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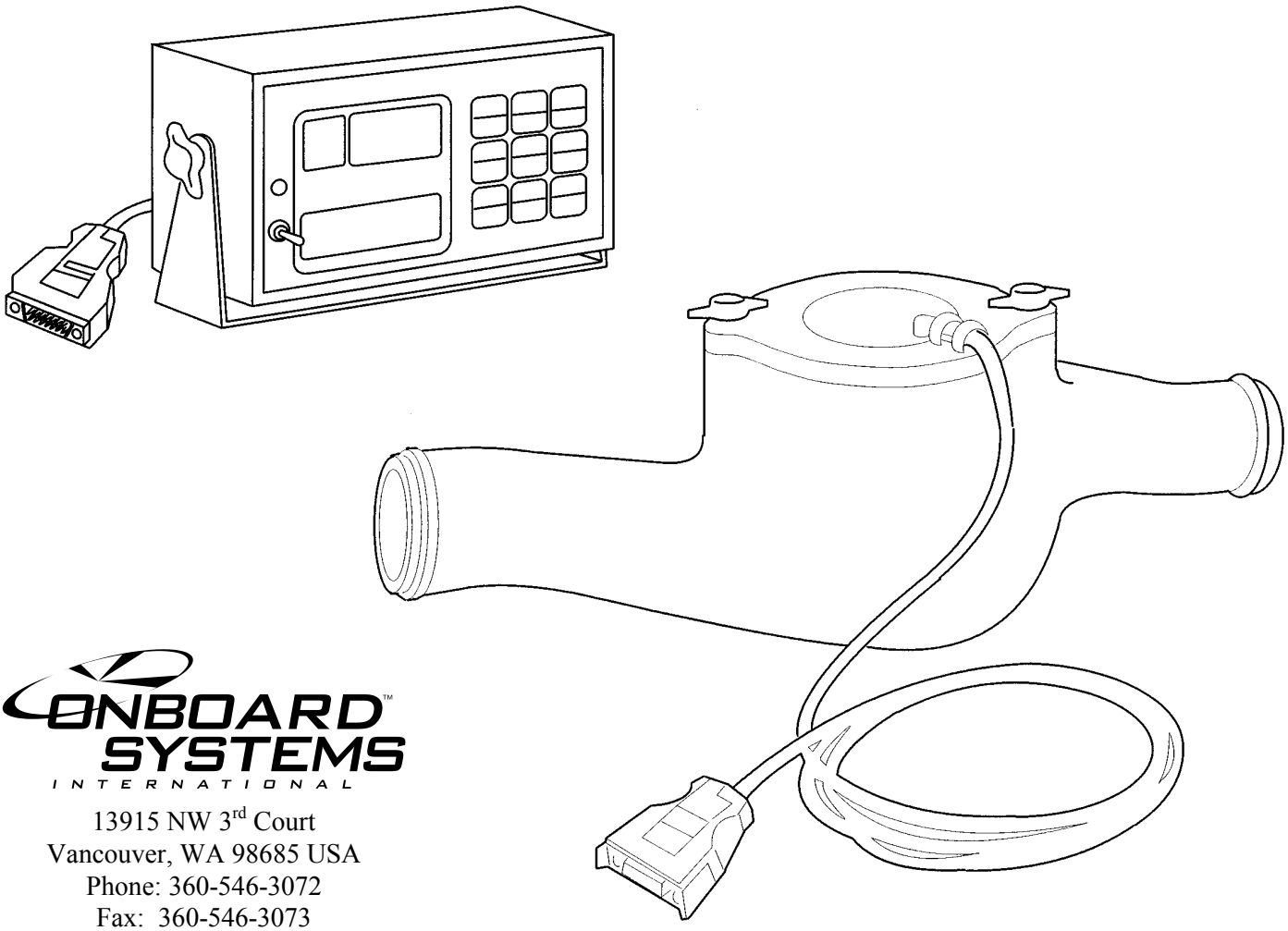
CROPHAWK

OWNER'S MANUAL

MODEL 7



ONBOARD SYSTEMS INTERNATIONAL

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Owner's Manual 120-012-00
October 18, 2007 Revision 5

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Section 1
General Information

Introduction

The CROPHAWK 7 is a flow management information system that compliments the existing aircraft chemical system by giving a cockpit display of the spray system flow readings. The standard system readings are in English units. Systems with Metric readings are also available.

The CROPHAWK flow section system consists of a cockpit mounted "DISPLAY UNIT" and a "FLOW SECTION".

Warnings, Cautions & Notes

The following definitions apply to Warnings, Cautions & Notes used in this manual.

Means that if this information is not observed, serious injury, death or immediate loss of flight safety could occur

Means that there is a risk of injury or degradation in performance of equipment if this information is not observed.

Draws the reader's attention to information which may not be directly related to safety, but which is important or unusual.

Bill of Materials

The following items are included with each system, if shortages are found contact the distributor from whom the system was purchased.

P/N	DESCRIPTION	QUANTITY
120-012-00	Owner's Manual	1
210-063-00	Display Unit	1
*210-xxx-00	Flow Section	1
230-017-00	Display Unit Dropping Resistor	1
235-065-00	Display Unit Mounting Bracket	1
511-003-00	Display Unit Wing Screws	2
**521-001-00	Gaskets	2
**510-023-00	Cap Screws	8
**290-130-00	2-inch Male Hose Adaptors	2
**290-129-00	2 1/2-inch NPT Female Adaptors	2
**290-128-00	3-inch Male Hose Adaptors	2

*Refer to the Ordering Information section in this manual for system part numbers.

**These items are only furnished with the 3-inch systems, and only one type of adaptor is furnished.

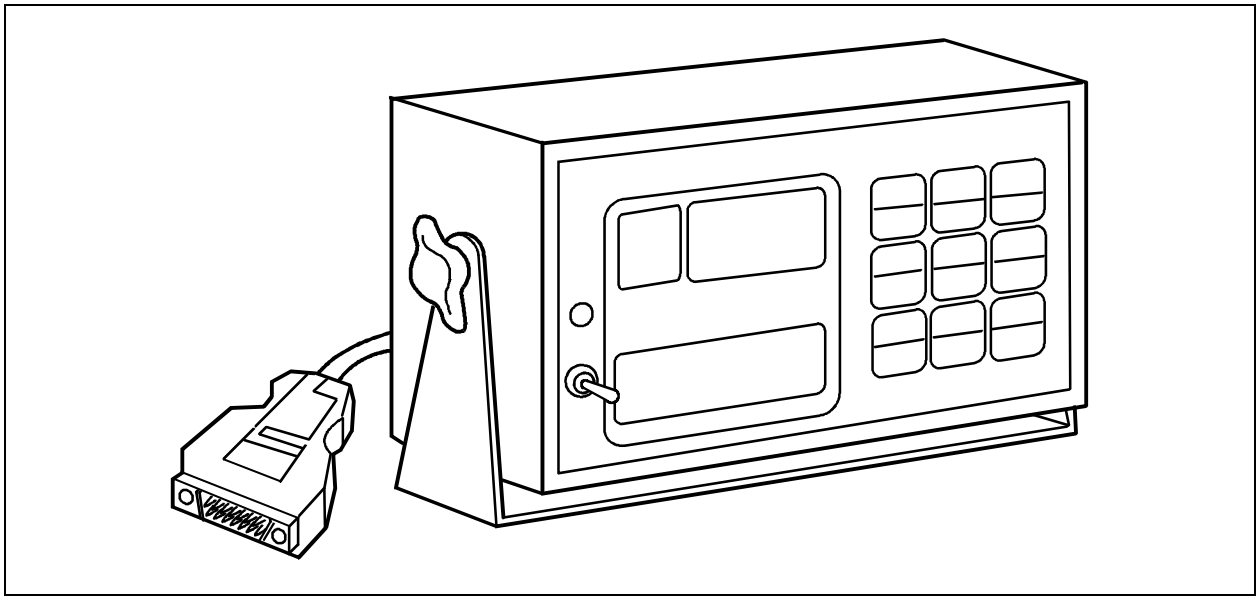
Display Unit Description & Specifications

The display unit is a microprocessor-based instrument that receives data from the operator and the flow section and then computes useful data that is available to the operator on three lighted digital displays.

Table 1-1 Display unit specifications

Operating Voltage	10 to 30 VDC
Current Consumption	300 ma @ 12 VDC
Power off Current Consumption	25 ma @ 12 VDC
Maximum Storage Temperature	158 F (70C)
Minimum Storage Temperature	-40 F (-40C)
Weight	1.1 pounds
Size	3" x 5" x 2"

Figure 1-1 CROPHAWK 7 display unit



Flow Section General Information

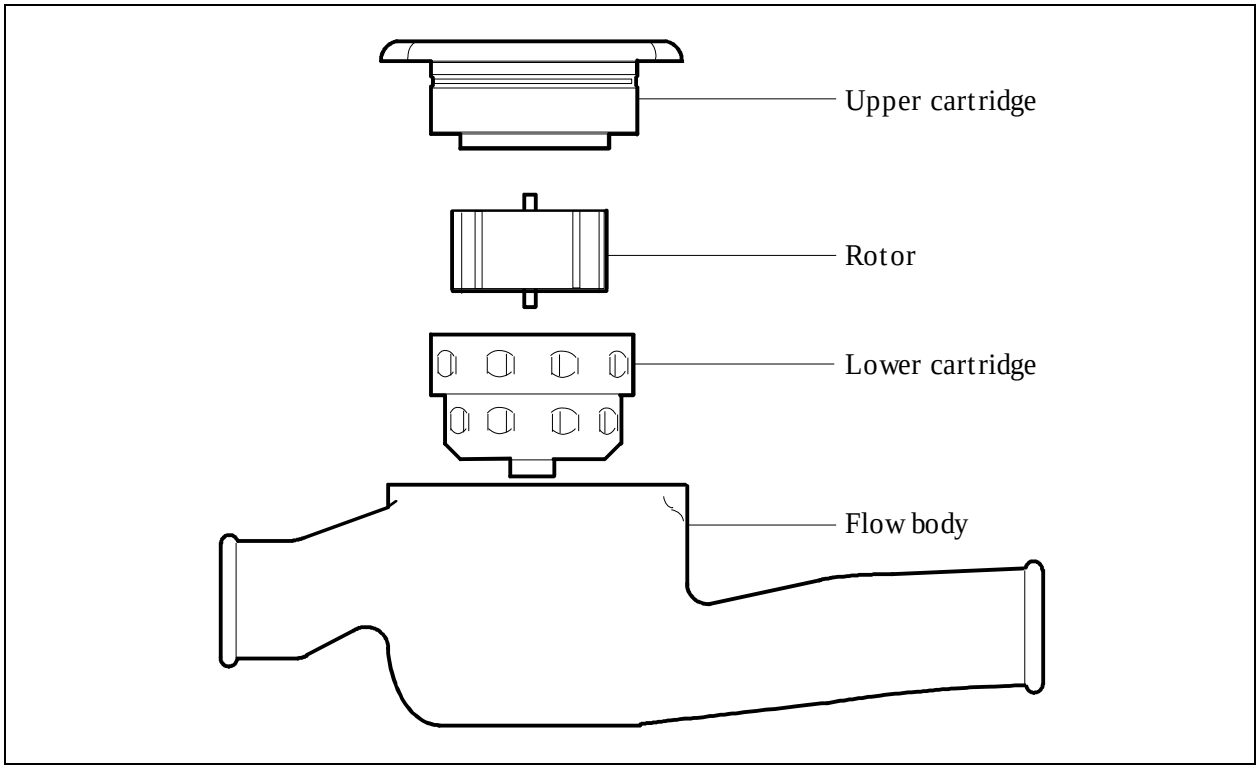
The flow section monitors the flow of chemical. It is inserted into the chemical dispersal line such that all of the chemical to be metered passes through it. As chemical passes through the flow section the rotor turns and a number of electrical pulses are generated. The pulses are passed to the display unit through the connecting cable.

Six flow sections are available: 2-inch aluminum, 2-inch nickel plated aluminum, 2-inch stainless steel, 3-inch aluminum, 3-inch nickel plated aluminum, and 3-inch stainless steel. Each flow section has a number of cartridges available. The combination of the cartridge and the flow body determines how much chemical will pass through the system and be measured accurately.

NOTE

Each cartridge has a range. If flow is passed through the flow section above or below this range, it will not be accurately measured. Ensure that the system supplied is suitable.

Figure 1-2 Typical flow section, showing major sections



- The *upper cartridge* contains an electronic fluid motion detector.
- The *rotor* turns as fluid flows through the flow section. Magnets in each of seven vanes on the rotor create pulses as they pass a stationary point in the upper cartridge. These pulses are counted to determine the rate of flow.
- The *lower cartridge* manipulates the fluid dynamics to control fluid movement and displacement, and determines the flow range of the flow section.
- The *flow body* connects to the fluid system and controls the flow.

Specifying a Flow Section

To determine the correct flow section to use for a particular installation you must consider several variables.

- The *connector size* of the flow body. Select the body that matches the existing plumbing the best.
- The *pressure rating* of the flow body. Select the body that meets operating requirements.
- The *material* of the flow body. Select either 356-T6 aluminum, 356-T6 nickel plated aluminum, or 303 stainless steel depending on chemical requirements.
- The *flow range* of the lower cartridge. Select the cartridge with a midrange rating suitable for most applications. Avoid using a cartridge right at its upper or lower rated limit. If actual flow is above or below the specified range, the flow cannot be accurately metered. Cartridges can be interchanged easily in the field if one does not meet all application needs.

  Use these formulas to calculate the flow rate in gallons per minute (GPM) or liters per minute (LPM).

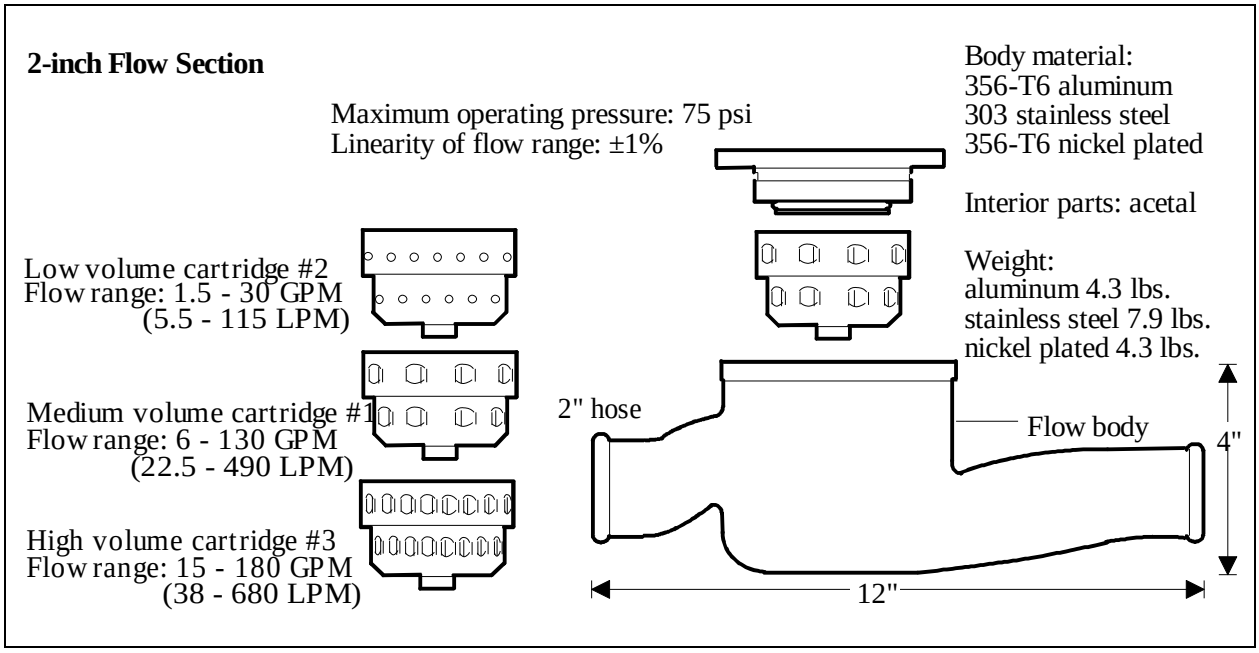
$$\text{GPM} = \frac{\textit{speed in MPH} \times \textit{swath in feet} \times \textit{gallons per acre}}{495}$$

$$\text{LPM} = \frac{\textit{speed in KPH} \times \textit{swath in meters} \times \textit{liters per hectare}}{600}$$

Figures 1-3 and 1-4 show the specifications for the two sizes of flow sections and their accompanying cartridges.

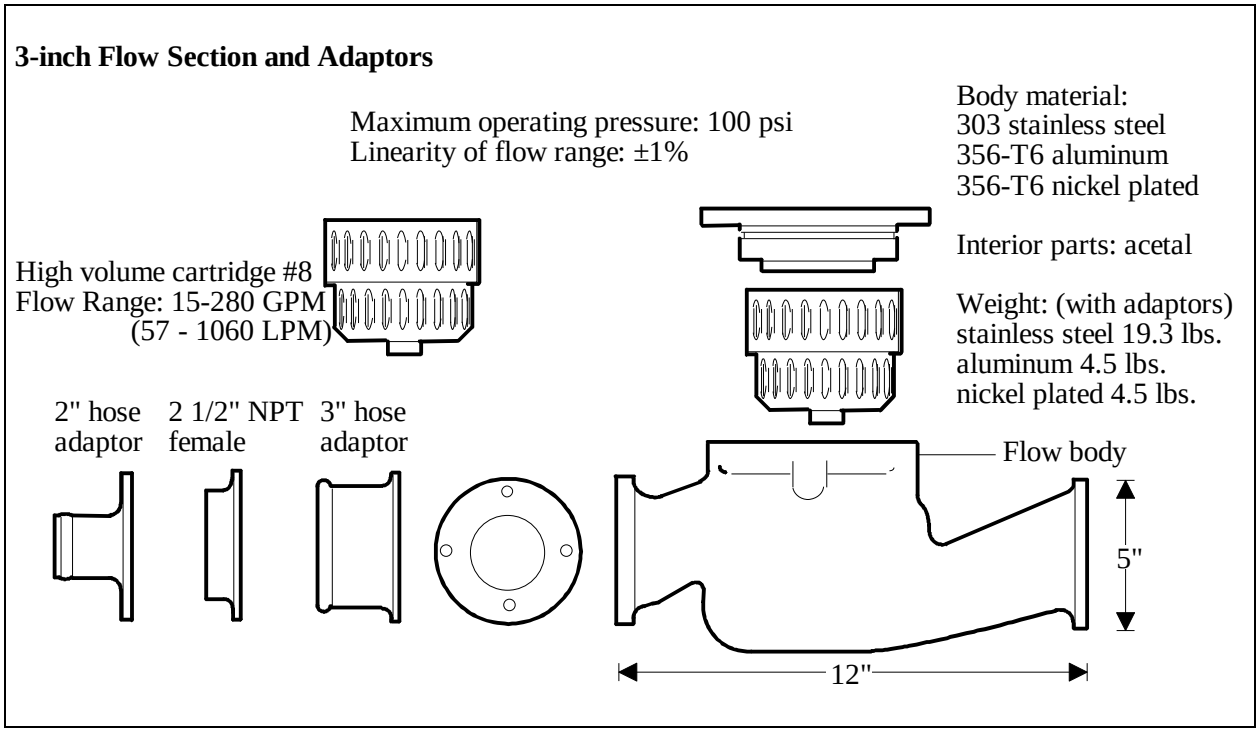
2-inch Flow Section Description & Specifications

Figure 1-3 2-inch flow section description and specifications



3-inch Flow Section Description & Specifications

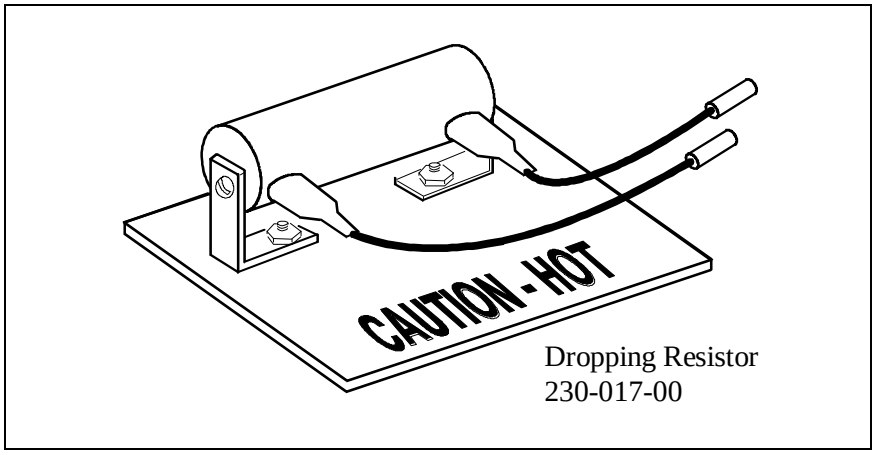
Figure 1-4 3-inch flow section description and specifications



Dropping Resistor

When the CROPHAWK system is installed on a 24-28 VDC electrical system the dropping resistor must be used. The dropping resistor reduces the voltage delivered to the system electronics. Do not use the dropping resistor on 12 VDC electrical systems.

Figure 1-5 Dropping Resistor



Work Switch

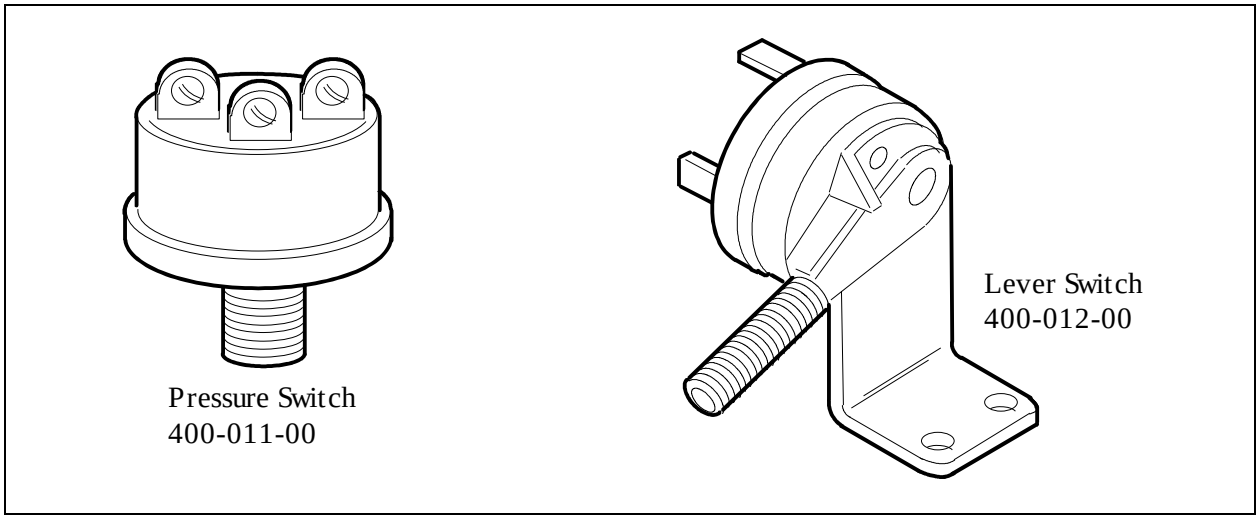
A work switch can be installed to tell the display unit when to count pulses from the flow section.

CROPHAWK systems after S/N 2499 have modified software such that it is no longer necessary to install a work switch to have all of the modes operational.

The computer now watches the RPM of the rotor and when the RPM drops below a fixed point it assumes a pass has ended and it is then able to compute gallons (liters) per pass, time per pass and number of passes. A work switch may still be necessary if the aircraft vibration is such that it causes the flow section rotor to turn while ferrying, or if a good suck back valve and leaky nozzles cause the display unit to count in turns.

The work switch can be a pressure switch which is mounted in the booms or a lever switch that is mounted next to the spray valve handle such that when the valve is open the switch is open. A work switch must be installed such that when the display is to count, the switch is open (wires not connected). Listed below are switches available from the factory.

Figure 1-6 Work switches



Section 2
Installation Instructions

Unpacking Inspection

After unpacking the components of your CROPHAWK 7 system, check each component against the packing list to ensure that you have received the correct configuration. If you find an error, notify the distributor immediately.

Inspect the components for evidence of mishandling or damage. All parts packaged at the factory were carefully tested, inspected, and packed. If damage is evident, do not proceed with installation. Instead, file a claim with the carrier and notify the distributor from whom the components were purchased. Refer to Returning a System to the Factory in the Trouble Shooting section of this manual for more information about returning a system or component.

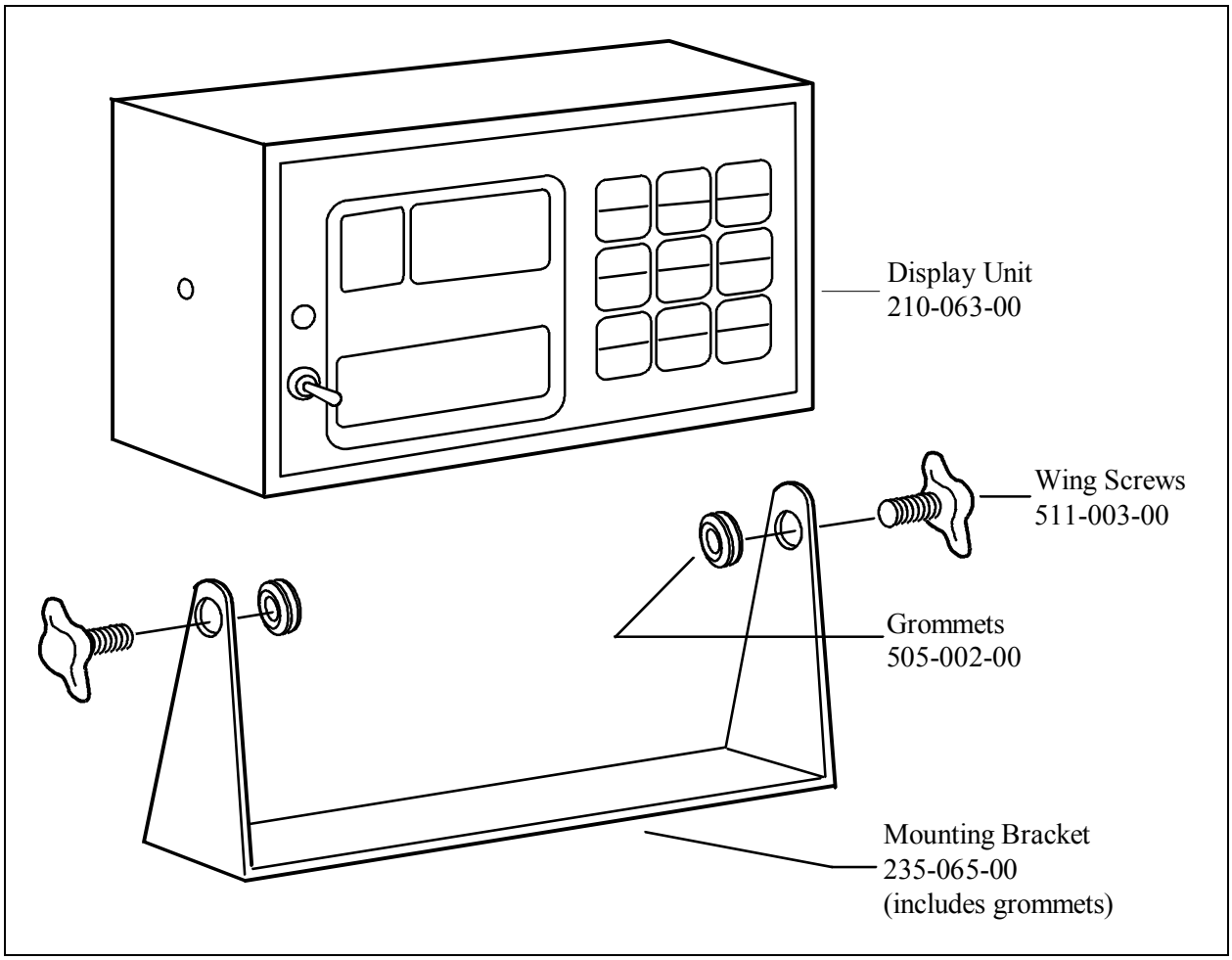
Display Unit Installation

Mount the display unit in a location that allows a comfortable viewing angle during operation. Since input may be made during operation, the display unit should be within easy reach.

NOTE

To avoid potential electrical noise interference problems do not ground the display unit. Use the mounting bracket with the insulation grommets.

Figure 2-1 Display unit with mounting bracket and wing screws



Flow Section Installation

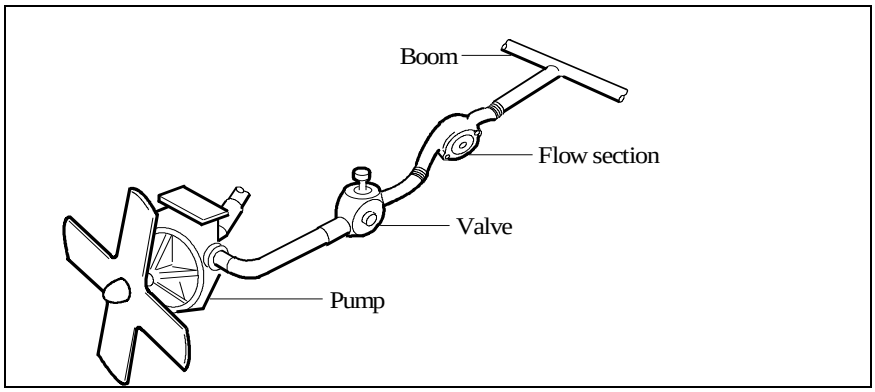
NOTE

Before installing the flow meter, ensure that its specifications for flow rate, capacity, and material are appropriate given the maximum operating pressure of the dispersal system and the chemical used. Refer to Flow Section Description & Specifications in the General Information section of this manual.

Before installing the flow section, examine the spray system to determine the best location for the flow section. Figure 2-2 shows a typical installation. Follow these general guidelines for all installations.

- Locate the flow section so that **all** of the chemical going to the spray booms passes through the section.
- Orient the flow section so that chemical flows in the direction of the arrow cast on the flow body. If it is more convenient, the flow section can be mounted on its side.
- Allow sufficient clearance so that the cartridge can be easily changed or removed.
- Locate the flow section as far as possible from control valves, elbows, and other turbulence-generating constructs.
- Mount the flow section securely to reduce excessive vibration.
- Double clamp all hose connections.
- After initial installation and before operating the system with chemicals, test connections by bringing the system slowly and cautiously up to operating pressure using **water only**. Watch for leaks and other problems.

Figure 2-2 Typical flow section installation

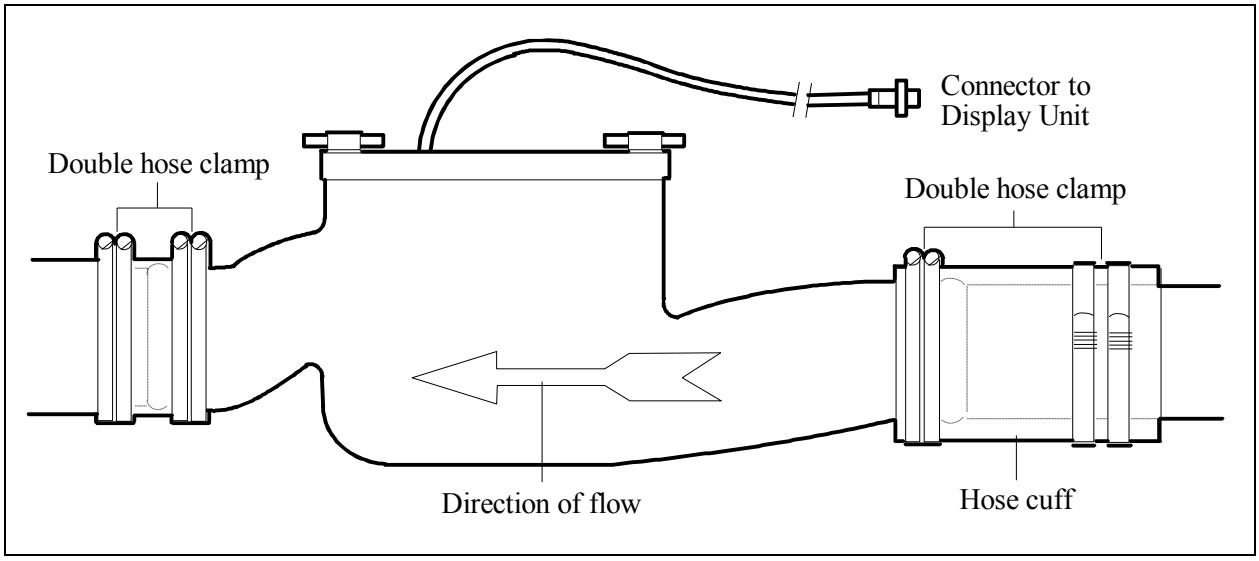


2-inch Flow Section Installation

Follow these guidelines for installing a 2-inch flow section. Refer to Figure 2-3.

- The maximum system pressure with this flow section is **75 psi**.
- The flow section has 2-inch male hose barbs. Use a short section of suitable hose to connect it to the spray system.
- Use double hose clamps to secure each end, as shown.

Figure 2-3 2-inch flow section installation

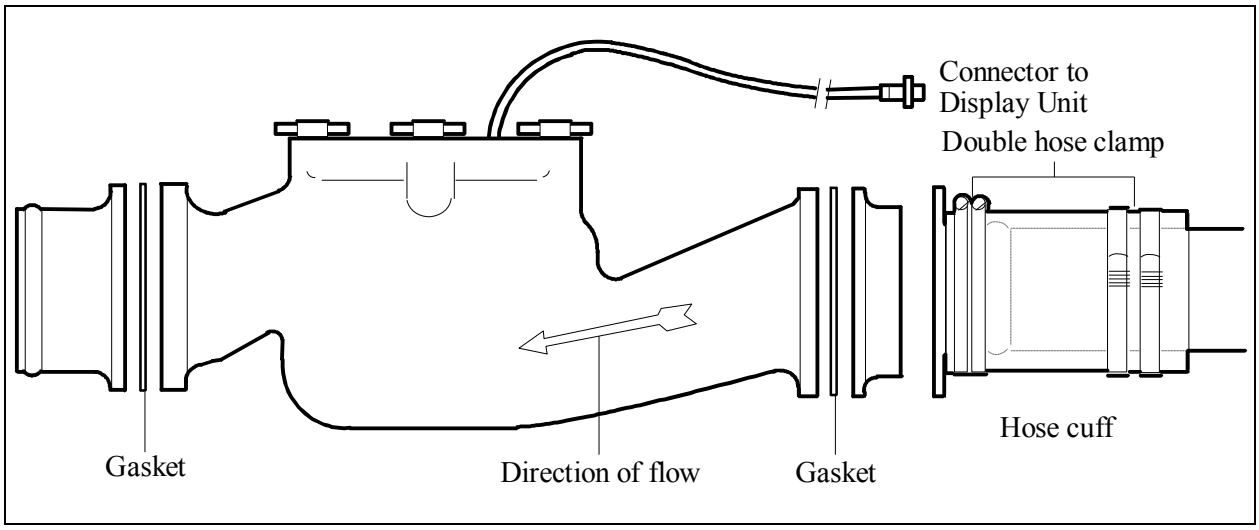


3-inch Flow Section Installation

Follow these guidelines for installing a 3-inch flow section. Refer to Figure 2-4.

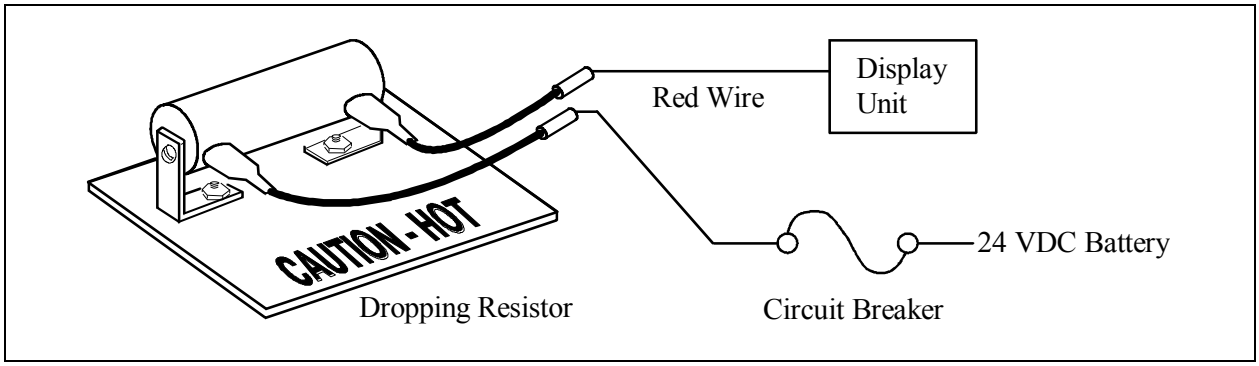
- The maximum system pressure with this flow section is **100 psi**.
- This flow section is available with one of the following connectors.
  - 2 1/2-inch female NPT threaded adaptor. If necessary, use bushings to mate with pipe of a different size. Use a good grade of thread sealant to prevent leaks.
  - 2-inch or 3-inch male hose adaptor. Use double hose clamps to secure each end.

Figure 2-4 3-inch flow section installation



Dropping Resistor Installation

Figure 2-5 Typical dropping resistor installation



Securely mount the dropping resistor by drilling appropriate holes in the metal base plate. Locate it in a ventilated area, away from other lines, wires, insulation, plastics or loose materials that may come in contact with the resistor. The resistor will become hot in use.

NOTE

Do not use the dropping resistor on 12 VDC electrical systems. Do not use with other voltage dropping devices.

Electrical Connections

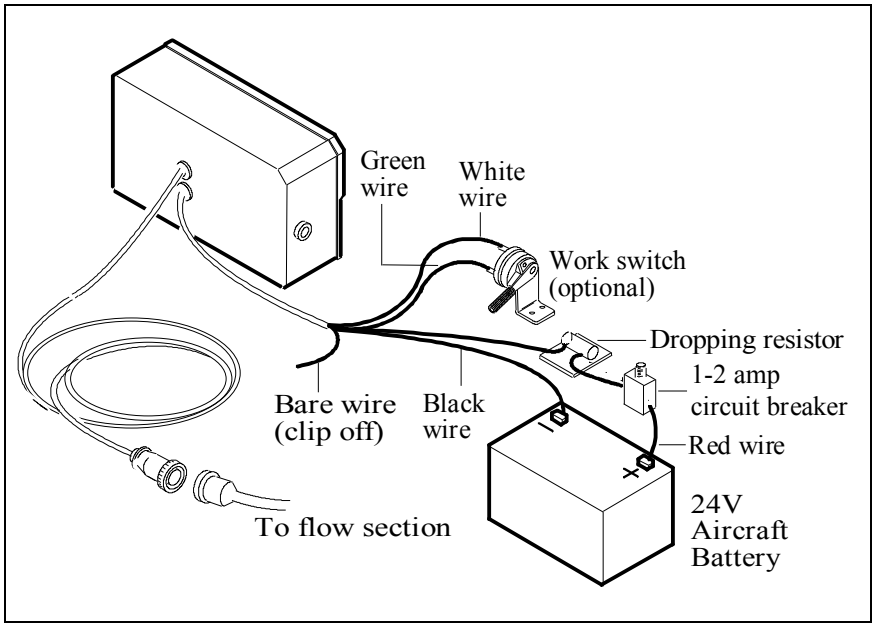
- To help eliminate electrical noise problems, make power connections directly to the battery with 18- or 20-gauge wire.
- Solder all wire connections with rosin-core solder to ensure that they remain tight and corrosion-free.
- The most common cause of system failure is damaged electrical cables. Route the cables so that they are protected from tension, shearing, and sawing. Secure them so that they are not subject to unnecessary bending and vibration.

Two cables extend from the back of the display unit, as shown in Figure 2-6. One, the power and switch cable, ends in five separate wires. The other, the flow section connector, plugs into a connector coming from the flow section.

NOTE

When the display unit power switch is in the down position the displays are not active but the memory section continues to be powered by the aircraft battery. If the system will not be used for several days it should be disconnected from the battery.

Figure 2-6 Electrical connections



1. Working first with the power and switch cable, clip off the bare, uninsulated wire. This wire is not used.

2. If desired, connect the optional work switch. To do this refer to Work Switch Installation in this section.

   If you are not installing a work switch, separate the green and white wires and tape them.

NOTE

The display unit will not count when the green and white wires are tied together or are touching conductive material.

3. Connect the black wire to the negative (–) side of the battery. Do **not** connect this wire to the aircraft frame.

4. Connect the red wire through a 1 amp circuit breaker or fuse to the positive (+) side of the battery and label it "CROPHAWK". In a 24 V aircraft electrical system use a dropping resistor. Refer to Dropping Resistor Installation in this section.

5. Now plug the flow section connector into the connector coming from the flow section.

Work Switch Installation

A normal CROPHAWK installation does not require a work switch. However, if a work switch is desired, refer to Work Switch in the General Information section of this manual. A typical installation would be a pressure activated switch located in the boom or a lever switch connected to the valve handle.

The pressure switch has three terminals: NC (normally closed), NO (normally open) and C (common). The green and white wires are attached to the NC terminal and the C terminal. It makes no difference which wire is connected to which terminal.

NOTE

Never connect the green and white wires to aircraft voltage.

Connect the green and white wires to the lever switch such that when the display unit is to count, the switch contacts are open (wires not connected), and when the display unit is not to count, the switch is closed. If a work switch is not installed, tape and separate the wires.

NOTE

The display unit will not count when the green and white wires are tied together or are touching conductive material.

FAA Paper Work

In the USA fill in FAA form 337 and make the appropriate aircraft log book entry.

FAA Follow-On Approvals

The installation of the CROPHAWK is FAA approved for those aircraft listed on the STC certificate. Follow-on approvals are possible by amendment to the STC or field approval on a FAA form 337. As the CROPHAWK installation is designed basically for external flow systems, generally described in Flow Section Installation (refer to the Installation Instructions section of this manual), and does not effect any primary aircraft systems, it readily lends itself to the field approval process. The applicant or installing agency requesting a follow-on approval should contact either Onboard Systems or FAA Engineering, ANM 190S (206) 227-2592 in order to:

1. Obtain verification of the CROPHAWK equipment approval status,
2. Discuss any problem areas or safety issues related to the installation of the CROPHAWK on the follow-on airplane,
3. Discuss what certification and air worthiness assessments should be made for such an installation.

NOTE

The above statement is based upon the follow-on air worthiness approval philosophy of AC 20-101C, paragraph 10.b., dated 9/12/88 for Omega/VLF installation approvals.

The following letter was prepared by FAA Engineering and distributed to help facilitate follow-on approvals.

U.S. Department
of Transportation
**Federal Aviation
Administration**

**Transport Airplane Directorate
Aircraft Certification Service**

1601 Lind Avenue S.W.
Renton, Washington 98055-4056

MAR 22 1993

In Reply
Refer To: 93-190S-170

Onboard Systems
11212 NW. St. Helens Road
Portland, Oregon 97231

Gentlemen:

In response to your request for our support in facilitating Coordinated Engineering Field Approval of your CROPHAWK spray system in agricultural airplanes, we initiated the issuance of the following message released to all Flight Standards District Office (FSDO) managers in an AFS-300 Memorandum dated March 18, 1993:

> The Renton, Washington, Aircraft Certification Office, ANM-190S, has issued Supplemental Type Certificate (STC) No. SA5783NM, approving the installation of the CROPHAWK spray monitoring system in Schweizer Aircraft (A/C) Model G-164A, Ayres A/C Model S-2R, and PZL-Mielec A/C Model PZL-M18 agricultural airplanes.
>
> In processing this STC, it was determined that the change was insignificant from a safety standpoint for the aircraft models reviewed. This installation does not impose significant safety concerns because it is mounted under the fuselage of these airplanes.
>
> Guidance for field approvals and installation of STC's can be found in FAA Order 8300.10, Airworthiness Inspector's Handbook, volume 2, chapter 1. Field approvals should be considered on similar makes and models to those covered on the STC's.

If we may be of further assistance, please do not hesitate to contact us.

Sincerely,

A. J. Pasion
Manager, Special Certification Branch
Seattle Aircraft Certification Office

STC

United States of America
Department of Transportation — Federal Aviation Administration

Supplemental Type Certificate

Number SA5783NM

This certificate, issued to Onboard Systems

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part * *of the* * *Regulations.*

Original Product — Type Certificate Number: * See Attached Approved Model List (AML)
Make: * No. SA5783NM for list of approved aircraft
Model: * models and applicable airworthiness regulations

Description of Type Design Change: Fabrication of Onboard Systems Model 7 CROPHAWK Spray Flow Measuring System in accordance with FAA Approved Onboard Systems Master Drawing List No. 155-018-00, dated August 10, 1992, or later FAA approved revision; and, Installation of this system in accordance with FAA approved Onboard Systems Owners Manual No. 120-012-00, Revision 2, dated August 10, 1992, or later FAA approved revisions. Inspect the flow measuring system in accordance with Section 7 of Onboard Systems Owners Manual No. 120-012-00, dated August 10, 1992, or later FAA approved revision.

Limitations and Conditions: Approval of this change in type design applies to only those agricultural airplane models listed on AML No. SA5783NM, dated October 29, 1992, or later FAA approved revision. This approval should not be extended to aircraft of these models on which other previously approved modifications are incorporated unless it is determined by the installer that the relationship between this change and any of those other previously approved modifications, including changes in type design, will introduce no adverse effect upon the airworthiness of that aircraft. A copy of the Certificate, Continuation Sheet No. SA5783NM and AML No. SA5783NM must be maintained as part of the permanent records of the modified aircraft.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: August 23, 1992
Date of issuance: October 29, 1992

Date reissued:
Date amended:

By direction of the Administrator

(Signature)
Manager, Special Certification Branch
Seattle Aircraft Certification Office
(Title)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

This certificate may be transferred in accordance with FAR 21.47.

FAA Form 8110-2 (10-68)

FAA APPROVED MODEL LIST (AML) NO. SA5783NM

FOR

ONBOARD SYSTEMS

Issue Date: October 29, 1992

ITEM	AIRCRAFT MAKE	AIRCRAFT MODEL	ORIGINAL TYPE CERTIFICATE NUMBER	CERTIFICATION BASIS FOR ALTERATION	FAA SEALED DRAWING/ DRAWING LIST		AFM SUPPLEMENT NO. AND DATE	AML AMENDMENT DATE
					NUMBER	REVISION NO. AND DATE		
1	Schweizer	G-164A	1A16	CAR 8.10(a)(1) effective 10/11/50, and CAM 8 Appendix B, as amended 3/19/57, Restricted Category	Onboard # 120-012-00	Revision 2 August 10, 1992	None	NC
2	Ayres Corp.	S-2R	A4SW	CAR 8 Effective 10/11/50, Restricted Category	"	"	"	"
3	PZL-Mielec	PZL-M18	A47EU	FAR 21.29, FAR 21.25(a)(1) using the airworthiness requirements of FAR Part 23, effective 2/1/65, including amendments 23-1 through 23-16, 11/19/73	"	"	"	"

FAA Approved: _____

Manager, Special Certification Branch
Seattle Aircraft Certification Office

Date: Oct 29, 1992

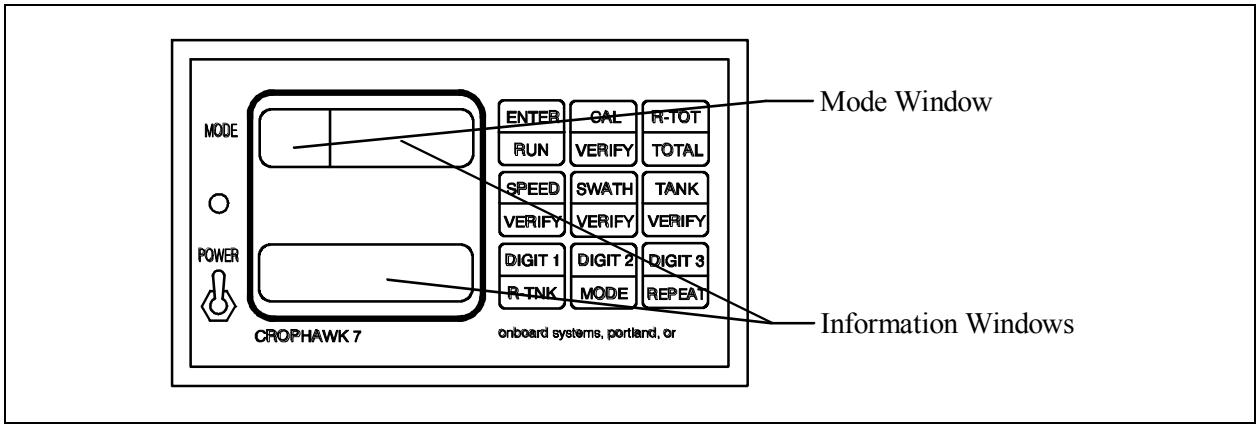
Section 3
Operation Instructions

Power Up

After the display unit and flow section have been correctly installed the circuit breaker can be activated and the display should come to life when the power switch is moved to the up position. When the switch is in the down position the displays are not active but the memory section continues to be powered by the aircraft battery. If the system will not be used for several days it should be disconnected from the battery.

Displays

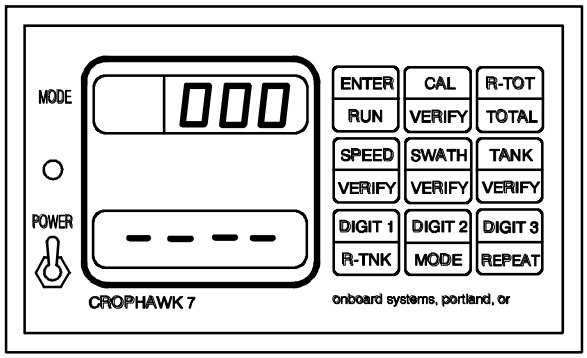
Figure 3-1 Display



The display unit has three display windows; two information windows and one mode window. The information windows display entered and calculated data to the operator. The mode window displays a code that tells the operator what is being displayed in the upper information window.

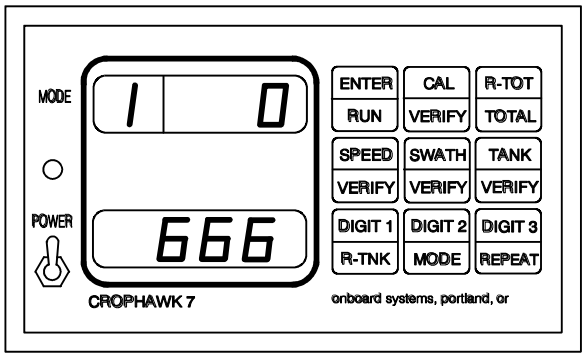
When the mode window is blank the operator can enter data into the unit, i.e. speed, swath, tank quantity, and calibration code. When the mode window is blank the system is referred to as being in ENTER, and the display looks like this:

Figure 3-2 Display



When a number is displayed in the mode window the system is in RUN. When in RUN, the system displays data to the operator.

Figure 3-3 Display



The ENTER/RUN key is used to move the system between ENTER and RUN.

Keys

The display unit is equipped with a power switch and 9 keys or buttons. Each key has two purposes depending if the system is in ENTER or RUN. If the system is in ENTER the label on the upper half of the key is active. If the system is in RUN the label on the lower half of the key is active. Note the keys are color coded to correspond with the ENTER/RUN key. The keys are activated by pressing gently in the center of the key.

ENTER (Entering Data)

Data can be entered into the display unit only when the system is in ENTER. If the system is not in ENTER press the ENTER/RUN key. Data is entered into the system by first placing a number in the upper information window using the digit keys. To enter a number press and hold a digit key. Note the appearance of a number in the upper display. The procedure is to hold the key until the desired number appears and then release the key. Use each of the digit keys to complete the desired number. After a number is displayed in the upper information window the system must be told what this number represents, this could be air speed, swath, tank or the calibration code. If the displayed number is air speed, press and release the SPEED key. The display will blink to indicate the number has been entered into the system memory. If an incorrect number is entered repeat the process, the system only keeps the last entered number.

NOTE

The data can be entered in any order, i.e., swath could be first then tank etc.; the order is not important.

Entering Air Speed

Air speed is a required input if gallons per acre (liters per hectare) or average gallons per acre (average liters per hectare) are needed. Speed is entered in miles per hour for English systems and kilometers per hour for Metric systems. The procedure is to enter a number in the upper display with the digit keys and then press and release the SPEED key.

Entering Swath

Swath is a required input if gallons per acre (liters per hectare) or average gallons per acre (average liters per hectare) are needed. Swath is entered in feet for English systems and meters for Metric systems. The procedure is to enter a number in the upper display with the digit keys and then press and release the SWATH key.

Entering the Quantity Remaining in the Tank

If the quantity loaded into the aircraft is entered, the system will keep track of the remainder and display it on the lower display when in RUN. The quantity is entered in gallons for English systems and liters for Metric systems. The procedure is to enter a number in the upper display with the digit keys and then press and release the TANK key.

Entering the Calibration Code

The calibration code is a required input. The code tells the system what cartridge is being used and how many pulses represent a gallon (liter). The procedure is to enter a number in the upper display with the digit keys and then press and release the CAL key.

The factory calibration code is on a sticker located on the front of the display unit. Use the calibration number that matches the cartridge being used, medium volume (100 series), low volume (200 series), high volume (300 series). Refer to the Calibration Procedures section of this manual for a complete discussion of calibration..

Garbage In, Garbage Out

Garbage in, garbage out is true when entering data into the CROPHAWK. The data is only as good as the data entered.

It is possible to enter a calibration code that would make the system think that 1 gallon was 2 or 10. It is essential that accurate data be entered for calibration, speed, and swath. If this is done the system can be a valuable aid.

RUN (Displaying Data)

After all data is entered, press and release the ENTER/RUN key. The system will go to RUN and be in mode 1 or gallons per minute (liters per minute if Metric). The tank quantity entered now appears in the lower display.

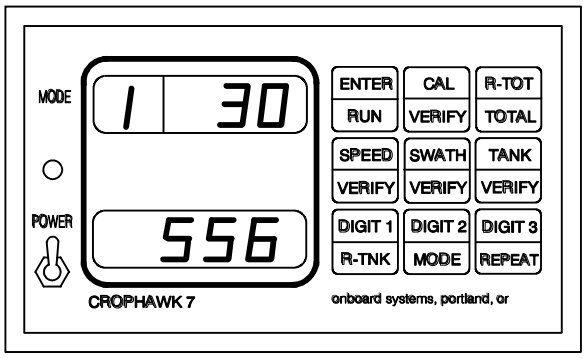
The mode key moves the system from one mode to another. If the system is in mode 1 pressing and releasing the MODE key will move the system to mode 2 and so on.

When spraying begins data will appear in the upper information window.

NOTE

As a gallon (liter) is sprayed out it is deducted from the tank quantity.

Figure 3-4 Display



The reading is 30 GPM (LPM)

Verification

Any time the system is in RUN, a check can be made to ensure the proper speed, swath, tank, and calibration numbers were entered. To verify the data, press and release the SPEED/VERIFY key and the last speed entry will be displayed for 3 seconds. The same procedure can be followed to verify the swath entry, tank quantity, and calibration number.

If the data entered is not correct, go to ENTER and re-enter the correct data as previously described.

NOTE

If tank is verified followed by a cycle of "Enter" and "Run." The tank quanity will be added to the remaining quanity in the lower display window.

Section 4
Display Description

Gallons per Minute (Liters per Minute)

Name	Gallons per minute (Liters per minute)
Mode number	1
Display format	000 or 00.0*
Resetable	No

This value is the volume in gallons (liters) per minute moving through the flow section. The display reads in full gallons (liters).

* For low volume work, the display reads in tenths.

Gallons per Acre (Liters per Hectare)

Name	Gallons per acre (Liters per hectare)
Mode number	2
Display format	0.00 to 00.0
Resetable	No

This value is the rate of spraying in gallons per acre (liters per hectare). It is calculated from the speed and swath setup data values and the gallons (liters) per minute measured by the flow section.

$$GPA = \frac{GPM \times 495}{\text{speed in MPH} \times \text{swath in feet}}$$

$$LPH = \frac{LPM \times 600}{\text{speed in KPH} \times \text{swath in meters}}$$

Gallons per Pass (Liters per Pass)

Name	Gallons per pass (Liters per pass)
Mode number	3
Display format	00.0
Resetable	Automatic

This value indicates the amount of chemical in gallons (liters) that was dispersed since the time the control valve was last opened. When the valve is closed, the last value is displayed until the valve is opened again, and the process starts over again.

Average Gallons per Acre (Average Liters per Hectare)

Name	Average gallons per acre (Average liters per hectare)
Mode number	4
Display format	0.00 to 00.0
Resetable	Yes

This value is a calculation of the gallons (liters) sprayed divided by the acres (hectares) sprayed. Reset the display by pressing the RESET key.

Number of Passes

Name	Number of passes
Mode number	5
Display format	000
Resetable	Yes

This value is a count of the number of passes. The beginning of a pass or swath is triggered by fluid flowing through the flow section or by closing the work switch. The value displayed is the count since the display was last reset. Press the SPEED and SWATH keys at the same time while mode 5 is displayed to reset the display.

Time per Pass

Name	Time per pass
Mode number	6
Display format	000
Resetable	Automatic

This value indicates the amount of time that has passed since the control valve was last opened. When the valve is closed, the last value is displayed until the valve is opened again, and the process starts over again.

Total Spray Time

Name	Total spray time
Mode number	7
Display format	00.0 to 000
Resetable	Yes

This value is an accumulation of all the time per pass (mode 6) since reset. The reading is in tenths of minutes up to 99.9 minutes and then it reads in full minutes up to 999 minutes. Press both the SPEED and SWATH keys at the same time while in RUN and while mode 7 is being displayed to reset the display.

Tank Quantity Remaining

Name	Tank quantity remaining
Display location	Lower display
Display format	0000
Resetable	Yes

This value is the amount of chemical remaining in the tank in gallons (liters). The value decrements as flow is measured moving through the flow section. Pressing the REPEAT key will cause the last entered tank quantity to be repeated and added to the number displayed in the lower window. This feature is used when the aircraft is repeatedly filled with the same quantity. The pilot can push the REPEAT key to repeat the last entry rather than going into ENTER and re-entering the quantity.

Each time the REPEAT key is pressed the last entered tank value will be added to the display. If the key was pushed 3 times in succession, the display would be 3 times the last tank entry.

Press the R-TNK key while in RUN to reset the display.

Total Sprayed

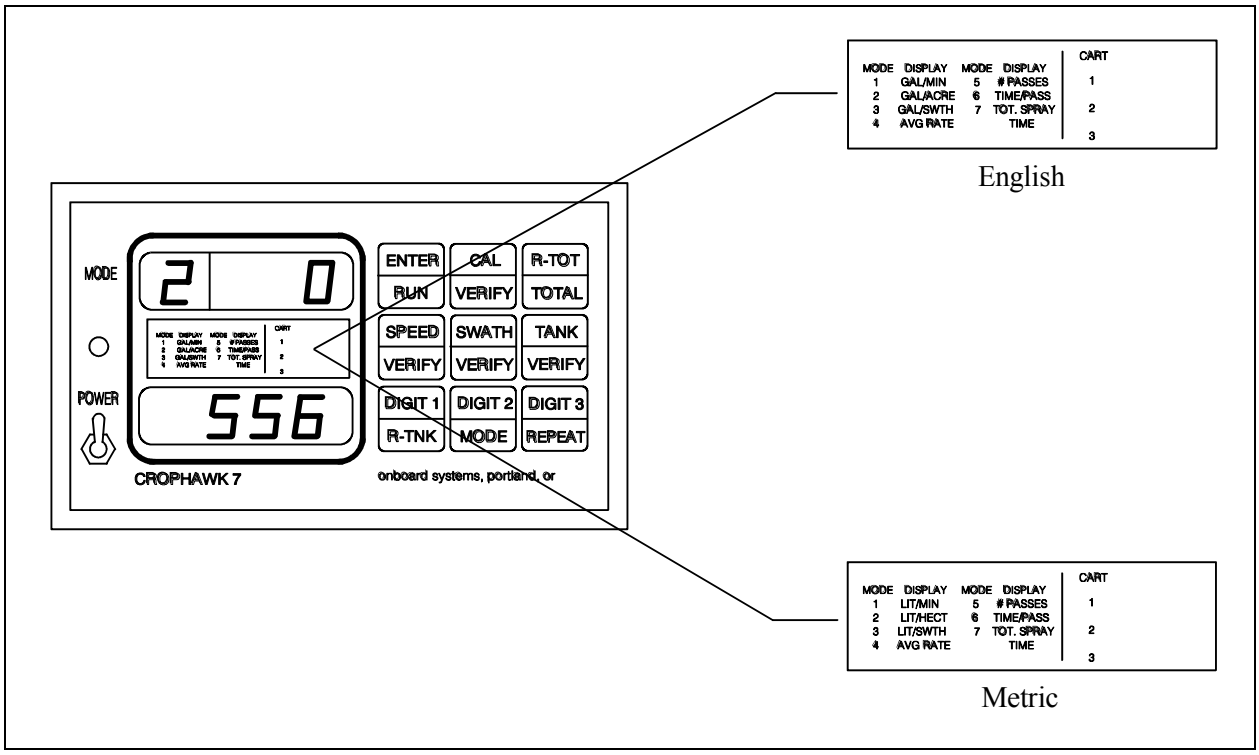
Name	Total sprayed
Display location	Lower display
Display format	0000
Resetable	Yes

This value is an accumulation of all gallons per pass (liters per pass) since the display was reset. This mode is displayed in the lower display by pressing the TOTAL key while in RUN. The display will hold for 3 seconds after the key is released and then revert to the tank quantity remaining display. For longer viewing time hold the TOTAL key down. The display is in full units (gallons or liters). Press the R-TOT key while in ENTER to reset this display.

Mode Label

Located on the front panel of the display unit is a label listing the mode numbers and a brief description of the display. The label also lists up to three calibration codes.

Figure 4-1 Mode labels



Section 5
Error Messages

Error Message Description

Error messages are another means the display unit has of communicating with the operator. Error messages indicate that something is wrong or that a procedure has been incorrectly followed. Error messages are displayed on the upper information window.

Error Message E1.0

Error message E1.0 is displayed when an attempt is made to display GPA (LPH) without having entered air speed. The unit will display the error message for 3 seconds and return to mode 1. The corrective action is go to ENTER and enter air speed and then return to RUN.

Error Message E2.0

Error message E2.0 is displayed when an attempt is made to display GPA (LPH) without having entered swath. The unit will display the error message for 3 seconds and return to mode 1. The corrective action is go to ENTER and enter swath and then return to RUN.

Error Message E4.0

Error message E4.0 is displayed when the value in mode 2 is above 163. The corrective actions would be to increase your speed or swath or to decrease the amount you are spraying (pressure).

Error Message E-30

Error message E-30 is shown on the lower display when the tank quanity goes above the value of 9999. Reset your tank quanity.

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Section 6
Calibration Procedures

Flow Calibration Description

Before attempting to calibrate the system be familiar with the Operation Instructions section of this manual.

A calibration code is a required input if the system is to measure and display flow. The calibration code tells the display unit which flow section and cartridge is installed and compensates for differences in chemical viscosity (a thin chemical will have a code different than a thick one).

The flow section rotor has a magnet in each of its 7 vanes. Fluid passing through the flow section causes the rotor to turn. As the magnets pass a point in the flow section, a pulse is generated. The calibration code tells the display unit how many of these pulses equal a gallon (liter).

The CROPHAWK has been factory calibrated and a calibration number has been placed on the display unit sticker. It should be understood that this code is for water in a system installed under ideal conditions. This code could vary from what might be needed for a thick chemical passing through a flow section installed in a less than ideal installation.

Each cartridge is identified with a single digit number located on the bottom of the cartridge, i.e., 1, 2, 3. This number is the first of the three digit calibration code.

The systems calibration must be verified upon installation and:

- After flow section maintenance
- As a part of regular periodic equipment checks
- When dramatic changes in chemical viscosity occur

Custom Calibration Code

The most difficult part of performing an accurate calibration is selecting a standard to check the flow system against. The accuracy of the CROPHAWK 7 is only as good as the standard with which it is compared. Quantity marks that appear on the hopper are usually not accurate enough to be used as a standard. In addition, most mix tank flow meters are converted oil truck meters and should not be considered as a standard. Thus, the best standard is a carefully hand-filled chemical tank.

Follow this procedure to perform custom system calibration for the particular installation and chemical used.

1. Using a graduated bucket, hand fill the hopper until it is at least half full. Keep a precise count of the exact quantity filled.
2. Mark the level in the tank for future reference and later calibrations.
3. Enter the factory calibration code found on the front panel of the display unit. If the flow section cartridge has been changed use the calibration code supplied with the cartridge.
4. Enter the speed, swath and tank quantity (use the precise hand-filled quantity for this test).
5. Spray until either the tank is empty or the remaining tank quantity display is zero.

6. Calculate the corrected calibration code from the error resulting from the test.

   - If the display reads zero, but chemical is left in the tank, the system is counting too fast and the calibration code needs to be a larger number. For example, if the tank was filled with 100 gallons and the remaining gallons display was set to match, but 10 gallons remain in the tank when the display reads 0, there is a calibration error of 10%. If the original calibration code was 256, the corrected calibration code is:

     $$\frac{256\ (100 + 10)}{100} = 281.6$$

     Because the calibration code must be a whole number, you would rerun the test with a corrected calibration code of 282 or 281.

     In general, to calculate a new calibration code when fluid remains in the tank but the gallons remaining display is zero, use this formula:

     $$\textit{new cal code} = \frac{\textit{old cal code (beg tank qty + end tank qty)}}{\textit{beg tank qty}}$$

   - If chemical runs out before the display reads zero, the system is counting too slowly and the calibration code needs to be a smaller number. Calculate the corrected calibration code using this formula:

     $$\textit{new cal code} = \frac{\textit{old cal code x beg tank qty}}{\textit{beg tank qty + displayed remaining qty)}}$$

   - If chemical runs out about same time the display reads zero, the system is in calibration for this chemical, and no further action is needed.

7. Rerun the test using the corrected calibration number.

8. For future reference, enter calibration test results into Table 6-1.

Table 6-1 Calibration data

Date	Calibration code	Flow rate	Chemical used

Section 7
Maintenance Information

Introduction

Minimum periodic maintenance is required to maintain maximum life and accuracy from the CROPHAWK system. The following procedures should be observed to ensure proper operation.

Display Unit Maintenance

During wet or cold weather, the display unit should be removed or covered to reduce the possibility of water absorption. Even though the display unit is water resistant, extreme temperature changes may cause moisture entry by reduction of internal pressure. Keeping the display unit warm and dry will extend its useful life. Do not open the unit as this will void the warranty. There are no user replaceable parts inside.

Flow Section Maintenance

The flow section consists of two major components, the body and the cartridge assembly containing the rotor. Follow these steps to disassemble the flow section. Refer to figures 7-1 and 7-2.

1. Remove all fluid from the spray system.
2. Remove the wing bolts or clamp holding the cartridge assembly in place.
3. Remove the cartridge assembly with a twisting and pulling motion.
4. Inspect the cartridge assembly for contamination and obstructions.
5. Ensure that the rotor is free to turn by directing slight air pressure through the bottom set of holes on the assembly. **Do not subject the rotor to high RPM.** The rotor should rattle when the cartridge assembly is shaken.
6. If the rotor does not spin freely, disassemble and clean the cartridge assembly as described in Steps 7 – 12. Refer to Figure 7-3.
7. Remove the lower cartridge from the upper cartridge with a twisting and pulling motion.

8. Inspect the rotor to ensure that the magnet on each of the seven rotor vanes is in place and secure. If any are loose or missing, replace the rotor.

9. Inspect the rotor shaft and bushings for wear, and replace, if needed.

10. Clean all the assembly parts thoroughly and ensure that no contaminating substances are between closely fitting parts. Ensure that the mating surfaces between the upper and lower cartridges are free of debris.

11. Reassemble the cartridge assembly by first placing the rotor in the upper cartridge and then placing the lower cartridge over the rotor.

12. Check the rotor end play. An adjustment screw is provided at the base of the cartridge assembly (lower cartridge). The screw must be adjusted whenever a new rotor or cartridge has been installed, and rotor play should be checked periodically and the screw adjusted for rotor wear. If needed, adjust the rotor bearing as described in Steps 13–14.

NOTE

The mating surfaces between the upper and lower cartridge must be free of debris and securely mated before attempting to adjust rotor end play.

13. Turn the rotor adjustment screw clockwise until there is no more end play in the rotor, then loosen the screw 1/2 to 3/4 of a turn.

14. Check that the rotor rattles just slightly when the cartridge assembly is shaken.

⚠ CAUTION

The bearings and rotor shaft can be damaged if the adjustment screw is over tightened.

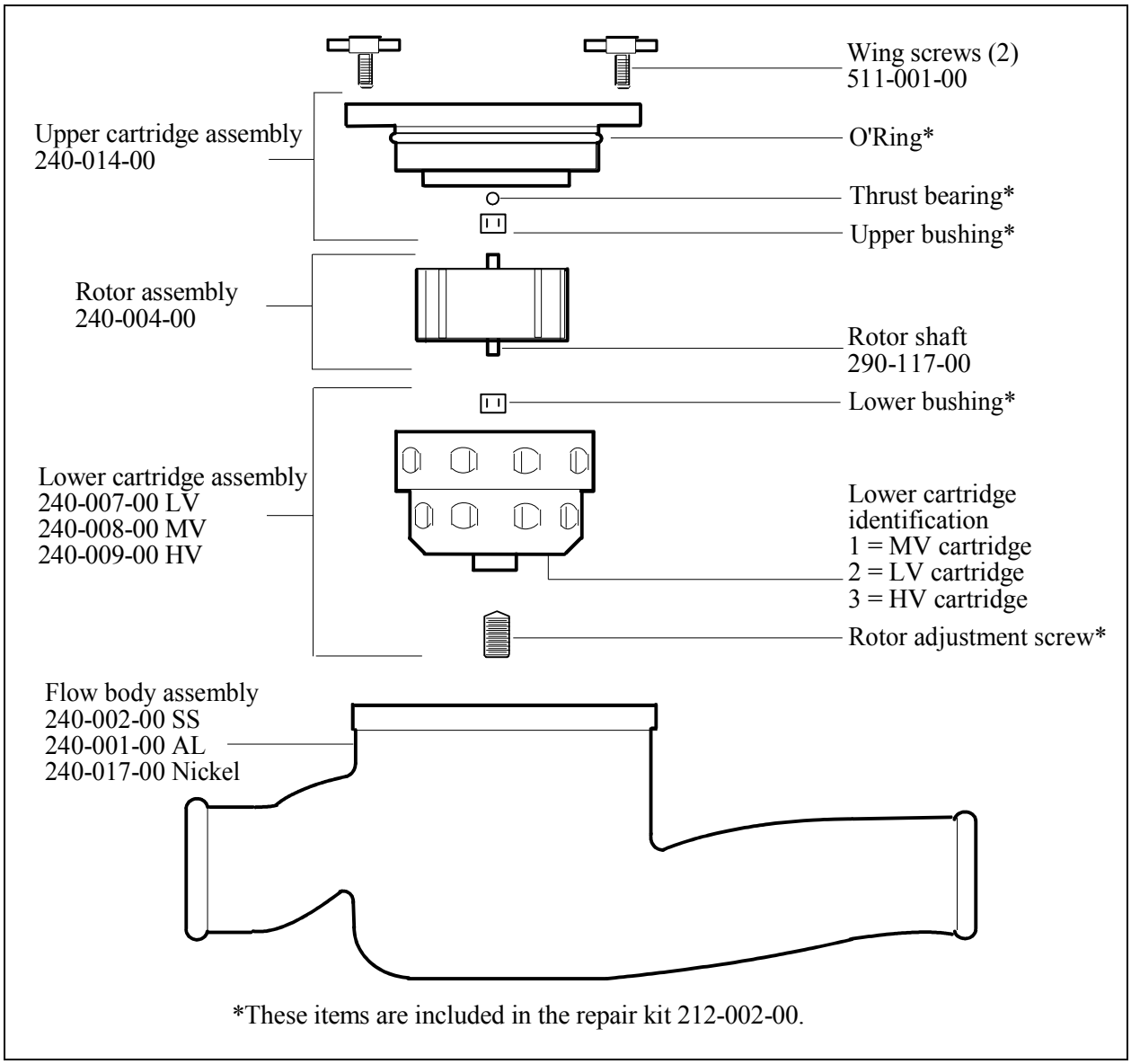
15. Before reassembling the flow section, inspect the O'Ring on the upper cartridge and replace it if it is damaged.

16. Lubricate the O'Ring on the upper cartridge.

17. Clean the flow section, paying particular attention to the O'Ring seal area and the cartridge seat area. Contamination here can cause the system to leak.

18. Reassemble the cartridge assembly and the flow section.

Figure 7-1 2-inch flow section assembly



*These items are included in the repair kit 212-002-00.

Figure 7-2 3-inch flow section assembly

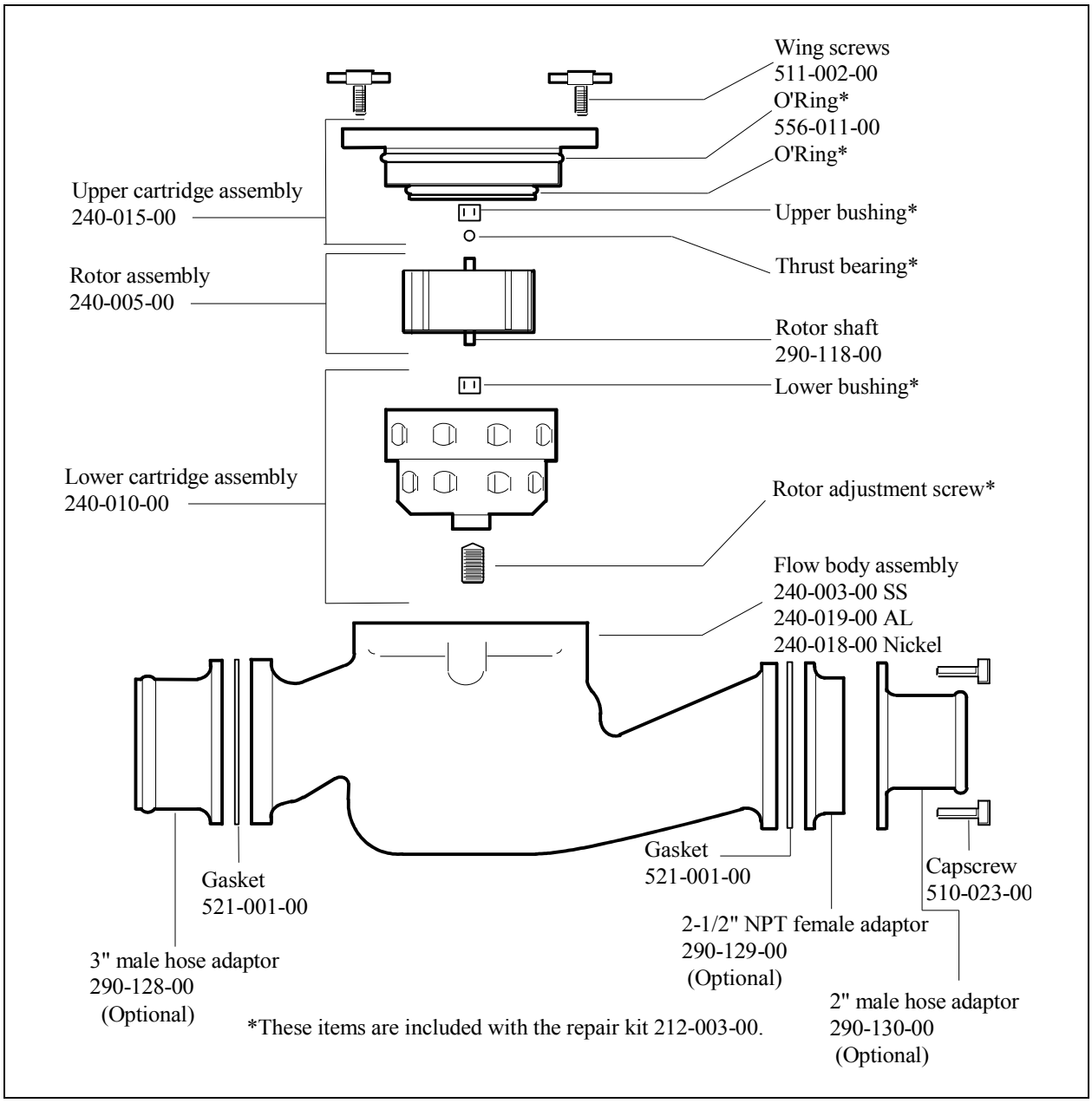
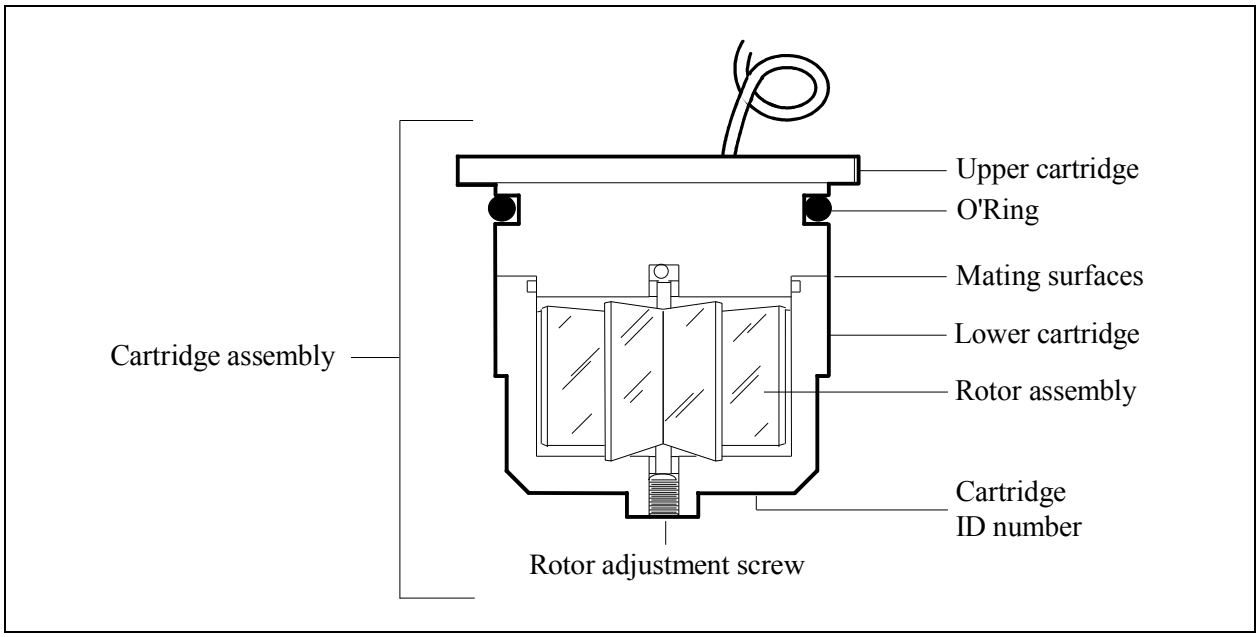


Figure 7-3 Cartridge assembly



Cable and Connector Maintenance

Follow these guidelines for cable and connector maintenance.

- Check cables and connectors periodically for signs of wear. Replace cables that have worn through the foil shield.
- Attempt to identify and correct the causes of cable wear including bending, shearing, and sawing.
- Cover and protect the connectors when not in use to prevent corrosion and mechanical damage to the pins.

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Section 8
Trouble Shooting

Trouble Shooting

PROBABLE CAUSE	DIFFICULTY	CORRECTIVE ACTION
A blown fuse, faulty circuit breaker, damaged power cable, corroded or faulty connections.	The display is blank, the unit appears dead.	Replace the fuse or circuit breaker, check connections for corrosion. Attach the unit to a charged 12 or 24V battery, if no response refer to Returning a System to the Factory in this section.
A momentary burst or absence of electrical power, loose or corroded wires.	The display shows numbers, but they do not change with flow or key closure.	Shut off the display unit power switch for 10 seconds. On some units it may be necessary to trip the circuit breaker or remove the fuse. The long term solution is to ensure that the wires are tight and free of corrosion and install an electrical filter.

PROBABLE CAUSE	DIFFICULTY	CORRECTIVE ACTION
The work switch wires are tied together or touching conductive material. The cable connecting the display unit to the flow section is damaged. The flow section connector is corroded or damaged.	The display does not count when flow is passing through the flow section.	If a work switch is not installed make sure the green and white wires are taped and separated. Check the red LED on the upper cartridge and make sure it is flashing when fluid is passing through the flow section. If the LED is not flashing make sure the flow section rotor can freely rotate and is adjusted correctly. Repair damaged cables and replace connections if corroded or damaged. If the above action does not correct the problem, it is necessary to isolate the cause to the flow section or the display unit. This can be done by replacing either unit with a known operational unit. If this is not possible, refer to Returning a System to the Factory in this section.
The system is not properly calibrated, wrong type of cartridge is being used, wires are not separated from other electrical wires, system picks up power from the same point that other electrical devices do, system is not grounded correctly, display unit touches the airframe.	The flow displays are significantly higher or lower than they should be.	Refer to the Calibration Procedures section to adjust the calibration code. Ensure that the correct cartridge is being used. Physically separate all CROPHAWK wires as far as possible from other electrical wires. Ensure that the CROPHAWK does not pick up its power from the same point that other electronic devices do. Ensure that the system is grounded only at the battery. The display unit must not touch the airframe. Use the display unit isolated mounting bracket.

PROBABLE CAUSE	DIFFICULTY	CORRECTIVE ACTION
The system is not properly calibrated, quantity in the tank is entered into the display unit incorrectly. A good suck back valve and leaky nozzles causes the displayed amount remaining in the tank to be incorrect. Each time chemical goes through the flow section it is counted, regardless of which way it is flowing. The display unit assumes it is going out the booms, when actually it may be going back into the tank. It is possible for some chemical to be measured three times. Once when it went to the boom, again when it was sucked back through the flow section into the tank and again when it was pumped to the boom. This problem is particularly noticeable on jobs with many turns.	The quantity remaining in the tank display runs out before the chemical tank.	Make sure the proper calibration code is entered and the correct quantity was in the tank. The addition of a work switch will prevent the system from counting the suck back chemical. The chemical, however, is still being counted two times. The only good solution is to calibrate the system using the gallons per minute or gallons per acre displays and then fix the nozzles.
The system is not properly calibrated, quantity in the tank is entered into the display unit incorrectly, a sticking work switch. With a sticking work switch the system would begin to spray before the switch would allow the display unit to begin counting. Thus the chemical would run out before the display unit.	The chemical tank runs out before the quantity remaining in the tank display.	Make sure the proper calibration code is entered and the correct quantity was in the tank. Check the work switch and make sure it is not sticking, replace if necessary.

Electrical Noise - An Explanation

Electrical noise is the enemy of micro-electronics. It can cause faulty readings, information to drop from memory, and shorten the life of the unit.

Electrical noise is generated by many of the vehicle components, such as: relays, solenoids, motors, defective alternators, worn starters, and some of the biggest culprits: loose wires and corrosion. Generally, any device that produces a spark will generate electrical noise. The electrical noise is radiated through the wires and through the air. It is picked up by the frame and the electrical wires and they act as an antenna and conduct the noise into the micro-electronic device. Electronic components and micro-electronics have elaborate filters to remove much of the noise before it reaches the circuits. However, no filter can remove noise generated by worn or defective systems.

Returning a System to the Factory

If you need to return a CROPHAWK 7 system or component to the factory, follow these instructions.

1. Write a detailed description of any problem with the system or component. Include information about when the problem first occurred and what action was being performed when the problem occurred (while spraying, when on the ground, then the engine was started, when the radio was keyed, etc.). Indicate whether the problem is intermittent or constant.

2. Be sure to include your name, address, and phone number with the description.

3. Clean the unit and package it carefully to ensure safe transit.

4. Send the unit to the following address with freight, cartage, insurance, and customs prepaid.

   ONBOARD SYSTEMS
   13915 NW 3rd Court
   Vancouver, WA 98685
   USA

   Telephone: 360-546-3072
   Fax: 360-546-3073
   Toll Free: 800-275-0883

Section 9
Ordering Information

CROPHAWK System And Flow Section Ordering Information

Table 9-1 CROPHAWK system and flow section ordering information

Flow Meter Specifications						Flow section part number	System part number
			Cartridge Volume				
Size	Material	Connection	Range	English (GPM)	Metric (LPM)		
2"	Aluminum 356 alloy black anodized	2" hose barb	Low	1.5-30	5.5-115	210-076-00	200-120-00
			Med	6-130	22.5-490	210-077-00	200-121-00
			High	15-180	38-680	210-078-00	200-122-00
2"	Aluminum 356 alloy nickel plated	2" hose barb	Low	1.5-30	5.5-115	210-067-00	200-132-00
			Med	6-130	22.5-490	210-068-00	200-133-00
			High	15-180	38-680	210-069-00	200-134-00
2"	Stainless Steel 303 alloy	2" hose barb	Low	1.5-30	5.5-115	210-073-00	200-123-00
			Med	6-130	22.5-490	210-074-00	200-124-00
			High	15-180	38-680	210-075-00	200-125-00
3"	Aluminum 356 alloy black anodized	flange w/2" hose adaptor	High	15-280	57-1060	210-082-00	200-129-00
		flange w/2 1/2" NPT adaptor	High	15-280	57-1060	210-083-00	200-130-00
		flange w/3" hose adaptor	High	15-280	57-1060	210-084-00	200-131-00
3"	Aluminum 356 alloy nickel plated	flange w/2" hose adaptor	High	15-280	57-1060	210-085-00	200-135-00
		flange w/2 1/2" NPT adaptor	High	15-280	57-1060	210-086-00	200-136-00
		flange w/3" hose adaptor	High	15-280	57-1060	210-087-00	200-137-00
3"	Stainless Steel 303 alloy	flange w/2" hose adaptor	High	15-280	57-1060	210-079-00	200-126-00
		flange w/2 1/2" NPT adaptor	High	15-280	57-1060	210-080-00	200-127-00
		flange w/3" hose adaptor	High	15-280	57-1060	210-081-00	200-128-00

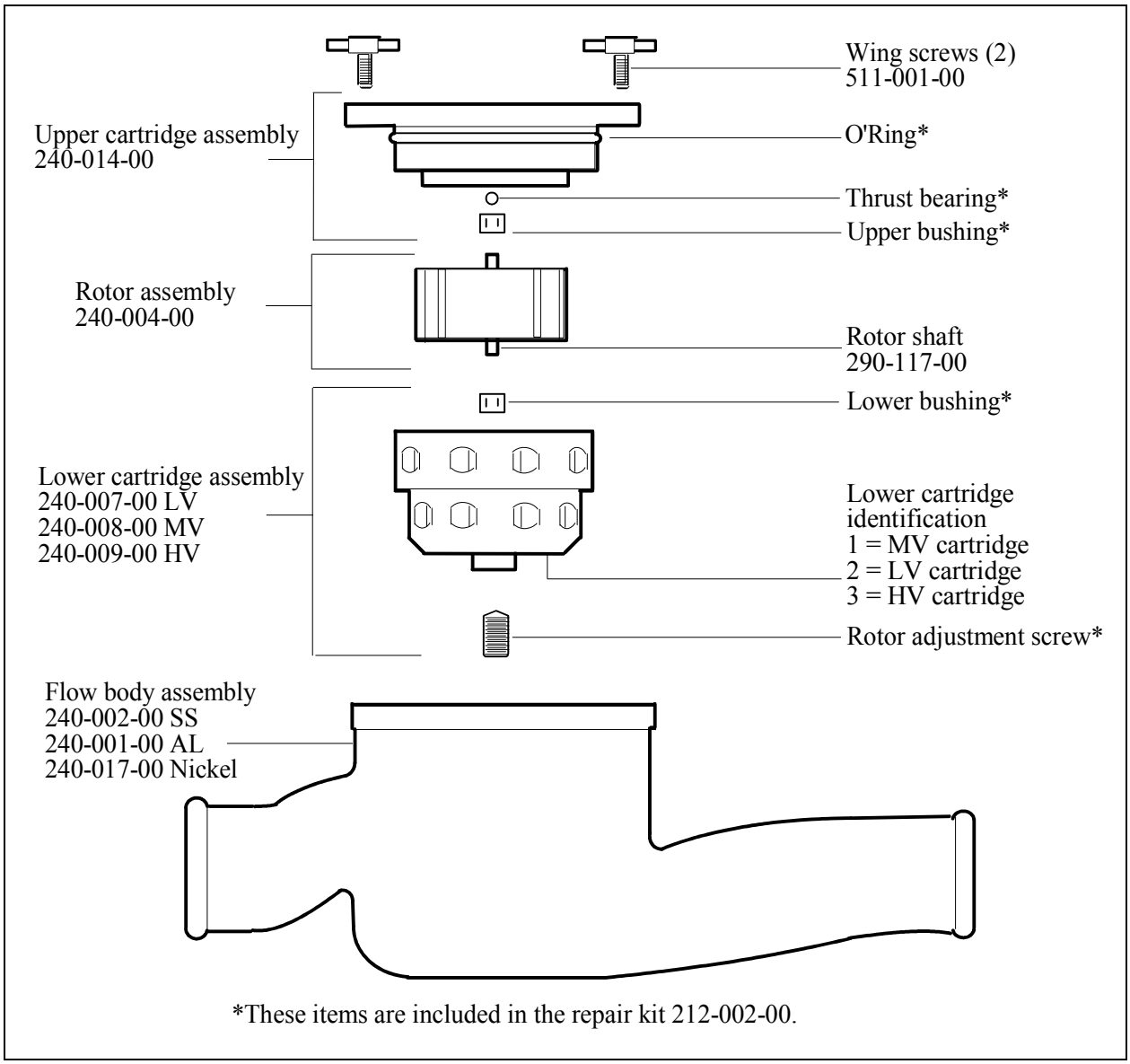
CROPHAWK Miscellaneous Replacement Parts

Table 9-2 CROPHAWK miscellaneous replacement parts

Description		Part number
Replacement items	CROPHAWK 7 display unit	210-063-00
	CROPHAWK 7 system owner's manual	120-012-00
	Work switch, pressure	400-011-00
	Work switch, lever	400-012-00
	Display unit dropping resistor assembly	230-017-00
	DCA frequency plug	210-051-00
	Display unit mounting bracket	235-065-00
	Display unit wing screws	511-003-00

2-inch Flow Section Assembly

Figure 9-1 2-inch flow section assembly

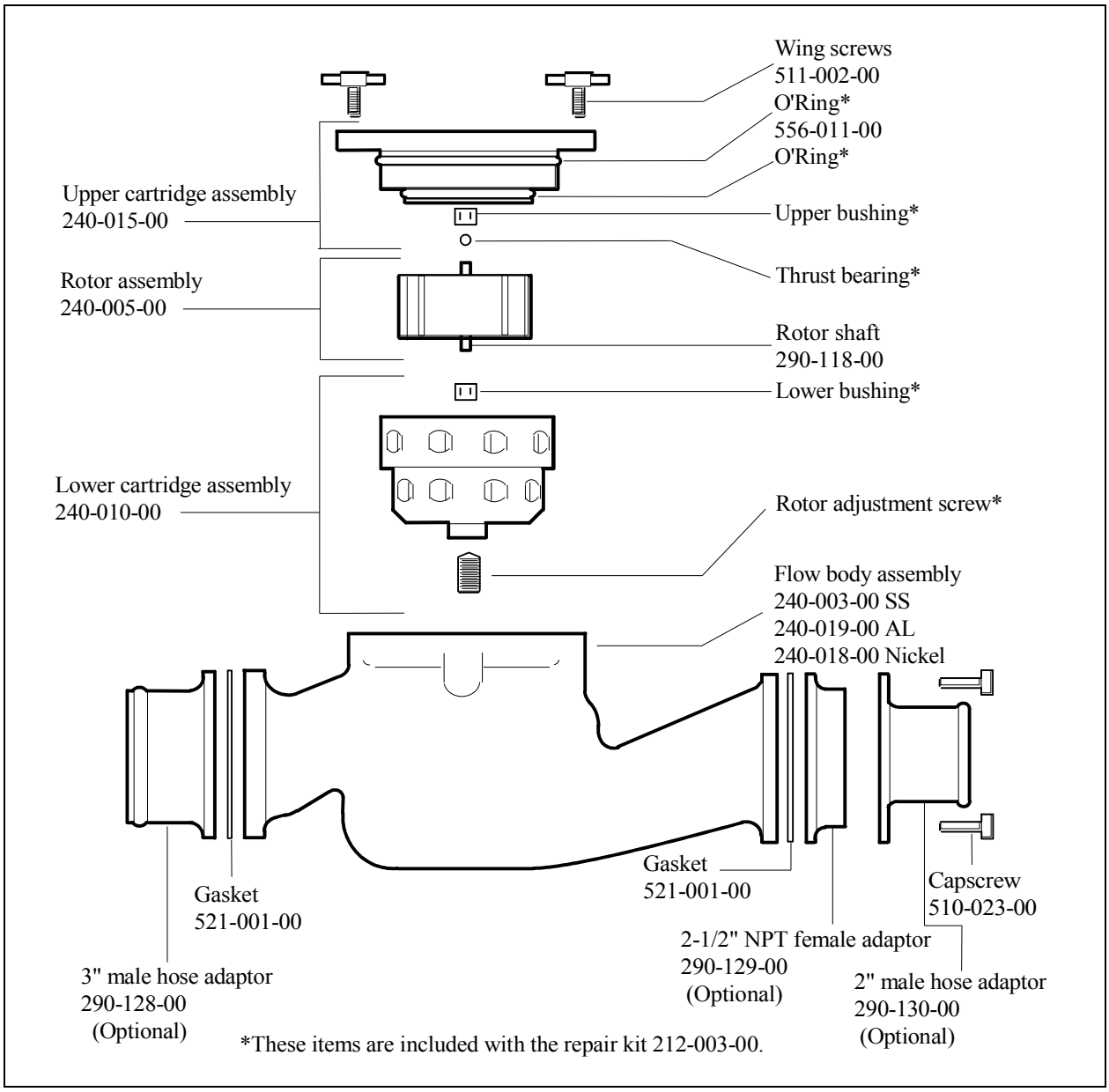


*These items are included in the repair kit 212-002-00.

ASSEMBLY P/N	FLOW SECTION DESCRIPTION
210-067-00	2" Nickel Plated Flow Section Assembly with a Low Volume Cartridge
210-068-00	2" Nickel Plated Flow Section Assembly with a Medium Volume Cartridge
210-069-00	2" Nickel Plated Flow Section Assembly with a High Volume Cartridge
210-073-00	2" Stainless Steel Flow Section Assembly with a Low Volume Cartridge
210-074-00	2" Stainless Steel Flow Section Assembly with a Medium Volume Cartridge
210-075-00	2" Stainless Steel Flow Section Assembly with a High Volume Cartridge
210-076-00	2" Aluminum Flow Section Assembly with a Low Volume Cartridge
210-077-00	2" Aluminum Flow Section Assembly with a Medium Volume Cartridge
210-078-00	2" Aluminum Flow Section Assembly with a High Volume Cartridge

3-inch Flow Section Assembly

Figure 9-2 3-inch flow section assembly



ASSEMBLY P/N	FLOW SECTION DESCRIPTION
210-079-00	3" Stainless Steel Flow Section Assembly with 2" Adaptors
210-080-00	3" Stainless Steel Flow Section Assembly with 2 1/2" NPT Adaptors
210-081-00	3" Stainless Steel Flow Section Assembly with 3" Adaptors
210-082-00	3" Aluminum Flow Section Assembly with 2" Adaptors
210-083-00	3" Aluminum Flow Section Assembly with 2 1/2" NPT Adaptors
210-084-00	3" Aluminum Flow Section Assembly with 3" Adaptors
210-085-00	3" Nickel Plated Flow Section Assembly with 2" Adaptors
210-086-00	3" Nickel Plated Flow Section Assembly with 2 1/2" NPT Adaptors
210-087-00	3" Nickel Plated Flow Section Assembly with 3" Adaptors

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Section 10
Limited Warranty

Onboard Systems CROPHAWK 7 components are warranted to be free from defects in workmanship and materials for a period of one year from the date of purchase. The components are warranted to function as intended when properly installed and used for their intended purpose. Parts which prove to be defective are repaired or replaced free of charge FOB factory at the manufacturer's option if the following conditions have been met.

- No repairs have been attempted by other than Onboard Systems personnel.
- The system or component is returned properly packaged, insured, with transportation charges prepaid.
- After examination, Onboard Systems personnel are satisfied that the defects were not caused by abuse, and that the components were not subjected to conditions that violate system specifications.

This warranty covers only the original purchaser. In no event shall Onboard Systems be liable for indirect, special, incidental or consequential damage resulting from the use of this product, even if Onboard Systems has been advised of the possibility of such damage. Each user must satisfy himself that the system is suited to his needs and is performing according to his requirements.

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