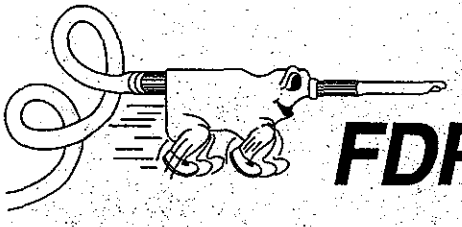
Operator's Manual

for the

ILT-C(P)

In-Line Tester



World Leaders in Gas Filling Technology

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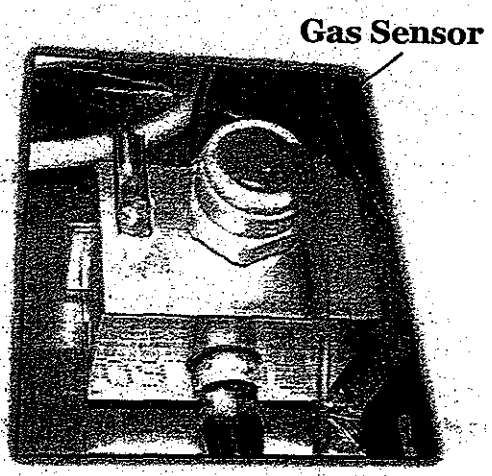
Introduction



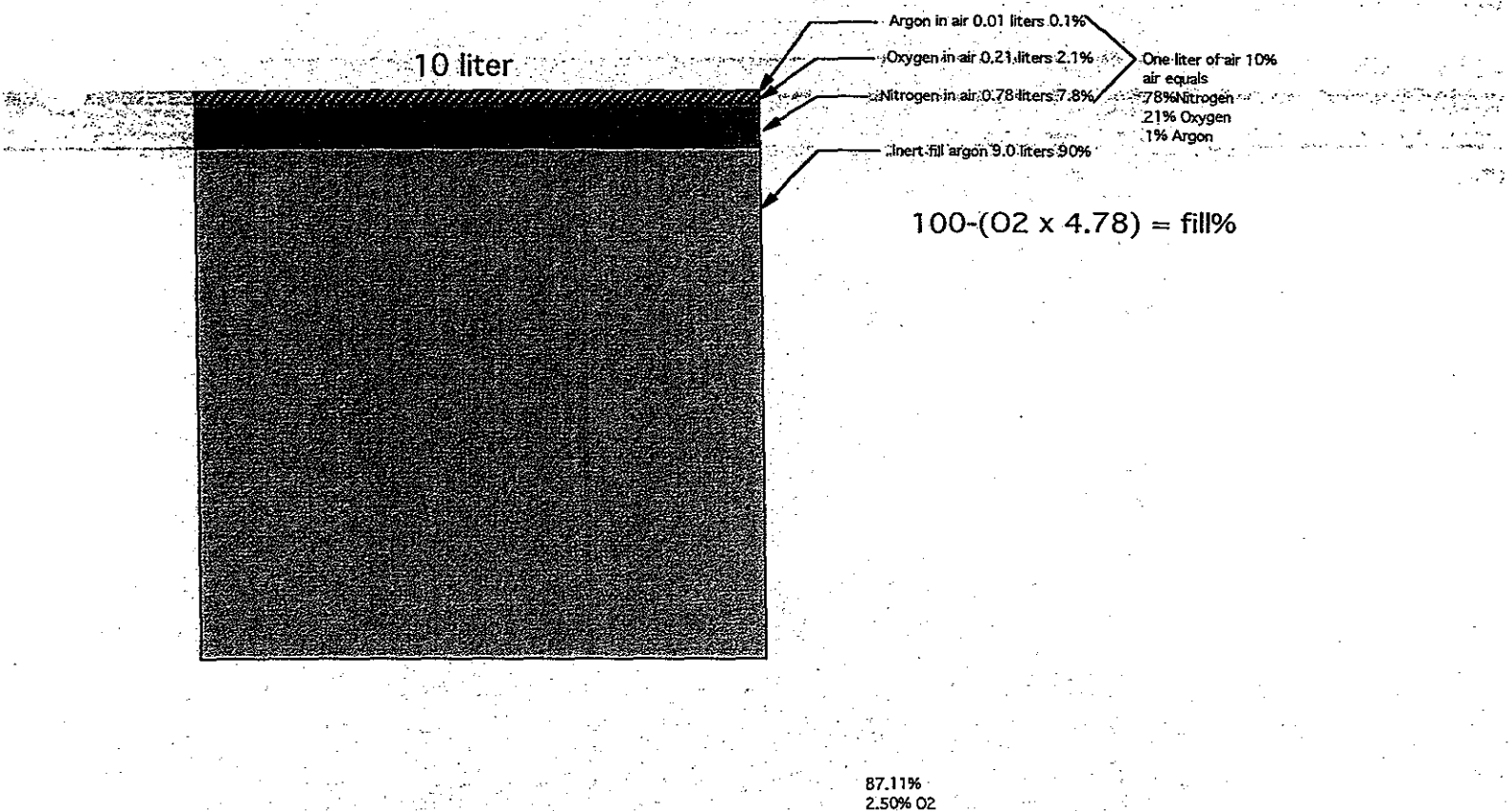
The heart of the ILT-C(P) is the FDR conductivity sensor, which is designed and built by FDR Design, Inc.

With an oxygen style tester, you read the oxygen content and multiply to obtain the argon fill percentage. (See drawing below)

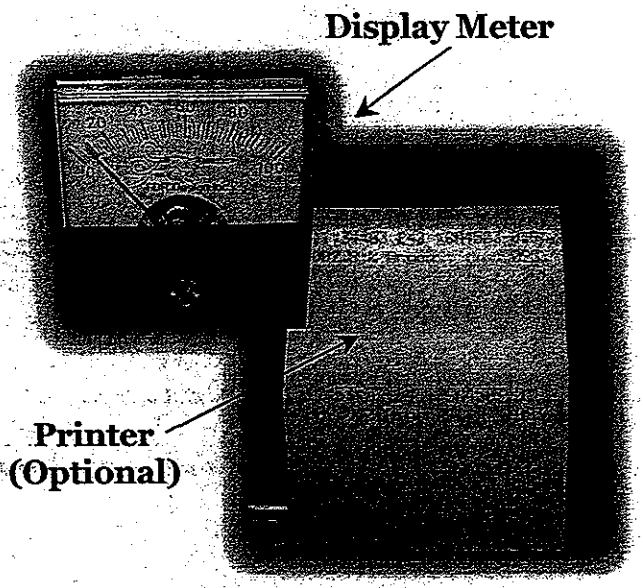
The formula...

```
100 - (Oxygen x 4.78) = Fill Percentage
(Assumes that the oxygen content in air is 20.9%)
```

The FDR conductivity sensor measures the conductivity of the fill gas in the window directly, not by calculations.



On the FDR ILT-C, the display meter, located on the front panel of the machine, shows the percentage of the fill gas immediately after filling. An optional printer will print the actual percentage that the display is showing.



Once an insulating glass unit is filled, the fill gas diffuses itself equally into the IG cavity. The gas tries to escape via any path — up, down, or sideways — due to the differences in the concentration of fill gas inside of the IG and the normal "air" surrounding it. If an IG has a 50% concentration of argon it is 50% everywhere in the cavity. It is not in a layer with 100% argon on the bottom half of the IG and air on the top half.

It takes a period of time for the gas in the IG to completely homogenize. The gas has to get into the spacer and the desiccant, and it has to balance itself in the IG. This may take anywhere from weeks to months to achieve.

The principle behind the ILT-C design is that we circulate the gas in the IG. The same gas is pulled from and returned to the IG unit after it is passed over the conductivity sensor. This forces the homogenization process. It is not completely homogenized, as the gas still has to work into the desiccant. However, it does give us a snapshot of the unit immediately after filling.

Setup

On the back of the ILT-C is a power cord and a long, hard, clear poly gas supply hose. There is also a soft poly hose that is meant to remain unconnected.

Step 1 — Power

Plug the power cord into a standard 120VAC outlet. The full load of the machine is very small — less than 5 amps.

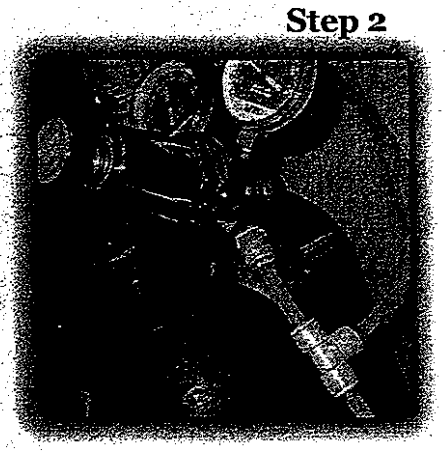
Step 1

Step 2 — Gas

Connect the hard, clear poly hose to the gas bottle regulator. It is not necessary to use a separate bottle of gas for the ILT-C. You can simply place a tee into the line of your existing gas supply hose and attach the ILT-C to that tee.

The supply gas pressure should be set to approximately 50PSI. On the back of the machine is a factory-set regulator, which directly controls the internal flow of the gas. This regulator should not be adjusted.

Step 2

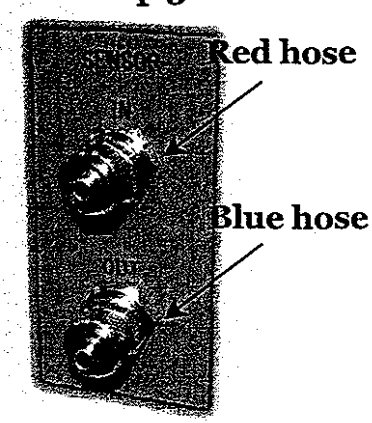


Step 3 — Hoses

On the front of the machine are two hose fittings. Connect the RED soft hose to the upper fitting marked "IN" and the BLUE soft hose to the lower fitting marked "OUT". The end of the red hose with the white filter connects to the bulkhead on the face of the machine.

```
Red = In = Suction = Sensor
Blue = Out = Blows = Return
```

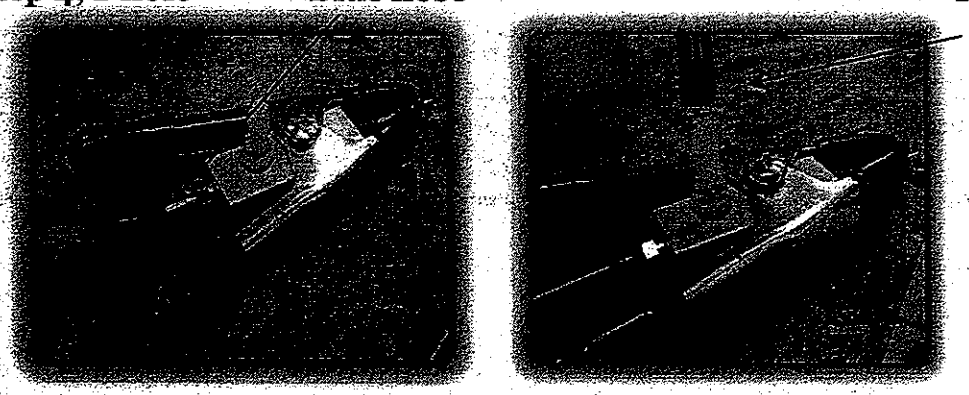
Step 3



Step 4 — Lances, 1-hole

If you are using the 1-hole method to test your IG units, connect the other end of the red and blue hoses to the clamp assembly. The blue hose goes on the fitting on the back, and the red hose goes on the fitting on the side.

Step 4, 1-hole **Blue hose** **Red hose**



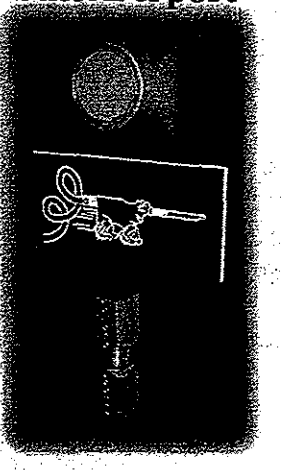
Step 4 — Lances, 2-hole

If you are using the 2-hole method to test your IG units, connect the other end of the red and blue hoses to the individual lances.

Step 4, 2-hole

Calibration

Calibration button & port



The calibration button is independent and is not connected to the electronics of the sensor. The calibration button turns on a valve that simply allows the supply gas to flow out of the calibration fitting at a fixed rate. When you press the calibration button, the button light is illuminated and the gas flows. When you press the button a second time, the light is turned off and the gas flow stops. Remember that the gas will flow as long as the button remains illuminated. However, there is a safety feature that turns off the valve and button light after five minutes.

It is important that during calibration and normal operation of the ILT-C all hoses and lances are in good condition and not restricted, pinched, damaged, or placed in an IG unit.

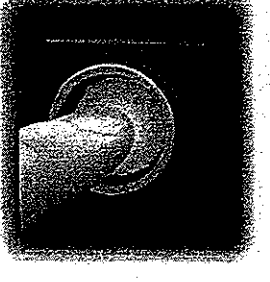
Calibration Stage 1 — Air calibration

Step 1
Have the clamp assembly (or lances) hanging in free air (not placed in the calibration port).

Step 2
Press the Pump button to start the circulation pump running.

Step 1
Clamp or lances in free air

Step 2
Press Pump button

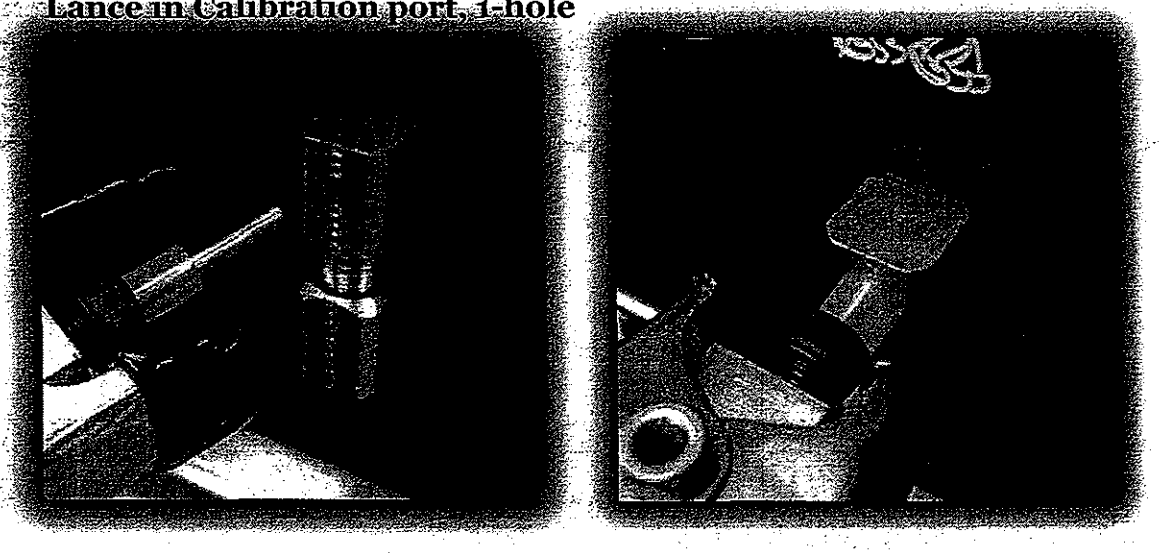


Calibration Stage 2 — Gas calibration

Step 1 • 1-hole method

Seat the clamp assembly firmly in the calibration port.

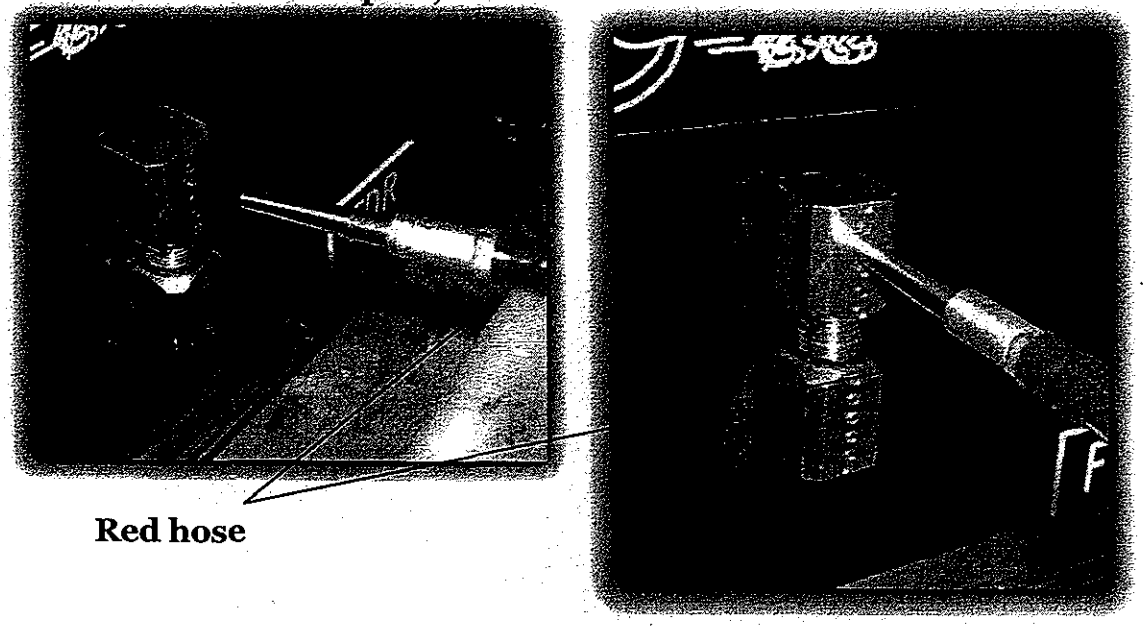
Step 1
Lance in Calibration port, 1-hole



Step 1 • 2-hole method

Seat the Red lance ("IN") firmly in the calibration port. The Blue lance ("OUT") can simply hang in free air.

Step 1
Lance in Calibration port, 2-hole



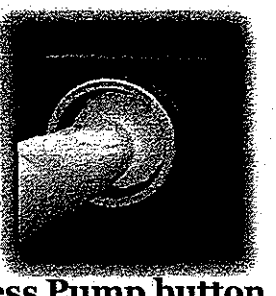
Step 3

Using a digital multi-meter, measure the DC voltage between the "com" — 24VDC common — (black probe) and the test tab (red probe). It may be necessary to adjust your meter to a more sensitive scale (2000m), as the measured voltage will be very low.

After approximately 2 minutes, the Pump light will begin flashing. Observe if the digital multi-meter voltage has stabilized. If it has, adjust the Zero potentiometer until the digital multi-meter reads 0.00VDC. ***If the voltage has not yet stabilized, wait until it has before adjusting the Zero potentiometer.***

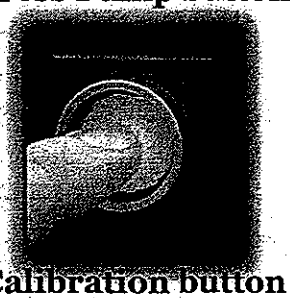
Press the Pump button to stop the pump.

Step 3
Adjust the Zero potentiometer



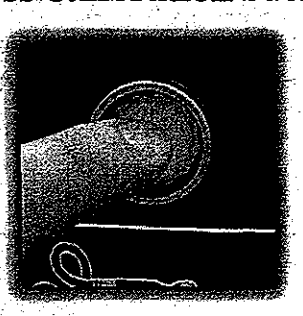
Step 2
Press the Pump button to start the circulation pump running.

Step 2
Press Pump button



Step 3
Press the Calibration buttons to start the calibration supply gas flow.

Step 3
Press Calibration button



Step 4
Using a digital multi-meter, measure the DC voltage between the 24VDC common (black probe) and the Output (red probe).

After approximately 2 minutes, the Pump light will begin flashing. Observe if the digital multi-meter voltage has stabilized. If it has, adjust the Gain potentiometer until the digital multi-meter reads 4.90VDC. ***If the voltage has not yet stabilized, wait until it has before adjusting the Gain potentiometer.***

Press the Pump button to stop the pump. After the pump has stopped, press the Calibration button to stop the flow of the calibration gas.

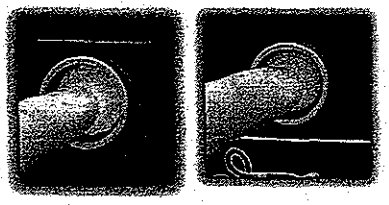
Step 4
Adjust the Gain potentiometer

Black probe

Gain potentiometer

Red probe

Press Pump button



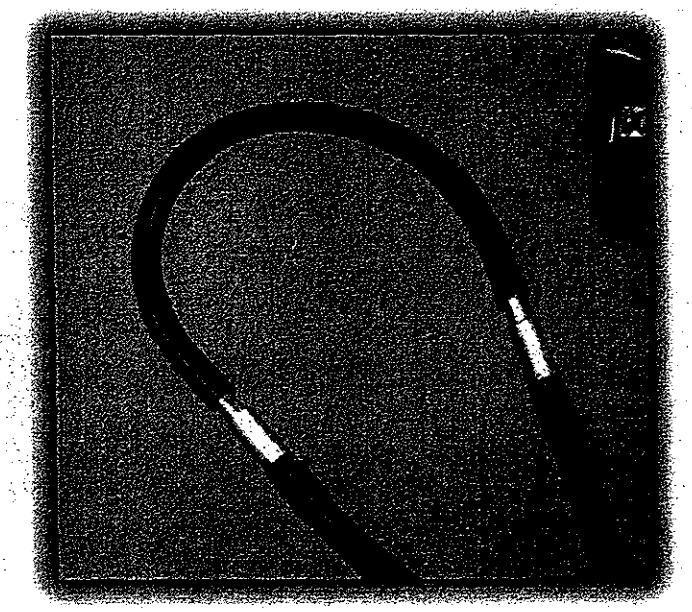
Press Calibration button

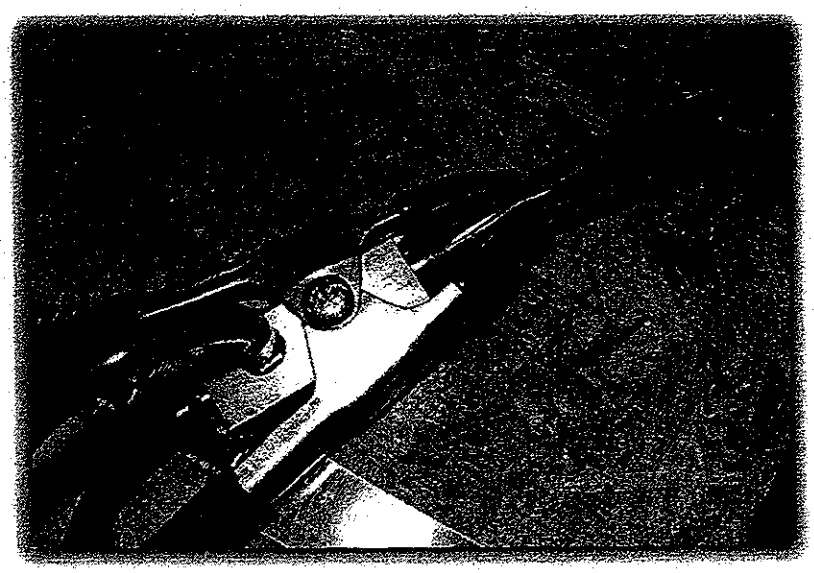
Once the ILT-C is calibrated, the supply gas does not need to remain connected to the machine. However, if you wish to recalibrate or purge the machine from time to time, the supply gas does need to remain connected.

After calibration, the clamp assembly or lances should be placed in the provided hoses until the operator is ready to test the first IG unit. Failure to do so may cause the ILT-C to dilute the readings of the first tested IG by allowing air from the hoses to contaminate the fill gas.

If you wish to verify the ILT-C's calibration at fill levels other than 100%, connect bottles of known gas to the gas supply hose and verify that the ILT-C is correctly calibrated. Contact FDR for information on where to obtain calibration gases.

Clamp or lances in supplied hoses





Operation

The ILT-C comes complete with a clamp for testing IGs using the 1-hole method and with lances for testing IGs using the 2-hole method. If your IG was filled with two holes, you can either use the 2-hole lances or plug the top (sniffler) hole using your normal plug method and then use the 1-hole method on the remaining gas filling hole. Either way, the accuracy of the ILT-C is the same.

It is important that there are no air gaps between the lances and the filling hole. The silicone seal around the clamp assembly lances is meant to provide a tight seal, ensuring that none of the fill gas is lost during testing. Also, the 2-hole lances are tapered so that they can be seated firmly into the gas filling holes.

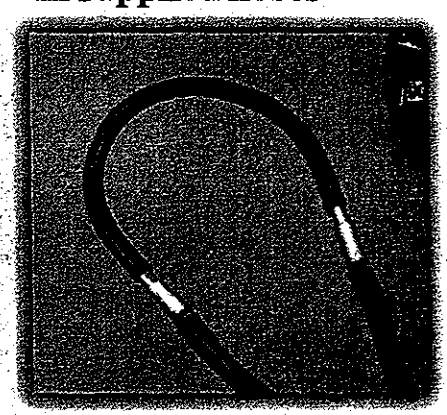
The length of time required to test an IG will depend on the size of the unit. The pump circulates the gas at approximately 6 liters per minute.

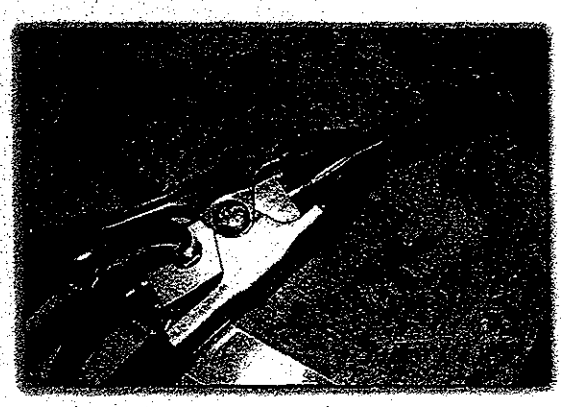
Gas Purge

It is important that at the start of each shift or after a long period of inactivity, the operator run a purge cycle to ensure the hoses contain 100% of the fill gas. Failure to do so may cause the ILT-C to dilute the readings of the first tested IG by allowing air from the hoses to contaminate the fill gas.

This purge can be accomplished by repeating the Gas Calibration stage of calibration. However, it is not necessary to use the multi-meter. Simply allow the display meter to reach approximately 100% before shutting off the pump and then shutting off the calibration gas. After purging, the clamp assembly or lances should be placed in the provided hoses until the operator is ready to test the first IG unit.

Clamp or lances in supplied hoses





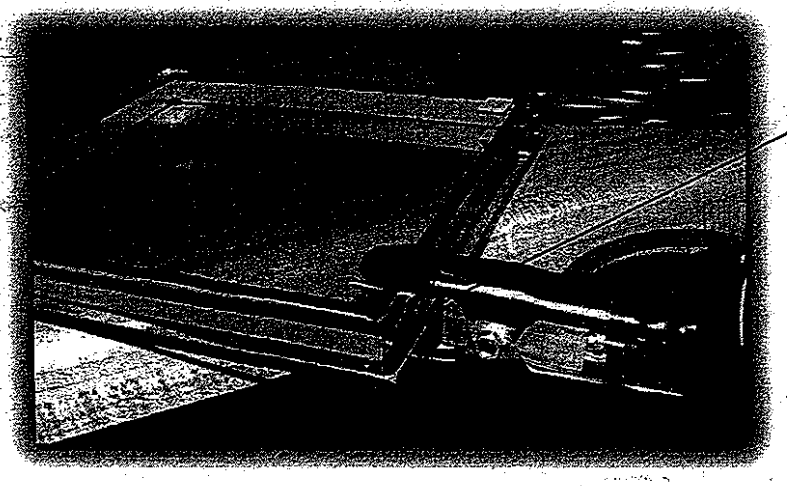
The clamp assembly or lances should now be placed in the provided sealed hoses until the operator is ready to test the first IG unit.

Testing an IG

Step 1 • 1-hole testing

Insert the clamp assembly into the existing gas filling hole, making sure that there is a tight seal between the lance and the hole.

1-hole testing

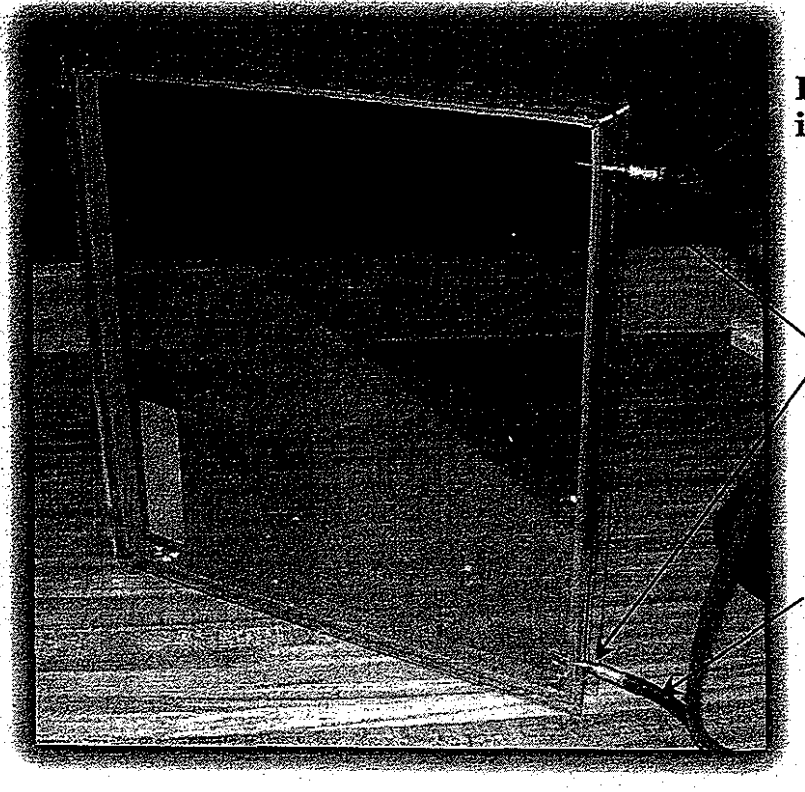


Tight seal

Step 1 • 2-hole testing

Insert the red lance into the sniffler hole (top), and insert the blue lance into the filling hole (bottom), making sure that there is a tight seal between the lances and the holes.

2-hole testing



Red hose in top hole

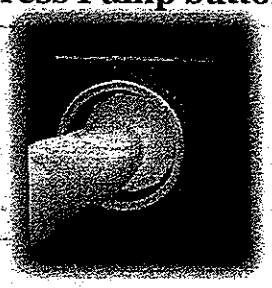
Tight seal

Blue hose in bottom hole

Step 2

Turn on the circulation pump by pressing the Pump button. The reading on the display meter may increase and then rapidly lower before stabilizing.

Step 2
Press Pump button

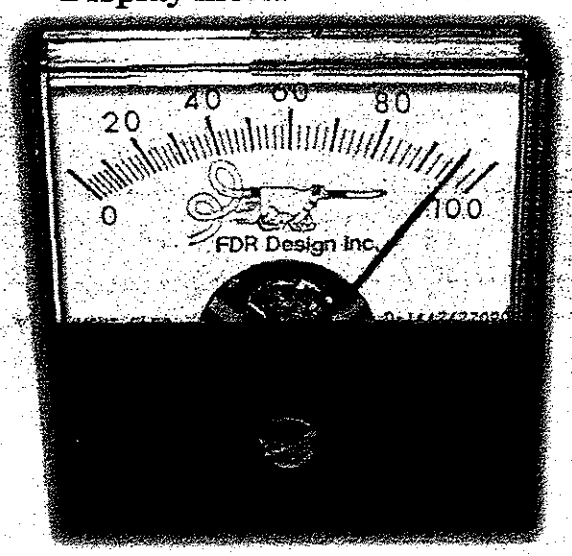


Step 3

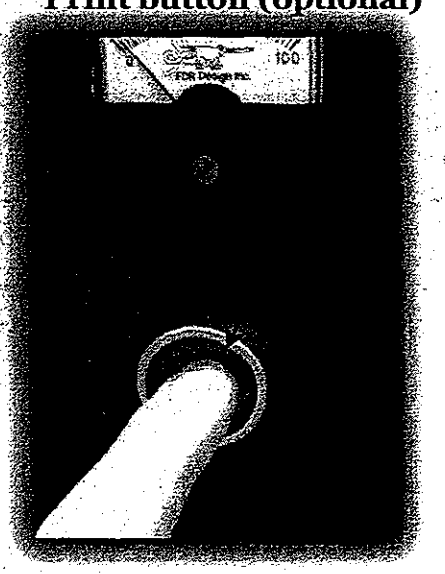
After the readings on the display meter have stabilized (this amount of time will vary depending on the size of the IG), note the gas fill percentage on the Display Meter. If your ILT-C is equipped with the optional printer, you can also print out the fill percentage by pressing the Print button for approximately 1 second. There is also a paper feed button located beneath the printer, should you wish to advance the paper after printing.

Step 3

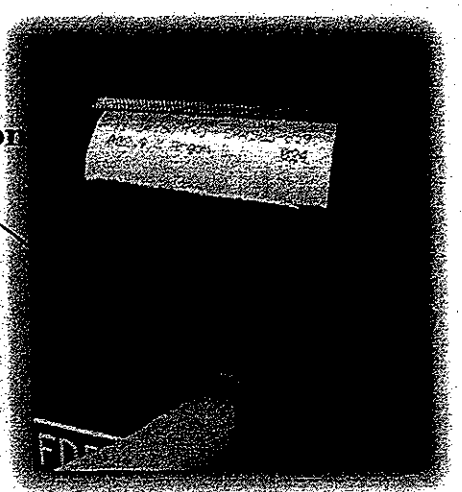
Display meter



Print button (optional)

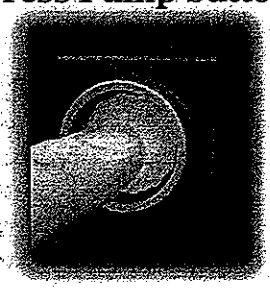


Paper feed button (optional)



Step 4
Press the Pump button to stop the circulating pump.

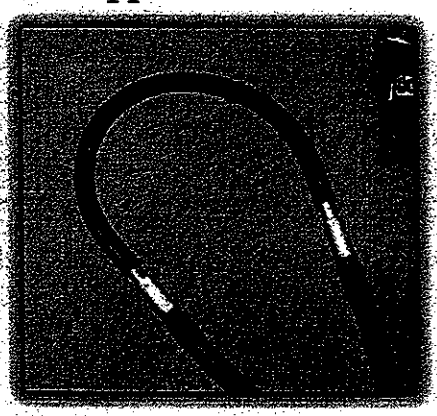
Step 4
Press Pump button

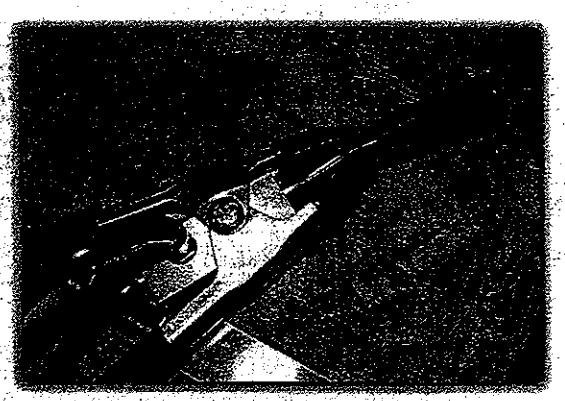


Step 5 • 1-hole testing
Once you have recorded the fill percentage, remove the clamp assembly and plug or seal the gas filling hole using your normal plugging or sealing method. Place the clamp assembly lances into the provided hose to retain the gas purge in the hoses.

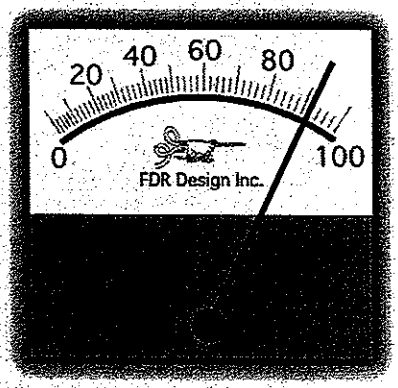
Step 5 • 2-hole testing
Once you have recorded the fill percentage, first remove the red hose and plug or seal the top hole. Then remove the blue hose and plug or seal the bottom hole using your normal plugging or sealing method. Place the red and blue lances into the provided hose to retain the gas purge in the hoses.

Clamp or lances
in supplied hoses





It may be easier for the operator to record test readings on a drawing of a blank Display Meter rather than a written log. We have attached an example below and in the drawings section of this manual.

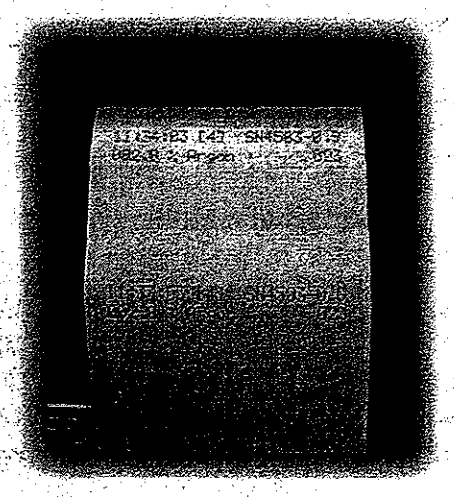


Optional Printer

The printer data will look like this...

```
14:49:27   [6]       SN4500-0.9

095.4% Argon                  862
```



What it means

14:49:27

The hour:minute:second from the real time clock in the PLC. In this example the time is 2:49 PM. The time is set at FDR and cannot be changed by the customer. Its primary purpose is to give you a unique time stamp to associate with the reading, much like a serial number.

[6]

The day of the week, a number between 1 and 7. Monday is 1 and Sunday is 7. In this example the day is Saturday.

SN4500-0.9

The serial number of the machine and the version of the PLC software. In this example, the machine has a serial number of 4500, and the PLC is loaded with version 0.9 of the software.

095.4% Argon

The fill percentage and type of gas contained in the IG. In this example, the window contains 95.4% argon. If your ILT-C was set up for a different gas, the gas will be listed here.

862

A number that represents what the conductivity sensor is sending to the PLC. It is there as a trouble-shooting aid and serves no purpose for the user.

Summary

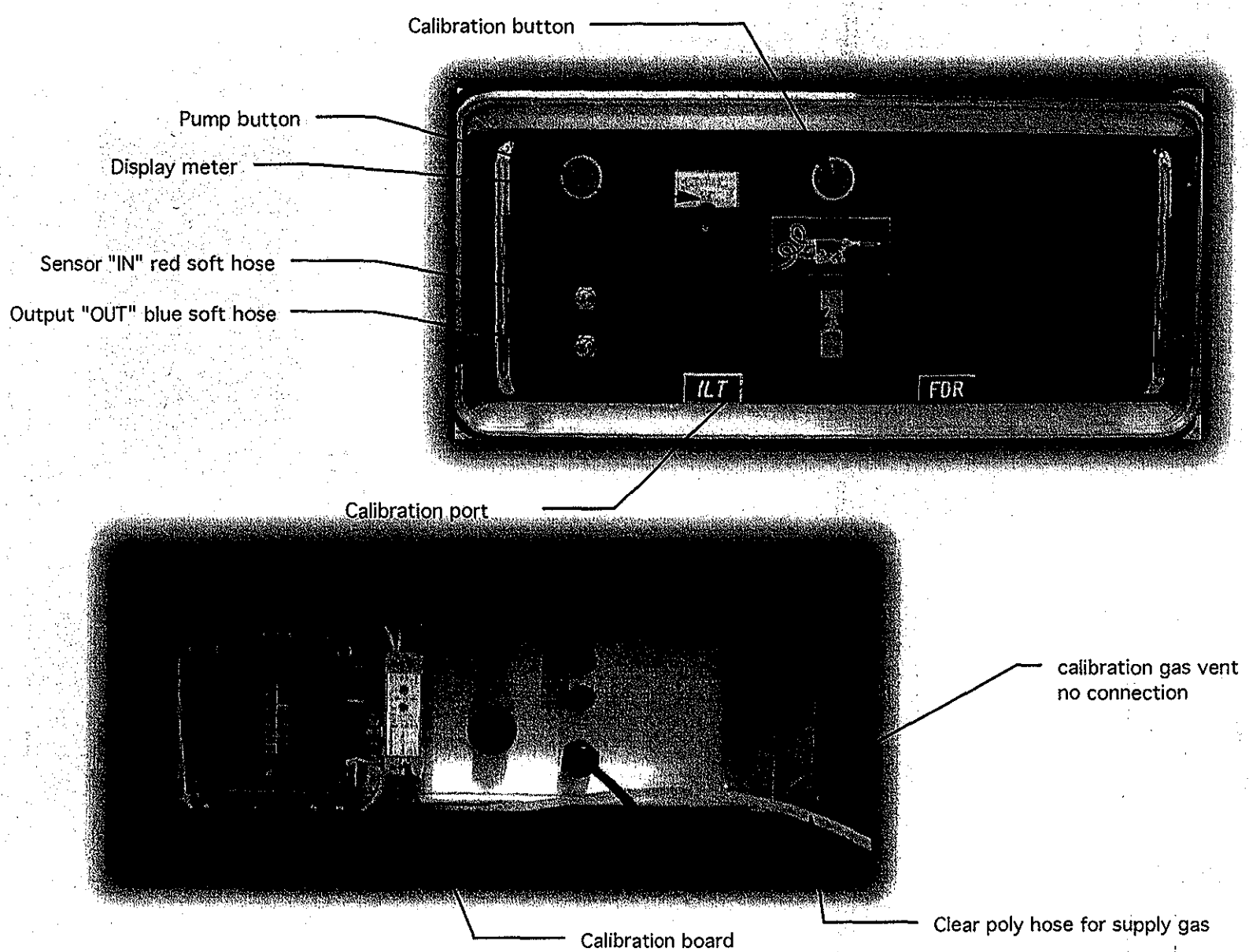
The purpose of the ILT-C is not to eliminate a quality control gas retention test before and after accelerated aging, as those tests are a good assurance that the overall IG is retaining gas. The ILT-C gives you an instant manufacturing check that the gas filling operation was successful.

It is also interesting to experiment with the ILT-C to see how long it takes for the gas to leak out of an IG if you do not plug the holes right away. The ILT-C can also be used to determine if different lances give better fill percentages in less time, thus conserving gas.

The ILT-C is part of the In-Line Tester family of machines manufactured by FDR Design. The "C" stands for the FDR conductivity sensor that is used in the machine. If your machine has the optional printer, it is called an ILT-CP.

The original members of the ILT family are the SS-ILT and the DS-ILT. The SS-ILT used a single oxygen cell to test the amount of oxygen present in the window. The level of oxygen was then used to calculate the amount of argon in the IG. The DS-ILT contained the oxygen cell and an FDR conductivity sensor. It had a printer that could log data. This data could then be transferred to a personal computer. The optional printer on the ILT-CP can print, but it cannot log data.

For all of the ILTs, the key to accuracy is the calibration gas that is used. By periodically checking the ILT against the calibration gas, you can be assured that good fills levels are being obtained.



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ILT-C Setup Calibration
Component Location

Created: 06/18/04 rle

Last Modified: 06/25/04 CG

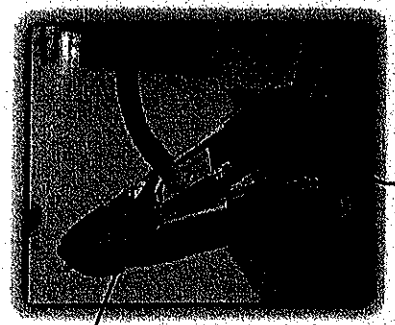
Scale: 2/1

Sheet 1 of 7
Drawing Number:
11670-A

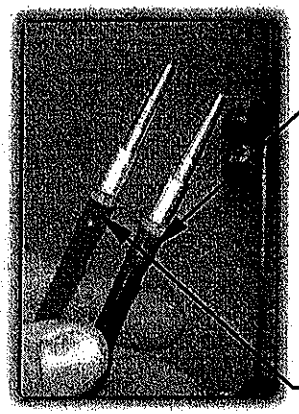
ILT-C Air calibration

Step 1

1-hole Clamp in free air



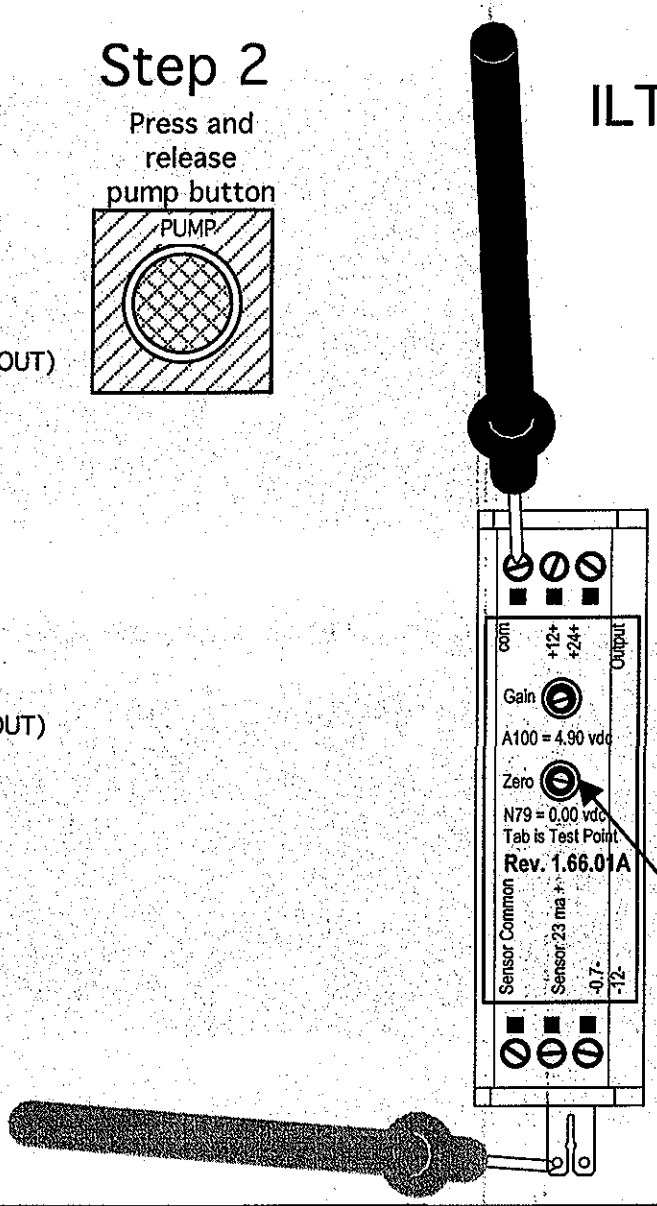
2-hole Lances in free air

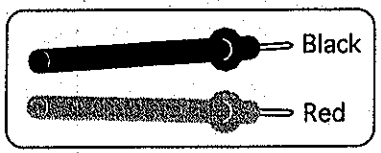


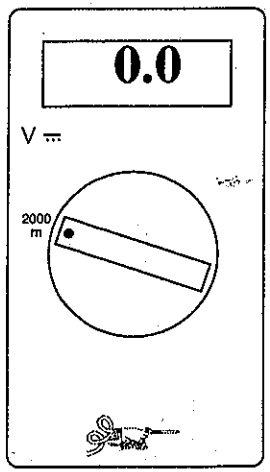
Stage 1 Air
Stage 2 Argon

Step 2

Press and release pump button







Step 3

After running for 3 minutes adjust zero to read 0.4mv to 0.0 mv
(0.0004 to 0.0000 volts dc)

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[illegible]ffalo, MN 55313
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fax763-682-6197

ILT-C Setup Calibration
Stage 1 Air

Created: 06/18/04	rle	Scale: 2/1	Sheet 2 of 7
Last Modified: 06/25/04	CG		Drawing Number: 11[illegible]0-A

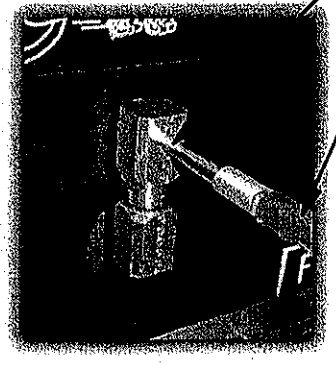
ILT-C Argon calibration

Step 1

1-hole Clamp in calibration port

2-hole Red Lance in calibration port

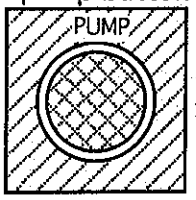
Tight seal

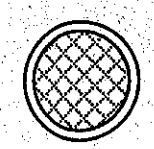


Red hose (IN)

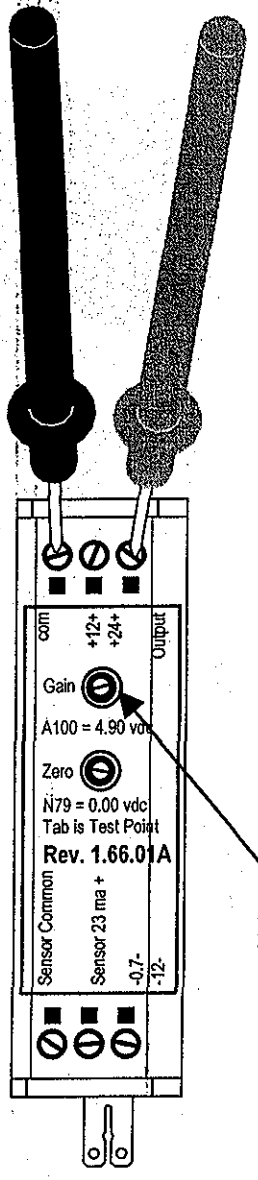
Step 2

Press and release pump button

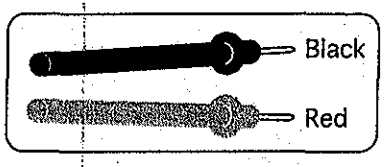


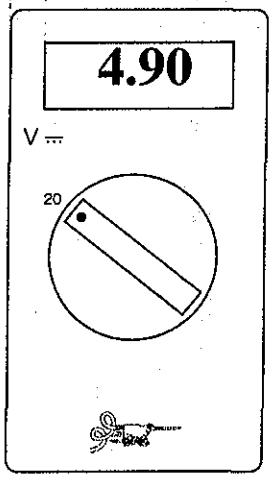


Press and release gas button



Black to "com" (common)
Red to "Out 1"





Step 3

After running for 3 minutes adjust gain to read 4.90 volts dc

Stage 1 Air
Stage 2 Argon

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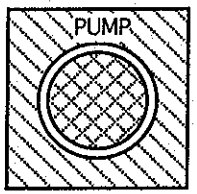
ILT-C Setup Calibration
Stage 2 Argon

Created:			Scale:	Sheet 3 of 7
	06/18/04	rle		Drawing Number:
Last Modified:			2/1	11670-A
	06/25/04	CG		

Testing ??th Unit

Step 1

Press and release

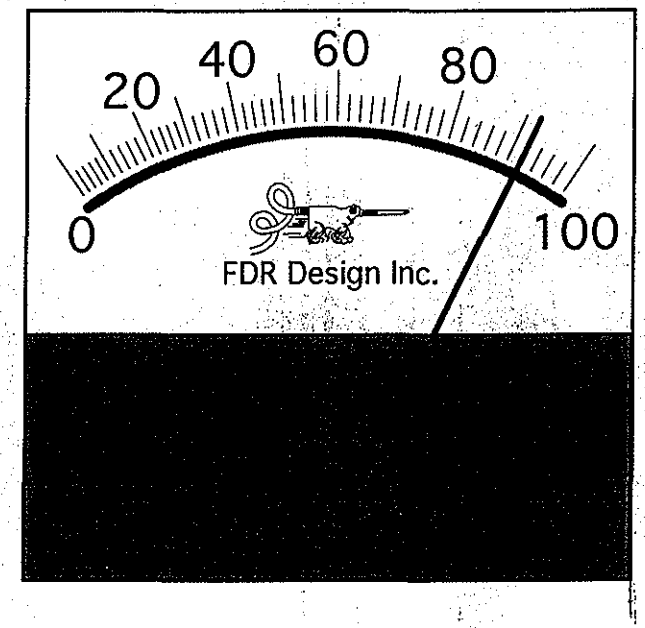


Step 2

After running for 3 minutes record reading

ARGON

Display should read between 88 and 100 (90% fill standard)



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ILT-C Setup Calibration
Testing 75th unit

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Last Modified: 06/25/04 CG

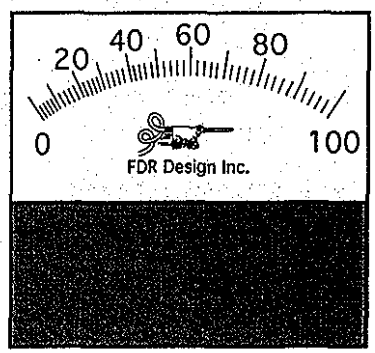
Scale: 2/1

Sheet 4 of 7
Drawing Number:
11('0-A

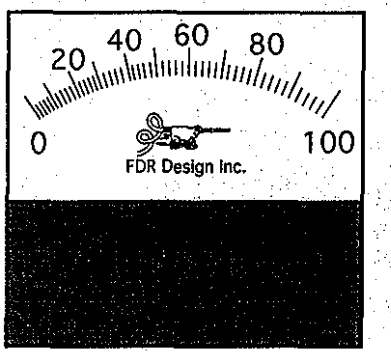
Calibration Gas Readings

Model: _____ Serial Number: _____ Job Number: _____

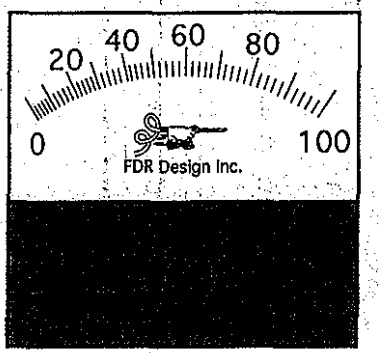
100% Argon
Output Voltage:
Tab Voltage:



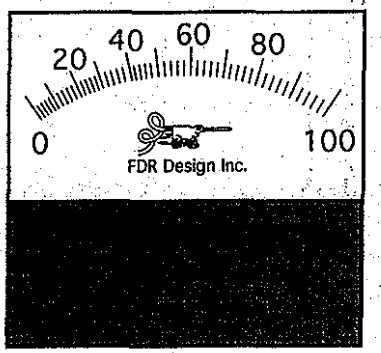
97.5% Argon
Output Voltage:
Tab Voltage:



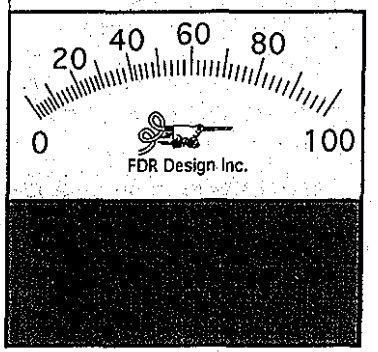
95% Argon
Output Voltage:
Tab Voltage:



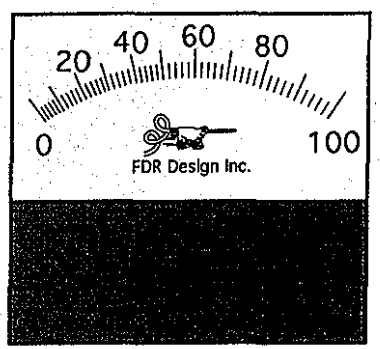
90% Argon
Output Voltage:
Tab Voltage:



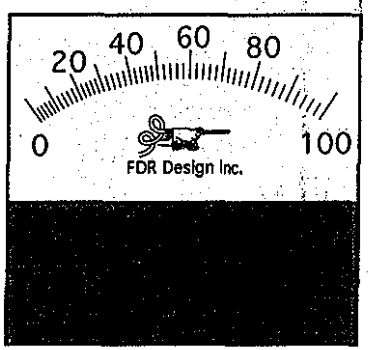
85% Argon
Output Voltage:
Tab Voltage:



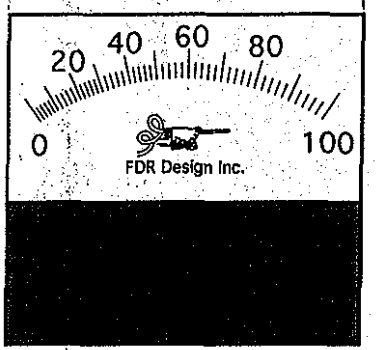
80% Argon
Output Voltage:
Tab Voltage:



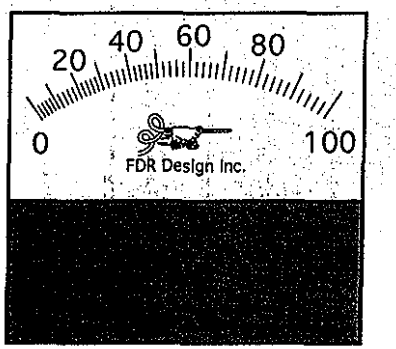
70% Argon
Output Voltage:
Tab Voltage:



50% Argon
Output Voltage:
Tab Voltage:



0% Argon
Output Voltage:
Tab Voltage:



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ILT-C Setup Calibration

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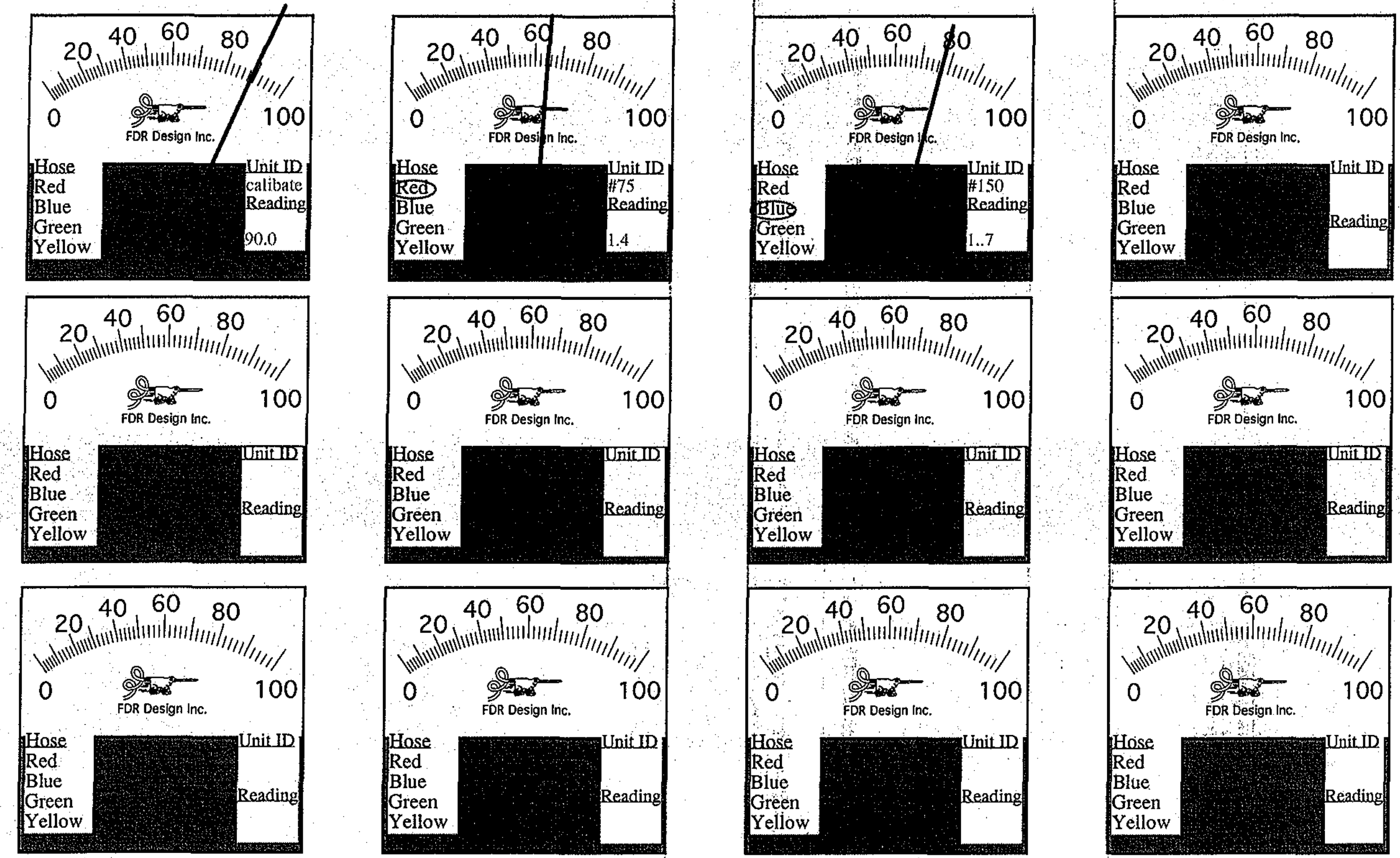
Last Modified: 06/25/04 CG

Scale: 2/1

Sheet 5 of 7
Drawing Number: 11670-A

Drawing 11670
6 of 7



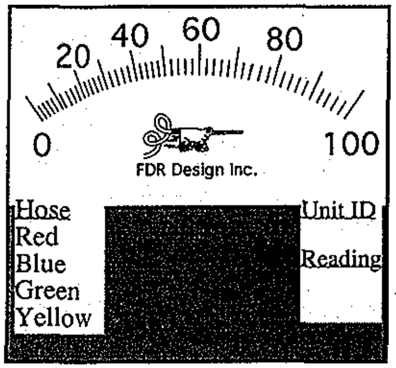
Date: 11/ 01 /2000

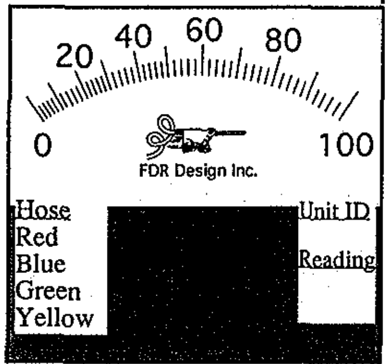
Shift: 1st

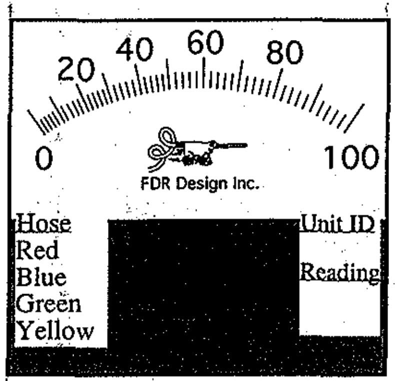
Operator: HAL

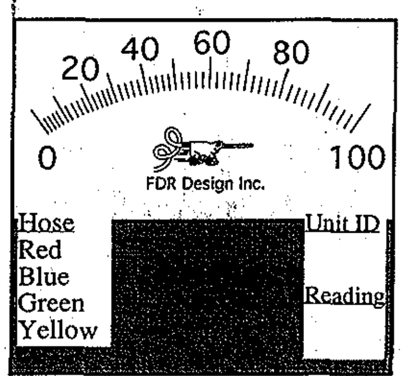
Production line: Specials

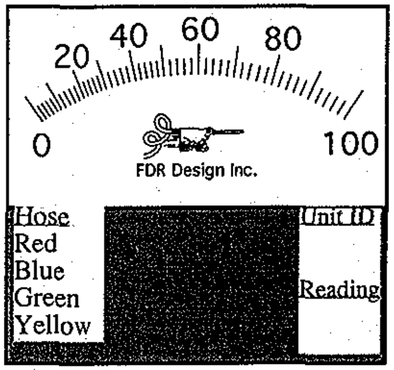
FDR Design, Inc. 3 12th Ave. South lfalo, MN 55313 phone 763-682-6096 fax 763-682-6197	ILT-C Setup Calibration	Created: 06/18/04 rle Last Modified: 06/25/04 CG	Scale: 2/1	Sheet 6 of 7 Drawing Number: 11('0-A

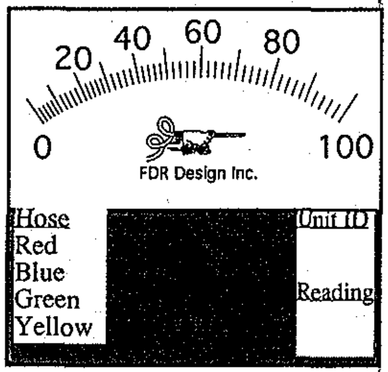


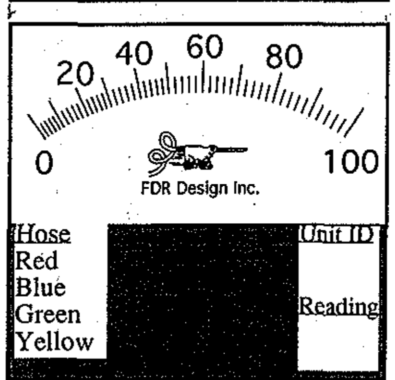


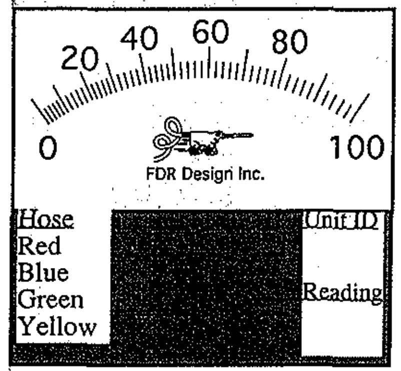


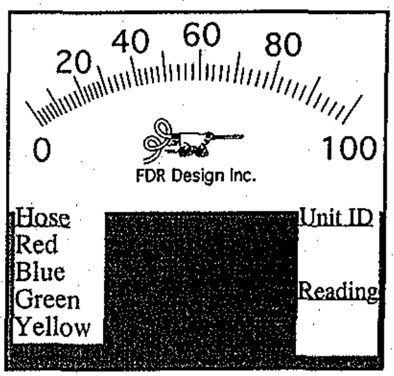


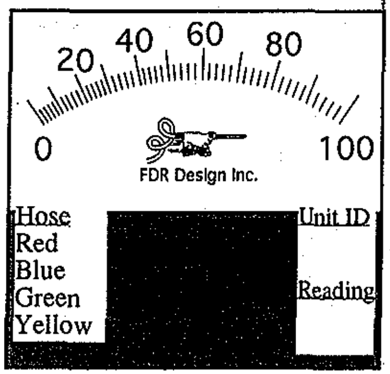


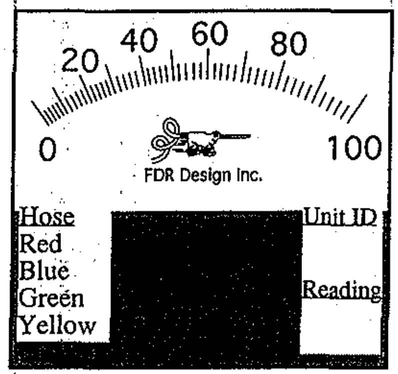


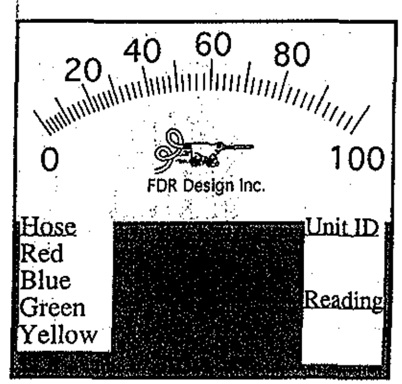












Date: ______________ Operator: ______________

Shift: ______________ Production line: ______________

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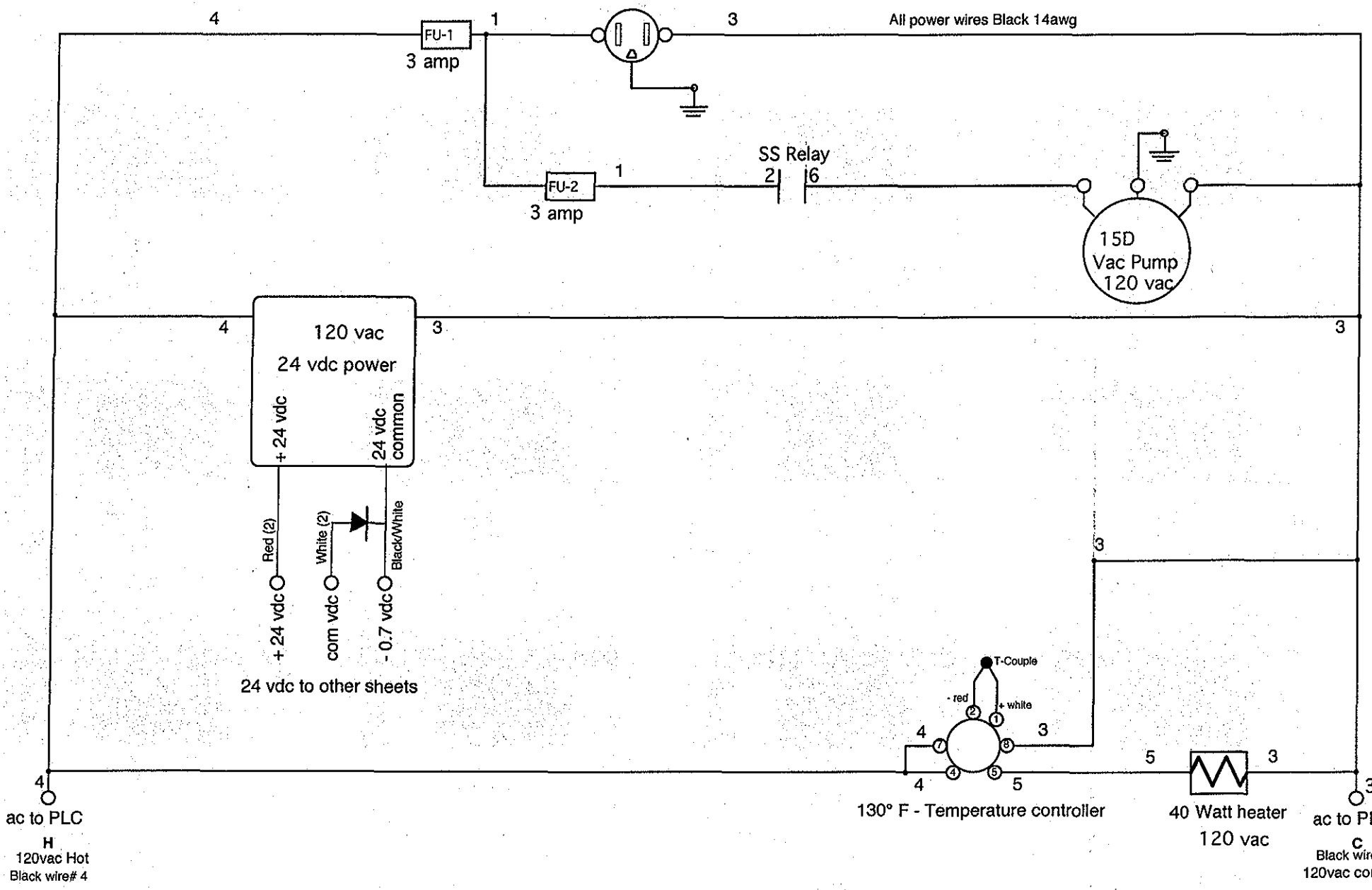
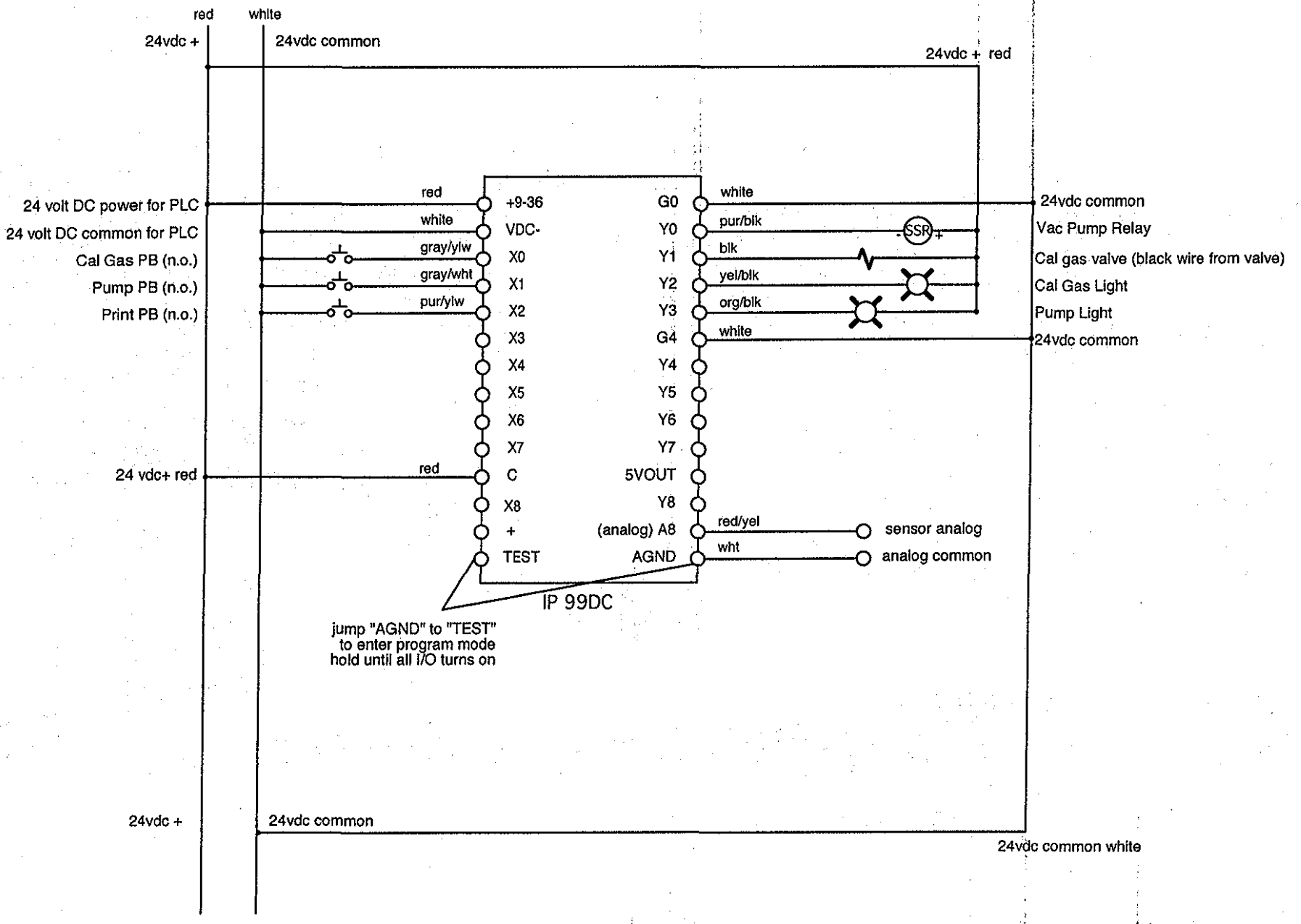
ILT-C Setup Calibration	Created: 06/18/04 rle	Scale:	Sheet 7 of 7
	Last Modified: 06/25/04 CG	2/1	Drawing Number: 11670-A

Drawing 11651
1 of 5



FDR Design, I 303 12th Ave. South Buffalo, MN 55313 phone763-682-6 fax763-682-6	ILT-C Elec Schem Pnuem Power	Created: 06/19/04 rle Last Modified: date by	Scale: na	Sheet 1 of 5 awing Number: 1651-B



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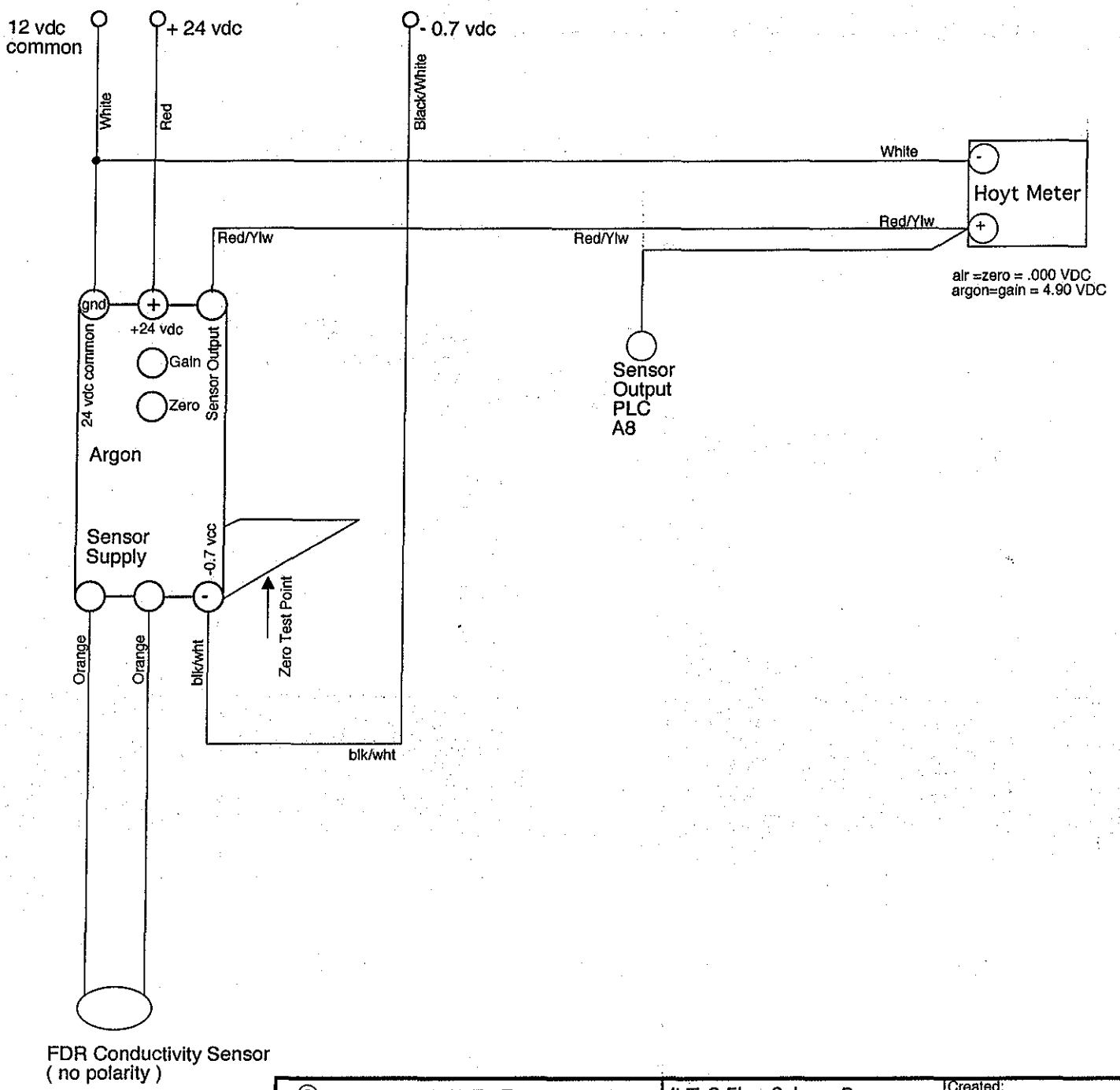
ILT-C Elec Schem Pnuem	Created: 06/19/04 rle	Scale: na	Sheet 2 of 5	
PLC	Last Modified: date by		Drawing Number: 11651-B	



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ILT-C Elec Schem Pnuem

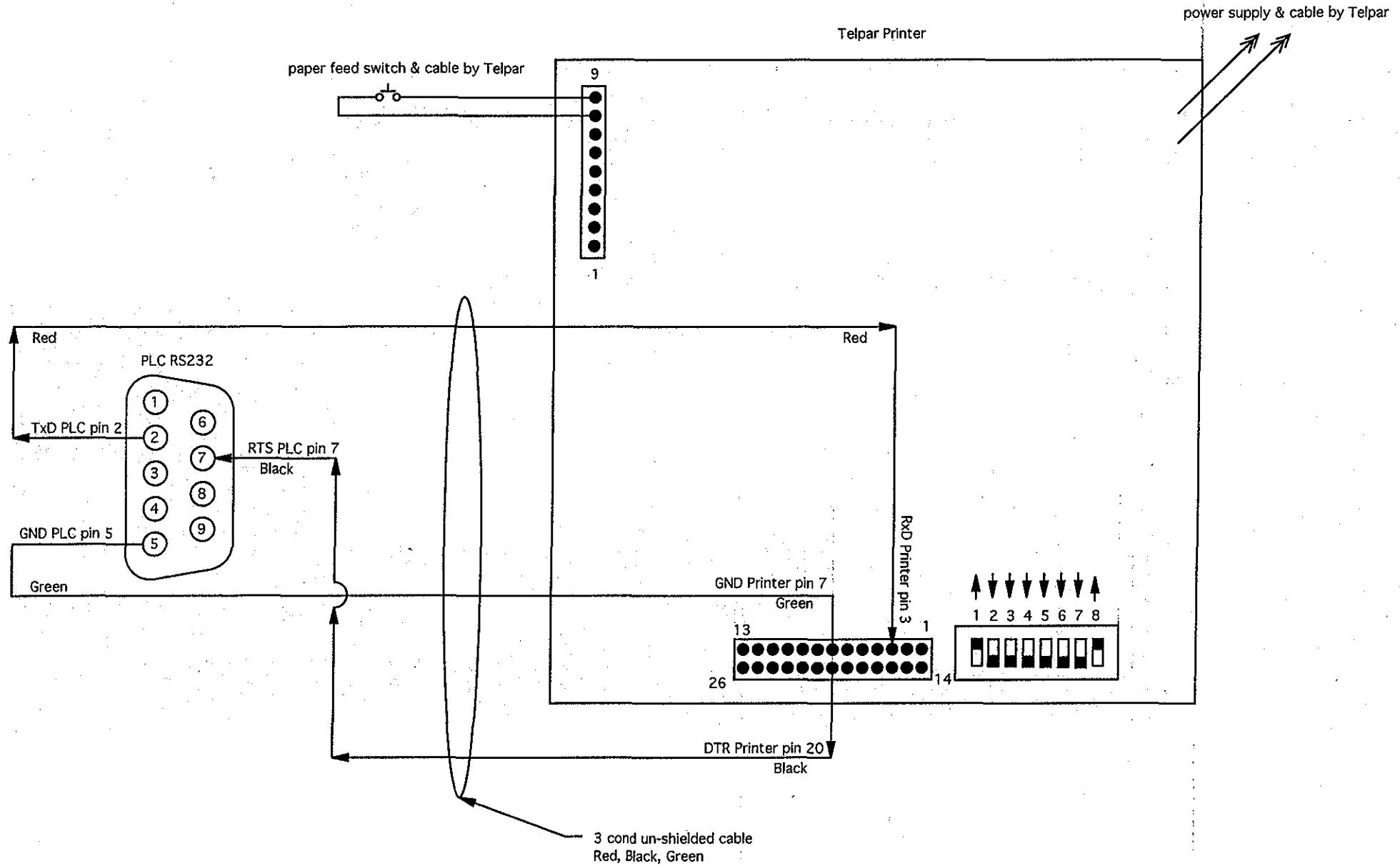
Sensor

Created: 06/19/04 rle

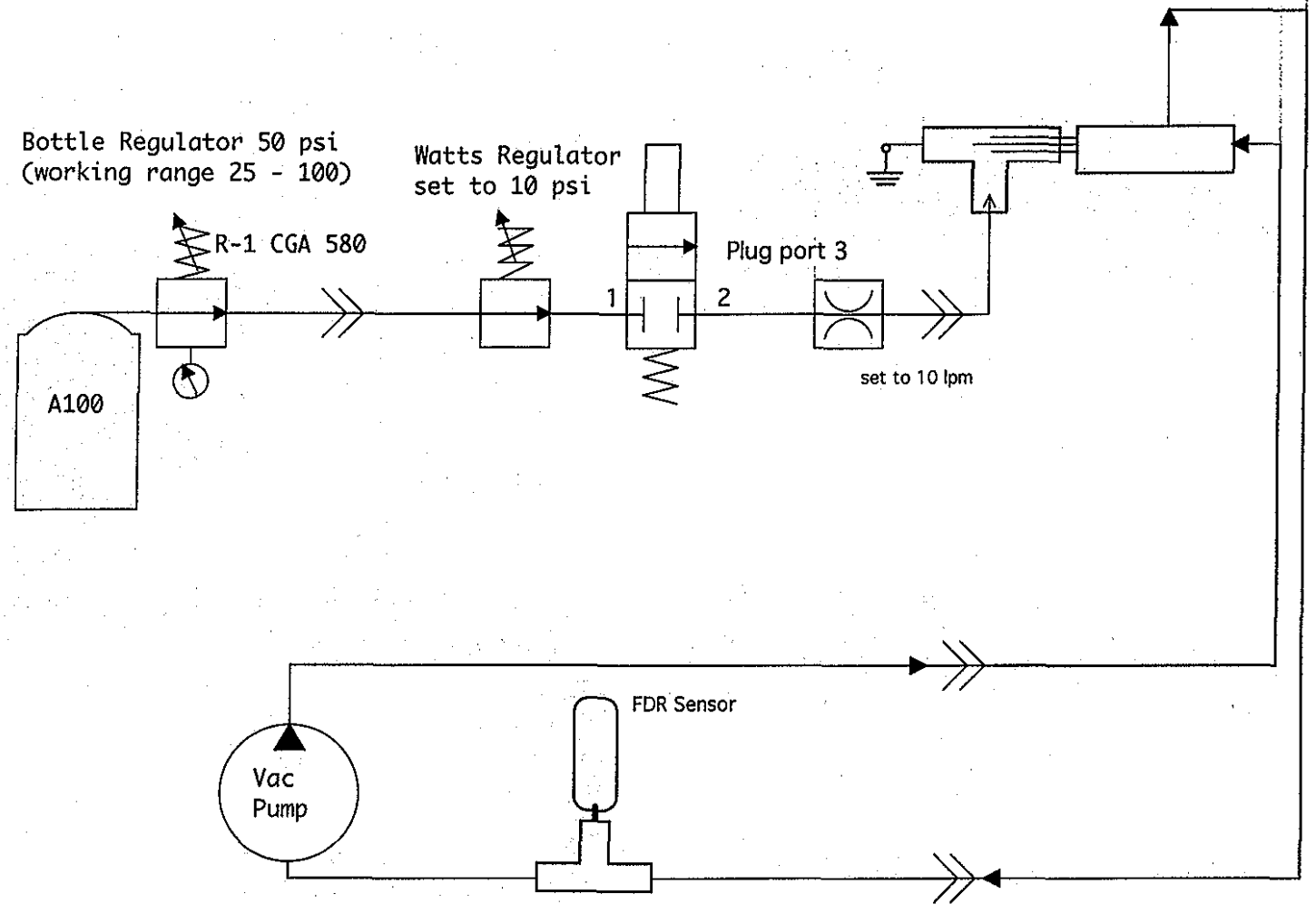
Last Modified: date by

Scale: na

Sheet 3 of 5
Drawing Number: 1651-B



FDR Design, Inc. 303 12th Ave. South Buffalo, MN 55313 phone763-682-6096 fax763-682-6197	ILT-C Elec Schem Pnuem Printer	Created: 06/19/04 rle Last Modified: date by	Scale: na	Sheet 4 of 5 Drawing Number: 11651-B



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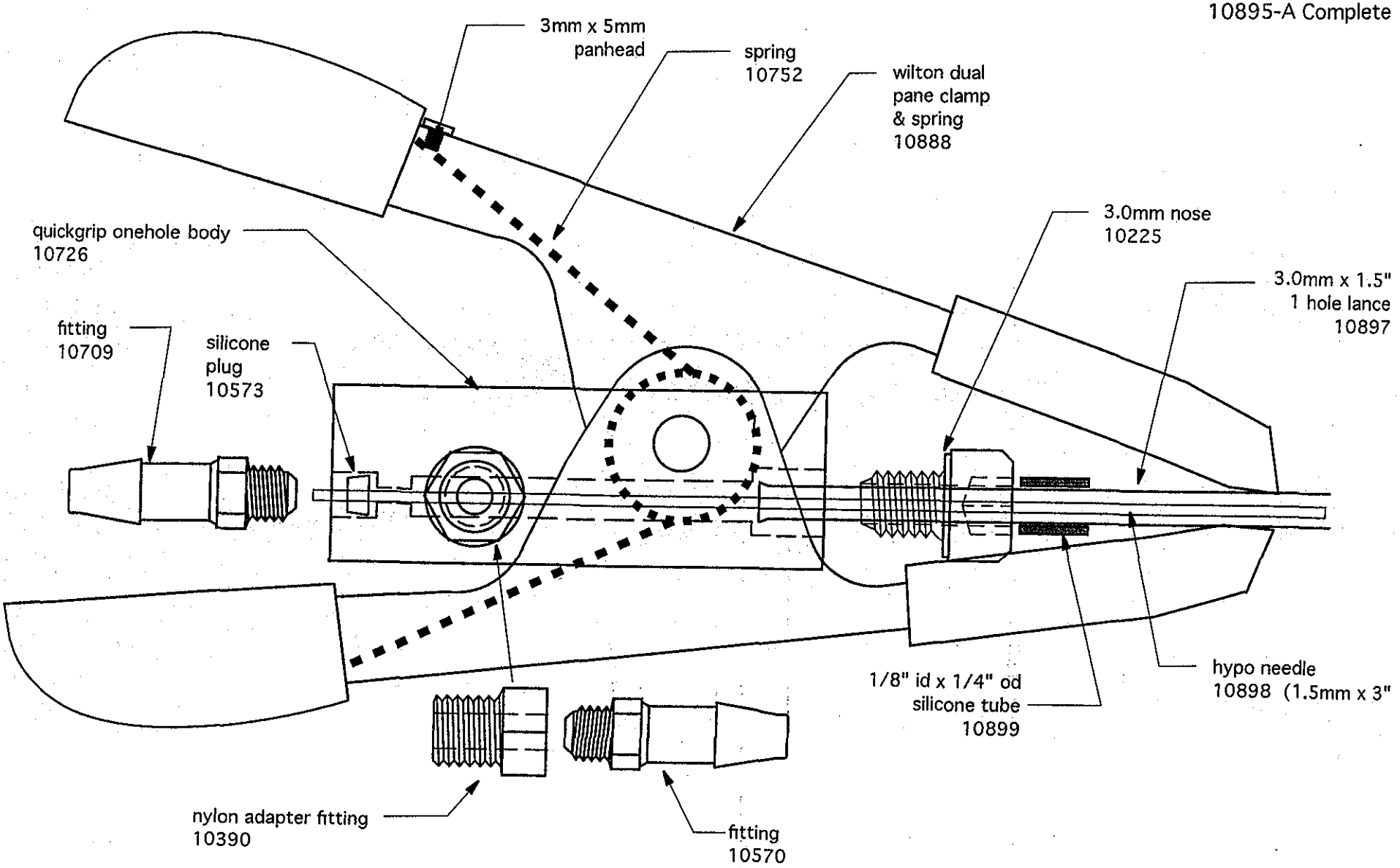
ILT-C Elec Schem Pnuem	Created: 06/19/04	rle	Scale: na	Sheet 5 of 5
Pnuematic	Last Modified: date	by		awing Number: 1651-B

10895-A Complete



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3.0mm ILT
1-Hole Wilton Clamp
Complete

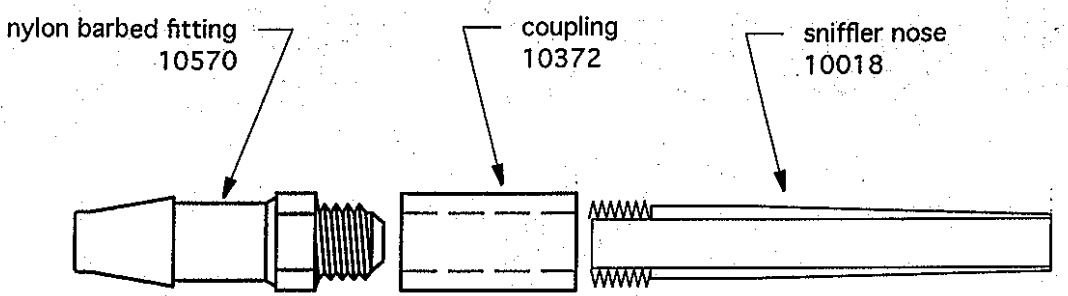
Created: 2/24/99 RLE

Last Modified: 06/25/04 CG

Scale: 2/1

Drawing Number: 10895-A

Drawing 11663



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ILT Lance Assembly
Complete

Created: 06/28/04 CG

Last Modified:

Scale: 2/1

Drawing Number: 11(3-A