler with a 1/4-in. thru-hole.
**Male Couplings** *(contd)*

Fig. 7-7  Male coupling
**Female Couplings**

See Figure 7-8.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>130 307</td>
<td>Coupling, female</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>941 120</td>
<td>• O-ring, hotpaint, 0.500 x 0.688 x 0.094 in.</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>940 305</td>
<td>• O-ring, PTFE, 0.188 x 0.375 x 0.094 in.</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>941 110</td>
<td>• Post, coupling</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>130 340</td>
<td>• Spring, compression, 1.500 x 1.095 OD x 0.120 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>130 319</td>
<td>• Body, post, coupling</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>945 017</td>
<td>• O-ring, hotpaint, 3/8-in. tube</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>7</td>
<td>900 056</td>
<td>• Ball, black glass, 0.343-in. dia., 50</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>8</td>
<td>130 324</td>
<td>• Spring, compression, 0.750 x 0.360 OD x 0.026 in.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>986 304</td>
<td>• Ring, retaining, internal, 43, push-on, SS</td>
<td>1</td>
<td>A</td>
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</tbody>
</table>

**NOTE A:** Noted parts are available in the Male and Female Coupling Repair Kit, part 139 401.
Fig. 7-8  Female coupling
## Repair Kits

See Figures 7-7 and 7-8.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Note</th>
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<tr>
<td>NS</td>
<td>139 401</td>
<td>Kit, repair, coupling, male and female</td>
<td>AR</td>
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<td>NS</td>
<td>139 403</td>
<td>Kit, repair, pump, Iso-Flo</td>
<td>AR</td>
<td>B</td>
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<tr>
<td>NS</td>
<td>282 188</td>
<td>Seal, packings, rod seal kit</td>
<td>1</td>
<td>C</td>
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<tr>
<td>NS</td>
<td>236 211</td>
<td>Kit, rod seal, pump</td>
<td>1</td>
<td>D</td>
</tr>
</tbody>
</table>

**NOTE A:** See Figures 7-7 and 7-8.
- B: See Figure 7-2.
- C: Inspect the rod nut on the 6 x 6 pump. Use this kit if the rod nut has wrench flats.
- D: Inspect the rod nut on the 6 x 6 pump. Use this kit if the rod nut is round without machined wrench flats.

AR: As Required

NS: Not Shown