ISOPur™
Fluid Technologies, Inc.

LR20P Series
Fluid Purification Units

Operator's Manual

m-LR20P-0711-00D

Software version IFT-4.0.0

Global Industrial Solutions
Improving System Reliability

219 GLIDER CIRCLE
CORONA, CA 92880
951-279-9830; Fax: 951-279-6706
www.globalindustrialsolutions.net

ISOPur Fluid Technologies

LR20P Operator's Manual

NOTE 1. *ISOPur Fluid Technologies, Inc. reserves the right to change this document without notice.*

NOTE:
This manual is only provided in English Only

This machine is intended to operate with software version listed on page 1.

Other software versions may appear to follow these conventions, but are likely to have subtle differences that may not be apparent.

NOTE: The Following marking may or may not appear on your specific LR20P model

CE

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1 FOREWORD

ISOPur's LR20P machines are the most advanced, deep cleansing fluid purification systems available. These systems employ advanced mechanical filters supercharged by ISOPur's Balanced Charge Agglomeration or BCA™ process to rid the fluid of virtually all particulate matter larger than 0.1 micron in size.

This manual encompasses all of the information and procedures necessary for installation, start-up, operation, maintenance, and safety requirements for the LR20P purification units. System descriptions, component nomenclature, and special procedures are included together with drawings and specifications. These manuals are synchronized with the version of software whose operation they describe. Upgrades to the manual may be available from http:// www.isopur.com Users are encouraged to check ISOPur's website for information before calling for assistance.

1.1 UNDERSTANDING YOUR NEW ISOPUR MACHINE

ISOPur strongly suggests that any person who will install service or operate this machine completely read and become familiar with the operation as described in section 7 before attempting to operate the machine. Should any questions regarding proper installation or servicing of the machine come up, call ISOPur at –

860.599.1872 and ask for Field Service

Mon-Fri 8AM – 5PM EST/EDT

1.2 WARNING ELECTRICAL SHOCK HAZARD

Please note the following before uncrating, installation, and start-up –

- ***The control enclosure contains a source of high voltage.***
- ***Never touch the high voltage leads with machine power on.***
- ***The control enclosure should never be opened or otherwise penetrated for any reason by anyone other than trained ISOPur personnel.***

1.3 HEAT PROTECTION

Since fluid temperatures of greater than 150°F (65.5C) are possible depending on the process and fluid being cleaned, the mechanical portions of the system (vessels, piping, and associated equipment) can reach temperatures capable of causing burns.

ISOPur Fluid Technologies has taken all precautions to provide warnings for the possible high temperature of the equipment, but users should still practice good judgment and avoid direct contact with the mechanical portions of the machine when it is in use.

When the machine has been switched off, certain parts of the machine may still hold residual heat for extended periods. Users are advised to wear protective gloves and/or other clothing when changing filters or otherwise servicing the equipment if the fluid temperatures exceed 100°F.

1.4 ADDITIONAL SAFETY RELATED

Please review the complete safety section prior to installation and start-up. We at ISOPur strive to make our systems as safe, self-sufficient and reliable as possible. Proper attention to the procedures and maintenance practice of this manual should

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provide many years of successful oil purification. Feedback and suggestions are always welcome and can be provided by way of http://www.isopur.com.

ISOPur advises that the unit have a customer-furnished fire extinguisher of the proper type and capacity permanently located within a short recovery distance should it ever be needed.

NOTE 2.

- *All warning labels, signs, instructions, and safety markings should be strictly observed and should never be disabled for any reason.*
- *Operational interlocks are provided for operation of the equipment in a safe manner.*
- *It is important these interlocks not be overridden or disabled to ensure safe operation.*
- *No probing, adjustments, connections, disconnection of other mechanical, electrical, or electronic operations are to be carried out in the control box.*
- *Please note that the only serviceable item inside the control box is a circuit breaker*
- *The cover of the control should only be opened by a trained ISOPur Fluid Technologies technician.*
- *Call ISOPur Fluid Technologies, Inc. if you suspect something inside is not working correctly.*

1.5 WARRANTY NOTE

NOTE 3. *Opening the Charging and Mixing Vessel for any purpose will cause the warranty to become voided.*

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On the WEB at http://www.isopur.com or email at Sales@isopur.com

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2 SPECIFICATIONS –LR10/20P

	US	International
PHYSICAL		
Dimensions	**45.5" H x 28" W x 28" D**	**115cm x 71cm x 71cm**
Dry Weight	**155 lbs**	**70.3 kg**
FLUID		

NOTE 4. Must be non-conducting with impedance >1000 MegOhms/cm

Viscosity **Up to 220 cSt**

NOTE 5. This viscosity number represents what ISOPur refers to as the "Apparent Viscosity" or the viscosity the machine is experiencing at any given moment. It therefore embodies the temperature curve for the fluid being processed by the machine. Since temperature significantly affects viscosity, the machine may shut down due to high pressure at the maximum viscosity when operating at the low end of the allowed temperature. This is a normal expectation of proper machine operation.

Maximum pressure	**50/80 PSIG (operating/static)**	**3.48/5.4 Bars gauge**
Minimum fluid temperature	**65°F**	**18°C**
Maximum fluid temperature	**200°F**	**93°C**
Minimum fluid flash point	**>140°F**	**>60°C**

POWER

Customer Provided Hookup **Dedicated Branch Circuit**

NOTE 6. NEVER POWER FROM A GFI PROTECTED CIRCUIT.
Variable Speed Drives AND GFIs ARE NOT COMPATIBLE

Voltage	**110-230**	**230-460**
Phase	**1**	**1 / 3**
Frequency	**60 Hz**	**50 Hz**

MOTOR

Power	**0.5 HP**	**0.38 KW**
Voltage/Ph/Freq	**0-230/3/variable**	**0-230/3/variable**
RPM	**0 to 2000**	

PUMP - Positive displacement – Adjustable Flow Rate

Design Flow Rate

120 GPH **454 LPH**

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AMBIENT CONDITIONS

INDOOR / OUTDOOR

NOTE 7. *Avoid placement in Direct Sunlight.*
Electronic enclosure should be shielded from wind driven rain

Temperature	**32-104°F**	**0-40°C**
Humidity	**0-95%Non-condensing**	

FILTERS

Pre-filter	**PLR20-001 ISOPur Fluid Technologies 6 micron, Beta 200**
Collection element	**CLR20-001 ISOPur Fluid Technologies 3 micron, Beta 200**

TRANSPORT / STORAGE

The machine must always be transported or moved with no pressure on the vessels. Ensure the pressure has been bled from each vessel before transporting. When transporting or moving, all connections and /or openings should be plugged and the plugs removed only by authorized personnel. Sealing surfaces must never be compromised by the use of temporary plugs.

Vessel surfaces must be kept clean and free from any form of contamination, no stains, no rust, etc.

NOTE 8. *Lift only at designated locations only using proper equipment to avoid damage to machine.*

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3 INTRODUCTION / BACKGROUND

The ISOPur Fluid Purification System is one of the most advanced non-conducting fluid purification systems available. This system employs basic mechanical filtration enhanced by an electronic purification system to cleanse the non-conducting fluid and the entire lubricant path of virtually all particulate 0.1 microns or larger.

Working oils become degraded over time due to accumulation of contaminants and oxidation of their hydrogen and carbon based components. Normal filters effectively remove large debris, but are not sized to remove the large volume of small particles created as the oil degrades. Over time, the OEM's filtration system will likely appear to maintain a reasonable "oil cleanliness level" using the ISO standards as a measure. However, with the small particle population on the increase, and the ISO codes not capturing this phenomena well, the particles begin to accumulate in the form of sludge and varnish. This combined with the oil's falling lubricity capability will ultimately lead to increased mechanical wear, equipment damage and associated high maintenance costs.

Proliferation of these small particles causes an increase in friction at points throughout the fluid path which facilitates a static charge to form on the fluid. These clouds of charge will circulate with the fluid until either the particles carrying them are removed, the charge becomes neutralized or the potential difference becomes large enough to arc to a nearby ground point. These arcs produce very high local temperatures which can chemically alter oil molecules near the arc. This effect has also been associated with providing raw materials for varnish formation which will subsequently adhere to surfaces in the system.

ISOPur's BCA™ process has been proven to help neutralize these charges producing a net zero charge on the fluid. This charge reduction is a beneficial by-product of ISOPur's Agglomeration process as it facilitates submicron particle growth into larger filterable "clumps" that are easily removed by conventional filtration. The result is prevention of damage to expensive machinery.

3.1 FLUID FLOW PATH

The patented ISOPur Fluid Technologies, Inc. process typically operates as a kidney loop to the parent reservoir and pulls a fluid source into its pump. It then splits the flow into two equal paths introducing a high potential electric field into each fluid path which causes contaminated particles to take on a net positive or negative charge. These two separate paths are re-combined and the charged particles then are encouraged to mix. During this mixing particles with opposite charges are attracted to each other and combine (agglomerate) to form larger particles. Many of these larger particles are then captured in the collection filter.

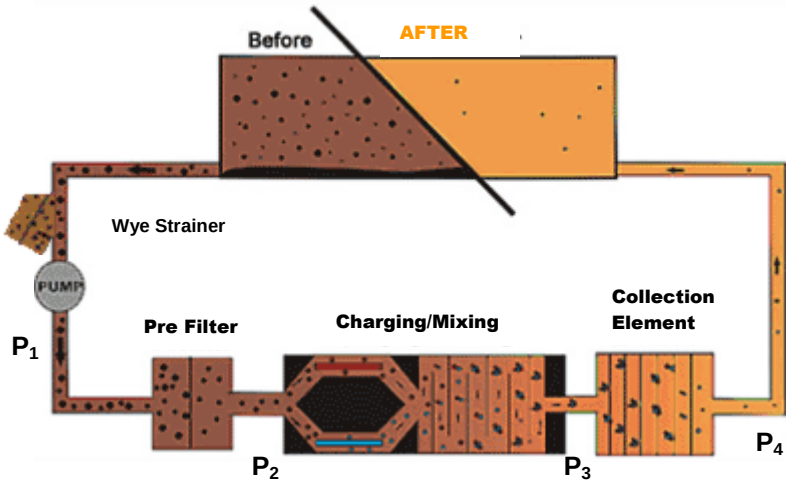

Figure 1: Balanced Charge Agglomeration

The fluid purification process is explained below:

a. Incoming fluid enters unit through the suction or inlet isolation valve.
b. The fluid passes through a WYE strainer. This strainer's job is to remove large items and debris that might damage the pump gears.

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c. Then the fluid is drawn into the suction side of the positive displacement gear pump. It is discharged at a positive pressure, P_1 that varies with fluid viscosity, flow rate and inversely with temperature. The fluid exits into the pipe leading to the pre-filter vessel.

d. The fluid then passes through the Pre-filter element (1st vessel) where most particles above 5 microns are removed. It then passes to the charging section in the Charging and Mixing vessel at a slightly reduced pressure P_2.

e. Inside this vessel is where the ISOPur Technology performs its magic. The flow is split into two identical paths wherein each is subjected to ISOPur proprietary charging technology. Each path is through a strong electric field. One of the paths experiences a high positive field, and the other a high negative field. Particles in the fluid are influenced by these electric fields where they are coerced into "absorbing" charge, one side a net positive and the other a net negative charge.

f. These charged particles then enter a mixing geometry where they are "encouraged" by innovative fluid dynamics techniques and mix. Each charged particle follows its electrostatic preference for an unlike partner and is attracted to ones with opposite charge. Most of them will cling to each other and therefore "grow" in size. This growing process is not bounded by a specific size, consequently any particle that is able to pass through the pre-filter is candidate for taking on a charge and becoming attracted to an unlike partner. Once they join, their unlike charges cancel, balancing out the charge on the fluid. The enlarged particles continue on their trajectory through the system being held together both by static attraction and by surface tension.

g. The single flow path then enters the Collection vessel (vessel #3) at a further reduced pressure, P_3, where many of the enlarged particles are trapped in the collection media.

h. Lastly, highly purified fluid is returned to the customer reservoir (at pressure P_4) where it begins mixing with untreated fluid.

i. Due to instantaneous dynamic properties of the fluid and static attraction dwell time considerations, a small portion of the charged particles are not able to mate with oppositely charged partners immediately in the mixing section. If small enough, these particles will pass through the collection media and therefore flow out into the remainder of the system. Here they are swept along by the fluid motion and effectively scour any metal parts in the fluid path while searching for an oppositely charged mate.

j. Some of these particles find mates that were created by the ISOPur charging process. Others find mates that were created by other static generators in the customer's system, like pumps or filters. As each attraction and mating process progresses, the resultant particle population decreases in total count while increasing in average size thus enabling standard filtration means to capture them.

NOTE 9. This shift in average particle size often results in an apparent increase in ISO code as previously "invisible" particles become visible to test equipment. This phenomena is often misdiagnosed as a malfunctioning process and will continue until the small particle population is reduced.

3.2 ELECTRICAL SYSTEM OVERVIEW

The following components are part of the electrical subsystem –

- Control enclosure: houses control electronics including PLC
- Pressure transducers: provide pressure readings to the PLC for fluid control
- Temperature sensor provides temperature reading to the PLC for safety operation
- 3 phase motor: used by the PLC as the prime mover for the pump and fluid flow

Contained within the control enclosure:

- Disconnect switch A means of electrical isolation from the plant electrical supply
- Function Switch Selects START/STOP/RUN
- DC power supply(s): Provides power for charging, external sensors, VSD and PLC
- PLC Stores and executes system logic
- I/O Expansion Modules Provide conversion of additional pressure signals for PLC
- VSD Variable Speed Drive for motor speed control
- Charging power supply: Creates and controls electric fields and charging currents

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3.3 VESSEL DESIGN OVERVIEW

Fluid definition:

Group II fluids as per pressure vessel code, typically mineral oil

3.3.1 DESIGN CONDITIONS:

Corrosion deterioration allowance:	N/A
Weld thickness efficiency	N/A
Wall temperature deg F and C	200°F [93°C]
Base material:	Aluminum.
Additional load:	N/A
Allowable minimum pressure	(0 psi)
Allowable maximum pressure	(1000 psi [68.9 bar]).

Allowable minimum and maximum temperature as per section 2

4 MACHINE INSTALLATION

All ISOPur Fluid Technologies, Inc. units are shipped fully assembled and tested. For shipping integrity, the unit is attached to a disposable pallet. All field connections are capped for protection and cleanliness. While every precaution has been taken in packaging and crating the unit, a thorough receipt inspection should be made to insure no damage has occurred during transport. As shipped, the packaging of the unit is adequate for short-term, indoor or otherwise protected storage.

Machine location and installation must always be in accordance with all applicable local and/or national codes.

4.1 PREFERRED LOCATION FOR THE MACHINE

The machine should be located indoors (or outdoors) as close to the fluid reservoir as possible as long as the environmental conditions of section 2 are not exceeded. The preferred elevation of the pump is slightly (1-2 feet [.3-.6m]) above the fluid level in the reservoir such that the fluid will not gravity drain from the reservoir in the event of a leak in the plumbing to or from the machine.

> *NOTE 10. EXCLUSION – All LR20P machines should be located out of direct sunlight. The PLC screen is subject to wash out and eventual destruction if positioned in direct sunlight. Machine electronics are housed in a NEMA-4 cabinet and are protected from normal wash down and humidity. However, the machine should not be placed in wind driven rain.*

4.2 ALTERNATE LOCATIONS FOR MACHINE

The machine may be located as high as 10 feet [3.0 meters] above the fluid level without an additional booster pump. This location will add some additional time to the fluid filling and air purging process, but once completely void of air, the machine will perform normally.

The machine may be located as much as 10 feet [3.0 meters] below the fluid level. This location will cause additional time and effort when changing filters, and add time to the pressure sensor calibration process. It is otherwise a normal operating location.

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4.3 PICKUP AND RETURN LOCATIONS ON RESERVOIR

The suction point on the reservoir should be at the lowest possible elevation to maximize the influence of the machine on removing contaminants from the bottom of the tank. The return into the reservoir should be at the highest and most remote point from the suction location that is possible. Care should be exercised in selecting a return point to minimize the creation of air bubbles and the following entrainment into the oil. Whenever possible, ISOPur recommends having the return exit point below the normal fluid level. Chosen properly, these locations will assure the best possible circulation of purified fluid and result in the maximum benefit to the customer.

When possible, schedule 40 metallic pipe should be used for all connections to an LR20P machine. All joints and connections should be by suitable safety rated connection methods and materials. Connection points should be isolated from vibration and physical stress as necessary to ensure zero leaks.

NOTE 11. The installation must never use any form of plastic pipe to attach the machine to the reservoir, including stainless braided Teflon tubing. Plastic pipe is a recognized contributor to the generation of static electricity.

ISOPur recommends the installation of customer-provided isolation valves at both suction and discharge locations as close to the reservoir as possible. These are a safety precaution in the event of a line break or other leak between the reservoir and the LR20P machine.

All piping installed for connection to an LR20P machine should be flushed and leak tested before being attaching to the suction and discharge connections of the unit.

NOTE 12. In the event that the unit cannot be located within 30 ft [10 m], the following pipe sizing is recommended with minimum additional hydraulic losses.

4.4 SUPPLY LINE TO MACHINE

When less than 25 feet (7.6 m) from the reservoir, use 0.5" (12 mm), or larger pipe size schedule 40 ABS 4/13.2 ASTM A53 Type S or E Grade A or equivalent. At distances greater than 25 feet but less than 80 feet (24.4 m) from the reservoir, use 0.75" (18 mm), or larger pipe with the same specifications.

NOTE 13. In no case should the equipment be placed into use at distances beyond 80 fluid path feet without contracting ISOPur for clarification and confirmation.

4.5 RETURN LINE FROM MACHINE

With a user provided anti-siphon system at return to the reservoir, pipe sizes of 0.5" (12 mm) and 0.75" (18 mm) respectively may be used to extend the distances as above.

NOTE 14. In all cases for both suction side and discharge side, the total lift above fluid level should not exceed ten (10) feet [3 meters].

4.6 AREA SURROUNDING MACHINE

The area around the machine must be such that no persons can be endangered by passing near by the equipment. Minimum acceptable clearances must be in accordance with local safety and hazard laws. Minimum clearances on all sides and the top must be provided to enable to proper servicing of the machine should it require service. Proper attire must be worn by serving personnel at all times in accordance with local customs and/or codes to preclude any safety-related accidents.

The machine should be placed in an orientation that will protect the pressure vessels from contact or damage from any vehicular traffic.

There should be fire suppression apparatus of the appropriate types within a safe distance of the machine for use in the event of a fire local to the unit

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4.7 ELECTRICAL INSTALLATION

Electrical wiring and connection to the local power supply should be made by a competent licensed electrician. All checks for safety, circuit breakers, proper connection and grounding shall be made by the electrician at this time. All installation parameters should be made in accordance with local codes.

Ensure the LR20P frame is connected to earth ground by a multi strand copper conductor cable of at least #8 size and not more than 5 feet [1.6 m] in length. Ground connections must use copper, brass or other conductive non-corrosive material. Total resistance from the internal control enclosure ground point to the earth ground must be less than 5 ohms.

NOTE 15. Ensure the electrical installation is performed by competent electricians to the requirements of the local jurisdiction. Ensure the power is OFF at the motor control panel or other circuit breaker location before wiring unit.

4.8 STEP-BY-STEP INSTALL

To aid in installation and startup, a checklist is provided. This checklist is not all encompassing. Good engineering practices should always be followed.

a. Uncrate the unit and inspect for condition and parts. Ensure the shock detector indicators are intact and that the carton is free from major dents or damage.
b. Move the machine into place lifting as necessary by forklift under the oil catch pan, or by rolling to the final location if equipped with casters.
c. If the machine is to be bolted in place, locate the machine on the studs and secure in place with flat washers, lock washers and nuts.
d. Remove all plastic caps from the inlet and outlet field connections.
e. Make the connections between the fluid reservoir and the LR20P machine's inlet and outlet points. ISOPur recommends the use of a suitable sealing compound on each joint such as Loctite 565 Thread Sealant and Primer 7649.

NOTE 16. When tightening the field connections always use two opposing wrenches on the connection to distribute torque equally between the two joining parts

f. Ensure that all isolation valves on the inlet and outlet side are shut.
g. Have the unit electrically installed by a competent electrician in accordance with local codes.

NOTE 17. ISOPur LR20P machines, because of their internal Variable Speed Drive (VSD) are not compatible with Ground Fault Interrupting (GFI) devices. Therefore, ISOPur does not guarantee proper operation of the unit if powered from such circuits. Should local codes require GFI's or similar safety devices, ISOPur recommends the use of an isolation transformer to preclude the unpredictable interaction of the VSD with the GFI.

h. Power should be supplied from a nearby Motor Control Panel or other location on a dedicated circuit not shared with any other machines.
i. Record the location and number of the breaker controlling the supply of current to the unit in the machine's log.
j. Ensure the unit is securely grounded to a proper earth ground. ISOPur recommends heavier than normal gauge grounding be provided such as a multi conductor cable of size 8 gauge or larger.
k. Turn OFF the Main Power Disconnect and open the control box.
l. Inspect for proper termination of the field wiring. If located outdoors, ensure that no glands have been compromised in the electrical installation.
m. Close the control box and secure.
n. Clean the area around the unit of any debris and obvious fluids to make leak detection easier should it be necessary.

4.8.1 COMMISSIONING OF EQUIPMENT

The unit must be installed as per manufacturer's instructions and the applicable safety devices set as prescribed herein. The machine must be installed in a proper location within the specifications described in this manual.

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After physical installation has been completed, the location and setup of the machine shall be verified according to the manufacturer's recommendations before operating up the equipment.

Where applicable, such inspections must be performed by the appropriate local safety representative(s) who must verify its safe installation to the local codes.

ISOPur recommends using the form below or its equivalent to maintain an installation and service log for the machine.

4.9 OPERATION CHECK LIST – INSTALLATION

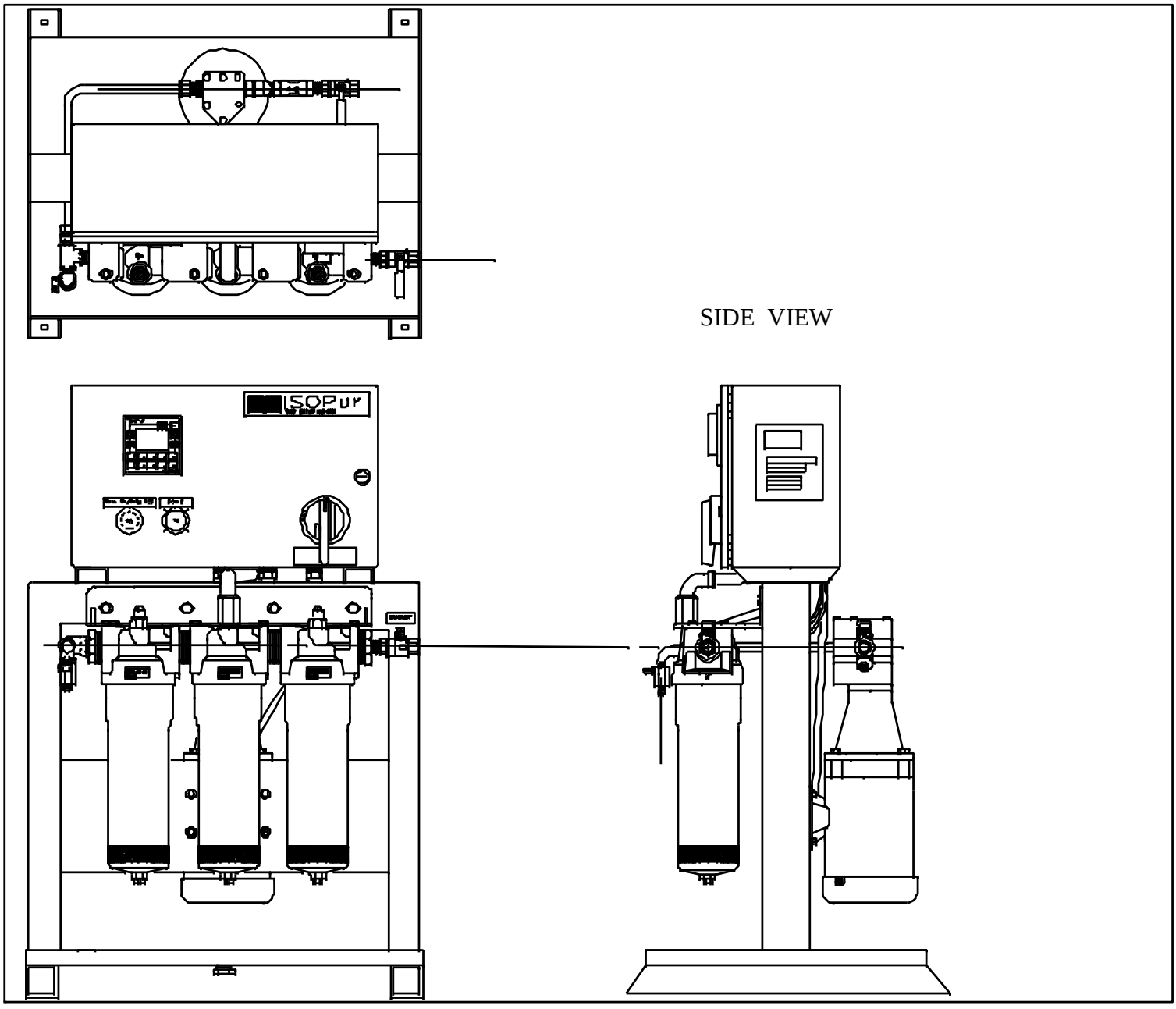
It is recommended to keep track of the following data log at the unit. This information is static data taken at initial installation and unlikely to change thereafter. Below is a ***sample*** of a filled out Check List –

Item	*Data*	*Comments* *Commissioning date 09.14.07*
ISOPur Model #	LR20P	**I-LR20P-0-2-n**
Serial #	1350709002	**2nd LR20P made in Sep. 2007**
Voltage	220 VAC	**Verified at 218 VAC at machine**
Phase	1	
Breaker rating/number/location	15A/205/East wall, pole 317	
Design Flow Rate	120 GPH	**Running at 120 GPH**
Piping run from inlet to tank	21 feet	**¾ "**
Piping run from outlet to tank	17 feet	**½ "**
Pre-filter #	ISOPur PLR20-001	**New 10.20.07**
Filter hours at change		**170 hrs**
Collection Element #	ISOPur CLR20-001	**New 10.20.07**
Filter hours at change		**170 hrs**
Machine hours at last change		**170 hrs**
Fluid Type	Turbine lube oil	
Fluid Manufacturer	Mobiline	
Fluid Brand name	Esterline 700	
Viscosity @40°C	36 cSt	
Reservoir Size		**550 gals**
Fluid added since last filter change		**15 gals**
Fluid Temperature	80°F < T < 200°F	**92-140°F**

5 MACHINE DRAWINGS

5.1 ISOMETRIC

TOP VIEW



SIDE VIEW

FRONT VIEW

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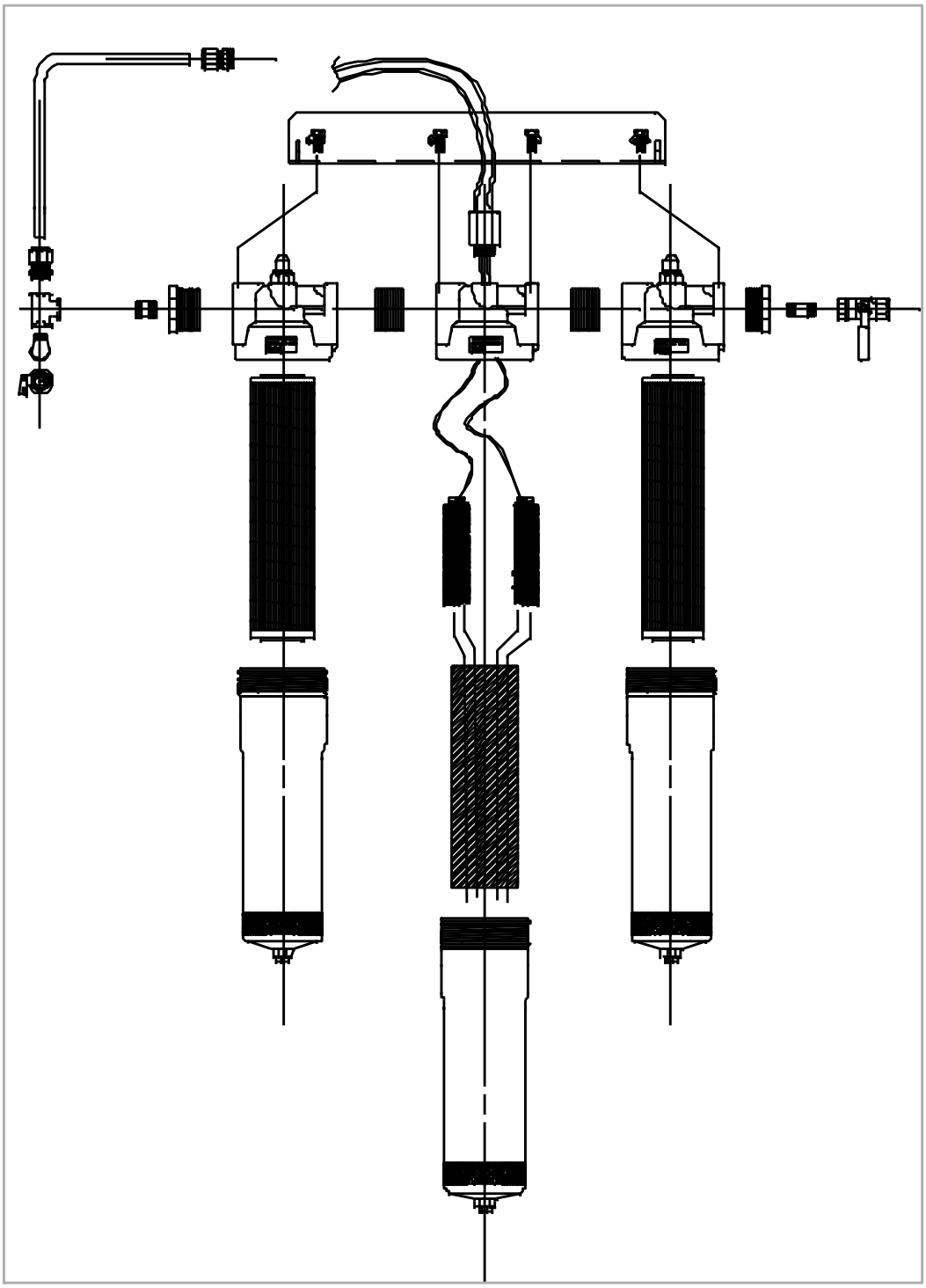
5.2 EXPLODED PLUMBING VIEW



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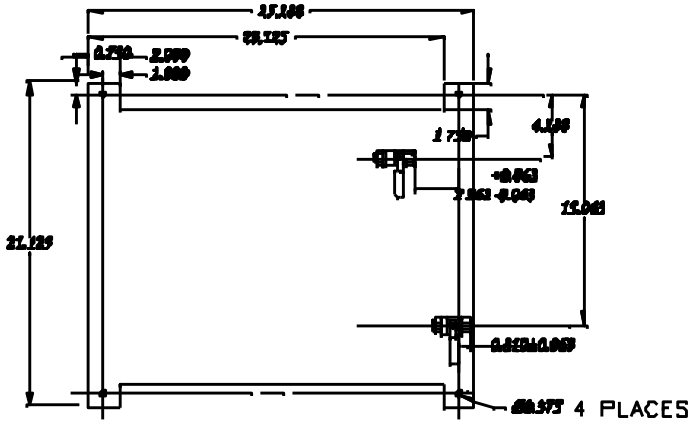
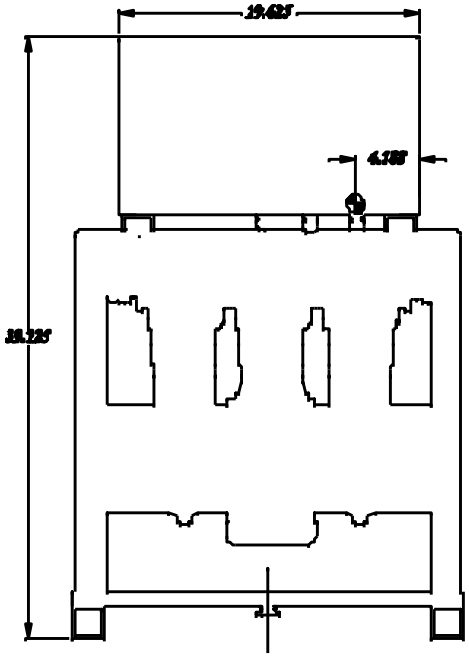
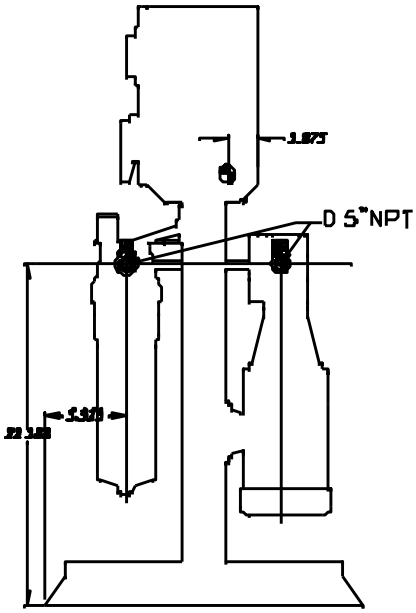
5.3 OUTLINE DIMENSIONS







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5.4 BILL OF MATERIALS – ASSEMBLY LEVEL

Item #	Select 1	Qty	ISOPur Part #	Description
1	A	1	165-00006	Drive, AC, A/B .5 HP 120V 1 PH
	B		165-00002	Drive, AC, A/B .5 HP 240V 1 PH
	C		165-00001	Drive, AC, A/B .5 HP 480V 3 PH
	A		165-00011	Drive, Line Filter, .5 HP 120V & 240V 1 PH
	B		165-00014	Drive, Line Filter, .5 HP 460V 3 PH
2		1	270-00006	PLC/HMI
3		1	275-00007	Power Supply, H.V.
4		1	275-00002	Power Supply, A/B 24V 110-240V
5		1	275-00006	Power Supply, C/H 24V 380-480V
6		1	290-00001	Relay, H.V., A/B
7		1	245-00006	Light Module, A/B, Green
8		1	245-00005	Light Module, A/B, Yellow
9	A	1	250-00011	Motor, .5 HP, 230-380 ATEX (Exp)
	B		250-00004	Motor, .5 HP, 230-460 NFPA (Exp)
	C		250-00005	Motor, .5 HP, 230-380 STD
10	A	1	280-00014	Pump/Bypass, 2 GPM, STD or NFPA (Exp)
	B		280-00002	Pump/Bypass, 2 GPM, ATEX (Exp)
11		1	255-00016	O-Ring, CMU
12		1	PMR20-001	Filter, Prefilter
13		1	CMR20-001	Filter, Collection
17		1	195-00003	Feedthru, H.V.
18	A	4	350-00001	Transducer, pressure
	B		350-00004	Transducer, pressure NFPA (Exp)
	C		350-00005	Transducer, pressure ATEX (Exp)

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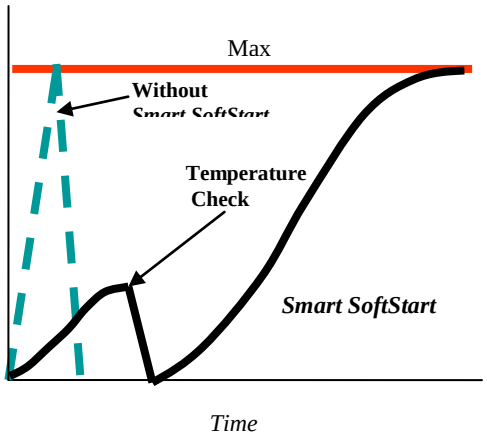
6 ADVANCED FEATURES

6.1 SMART SOFTSTART™

A direct benefit of ISOPur Fluid Technologies Variable Flow design is the capability to operate over an increased range of fluid viscosities and temperatures. The PLC control also incorporates new automation features to help with installation and maintenance of the machine.



ISOPur Fluid Technologies has incorporated a *Smart SoftStart* technology to address high pressure conditions sometimes experienced during startup at high viscosities or low temperatures. This technology smoothly increases the flow up to the Desired Flow Rate or stops at pre-determined pressure levels as defined by the operator.

This ultra smooth start up is extends pump and motor life. It greatly reduces stress on the filter media and the resultant proliferation of particle clouds as often occur when a pressure shock dislodges them from the filters. These particle clouds are associated with the harsh startup of fixed speed pumps.

6.2 PRESSURE GUARD™

ISOPur has incorporated Pressure Guard to keep the machine operating safely in varying temperature and viscosity conditions. Under the watchful eye of Pressure Guard, fluid pressure is constantly monitored. Should something in the system to which the ISOPur unit is attached change and cause the system pressure to climb above the maximum operating pressure, Pressure Guard will automatically spring into action. In Pressure Guard, the rising pressure results in a request to reduce flow to keep the pump pressure within the safe operating limits as specified by the user. Once Pressure Guard has modified the flow rate, it will attract attention by blinking the YELLOW Alert Light and indicating in the PLC display what action it took.

If for some reason the pressure were to continue to climb above the maximum safe operating level to the Hard Shutdown point, Pressure Guard will force the machine to shutdown. It will attract attention to the shutdown condition by turning the YELLOW Alert Light ON solid. At this point Decision Maker™ (below) will await operator input before proceeding. Similarly, Pressure Guard will shut the machine down if an operator selected minimum pressure is not maintained at the pump discharge (P_1) to prevent major leaks from causing damage.

6.2.1 MECHANICAL SAFETY

In addition to high tech PLC software safeties, all LR20P machines use a pump with built-in mechanical bypass set to protect the vessels and other components from damage if all else were to fail.

6.3 SUCTION WATCH™

In addition to normal closed loop flow operation, and the closed loop pressure limit performed by Pressure Guard, Suction Watch constantly seeks to identify perturbations in the pump discharge pressure (P_1) that imply system abnormalities. The first of these is the constant monitoring of pump pressure for sudden changes, either positive or negative. Negative changes imply an instantaneous loss of pressure as can occur with air leaks on the suction side. Similarly, positive changes can occur from sudden downstream blockages or after the passing of a large air bubble past the sensor. If a predetermined limit is exceeded in either direction, Suction Watch will indicate in the PLC display which of the conditions has occurred. It will also blink the YELLOW Alert Light to attract attention to the condition. Prolonged running in this condition is not advised. Personnel should find the cause of the disturbances.

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6.4 TEMPERATURE MINDER™

Temperature Minder monitors fluid temperature. If determined to be too hot or too cold, Temperature Minder will cause the machine down. If enabled by the operator, Temperature Minder will work with another PLC program, Auto Temperature Extreme Restart (described below), to automatically monitor the fluid temperature and restart when it is in a safe range.

6.5 FILTER MINDER™

Filter Minder is a unique set of software tools designed to maximize the collecting capability of the pre and post filters in LR20P Series machines. The pressure drop across each filter ($\Delta P_{1\text{-}2}$ and $\Delta P_{3\text{-}4}$) first monitored, and if either exceeds an operator settable limit becomes controlled to keep the element from being compromised. As an element begins to load up with debris, Filter Minder systematically adjusts the flow rate to keep the pressure drop across the filter at or below the operator specified maximum.

Should either sensor used to calculate the pressure drop across either vessel fault while Filter Minder is in control of the ΔP, the PLC will shut the machine down and describe the fault on the PLC screen.
Similarly, if a fault occurs in the same sensor when Filter Minder is not in control, the associated control loop will be disabled and a warning message put in the LCD screen indicating the inability to control the specific ΔP.

6.6 DECISION MAKER™

Decision Maker is the software logic in the PLC that constantly weighs the requests from all control and safety modules– Smart Start, Pressure Guard, Filter Minder and Temperature Minder to determine what flow rate to set. It incorporates a closed loop PID (Proportional-Integral-Derivative) control, temperature compensated gains, error-selection and flow biasing logic that together control the pump speed to match the dynamics within the fluid system at any point in time.

Should there exist more than one high pressure (or ΔP) condition, Decision Maker uses the following precedence relationship to determine the magnitude of error used by the PID loop –

$$\Delta P_{1\text{-}2} < \Delta P_{3\text{-}4} < P_1$$

As a maintenance benefit, when Decision Maker determines to reduce the User Requested flow rate, it blinks the YELLOW Alert Light to call attention to the "Reduced Flow" condition being experienced. The YELLOW Alert Light will continue to blink until the cause of the high-pressure condition has been alleviated.

Should Decision Maker have to reduce flow below 25% of the maximum allowable rate, it causes a maintenance shutdown, causing the YELLOW Alert light to go ON solid. At this point Decision Maker awaits user intervention.

6.7 AUTO BROWNOUT RECOVERY™

Auto Brownout Recovery is a PLC software function that must be activated by the user, and is under password access. Auto Brownout Recovery allows Decision Maker to return the machine to Automatic Operation (if it was running at the time of interruption) upon restoration of a normal power level. When automatically restarting, the same safety-driven operation as the original manual start is followed to ensure all parameters are within safe bounds before returning the machine to Automatic Operation.

6.8 AUTO EXTREME TEMPERATURE RESTART™

Often as fluid temperature conditions change dramatically, both high (as in hotter locations in mid summer heat) and low (as in an outage in a northern location in the winter cold) a PLC function called Auto Extreme Temperature Restart can deal with these conditions. When this function is enabled by the operator, the PLC will shut the machine down on fluid temperature excursions outside the programmed limits. The PLC will automatically bring the machine out of hibernation approximately every 30 minutes to check the fluid temperature – a cycle that runs for 3 minutes to draw a representative amount of fluid from the reservoir and bring it to the temperature sensor. If the temperature has come back within safe operating limits, the PLC will return the machine to Automatic Operation. If still too hot or too cold, the PLC will hibernate again and try 30 minutes later. It will continue this cycle indefinitely until the temperature comes into operating range or the operator manually shuts it down.

When automatically restarting, the same safety-driven operation as the original manual start is followed to ensure all parameters are within safe bounds before returning the machine to unattended operation.

7 HUMAN MACHINE INTERFACE

LR20P Series machines have two distinct types of user interface, the PLC display / keypad and the two Button / Indicator lights (GREEN and YELLOW). Both are used to communicate from the machine to the user and from the user to the machine. Buttons are used to START and STOP the machine and RESET ALARMS. Their associated indicator lights display simple status and alarm conditions.
The PLC display and keypad are used to communicate more detailed system information and to set various machine operating parameters.

When the LR20P machine is powered up, the following screen will appear for a few seconds. Please verify it shows the model of the machine you are standing in front of.

Figure 7 LR20P Splash Screen

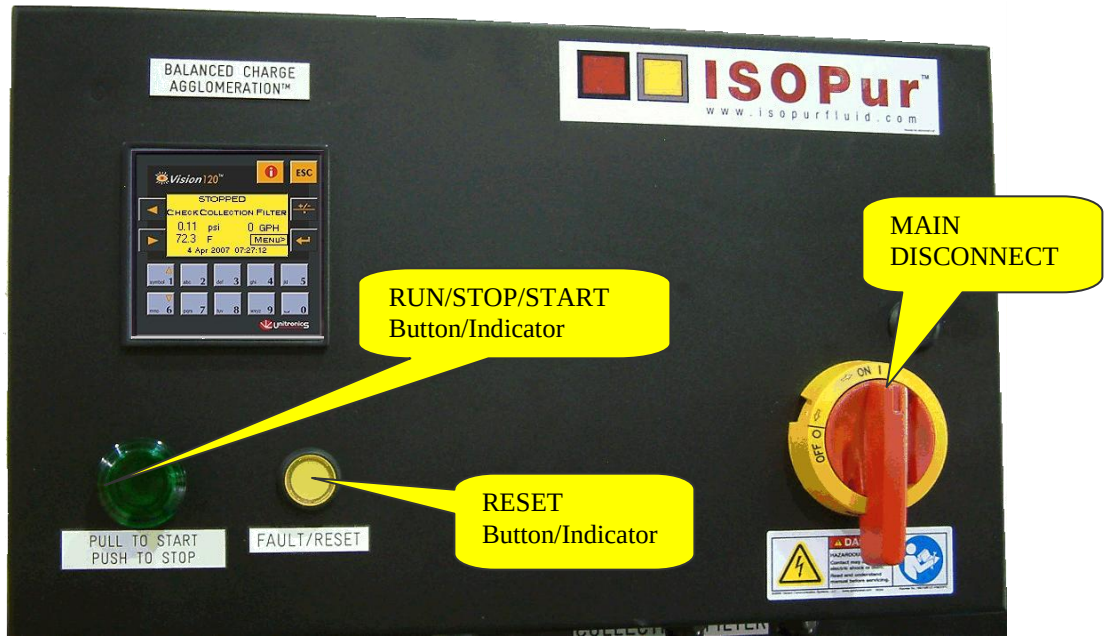

Figure 9.1 Control Box

NOTE 18. ISOPur recommends reading and understanding the method of powering, operating and shutting down the machine before attempting to program machine features. The menu system and operating parameters should be understood and reviewed BEFORE attempting to operate the machine.

NOTE 19. The equipment must be supervised and operated by trained personnel only who are familiar with the safe operation of the machine. ISOPur is not responsible for the training of all personnel who must interface with the machine.

NOTE 20. Where required, machine startup must be performed in a way to limit temperature increase to 50C per hour to minimize physical stress on the machine. Operators should check for leaks while the machine startup is building pressure

NOTE 21. The machine must only be operated when all safety devices are intact and functional and within the limits specified in this manual

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NOTE 22. Should the machine malfunction in an unsafe manner, it must be shut down immediately.

NOTE 23. Where required, any pressure or temperature excursion exceeding more than 110% of the maximum pressure or temperature rating of the machine must result in a retest of vessel integrity and must be performed before returning the equipment to normal operation.

The default screen displayed when the system is running, or shutdown with all alarms cleared is the "*System Run"* screen. It will show the basic operating parameters of flow rate, fluid temperature, system pressure, time, date, as well as any system alarms or messages. From any point in the menu system, the user can press the [ESC] key a multiple of times to return to the System Run screen.

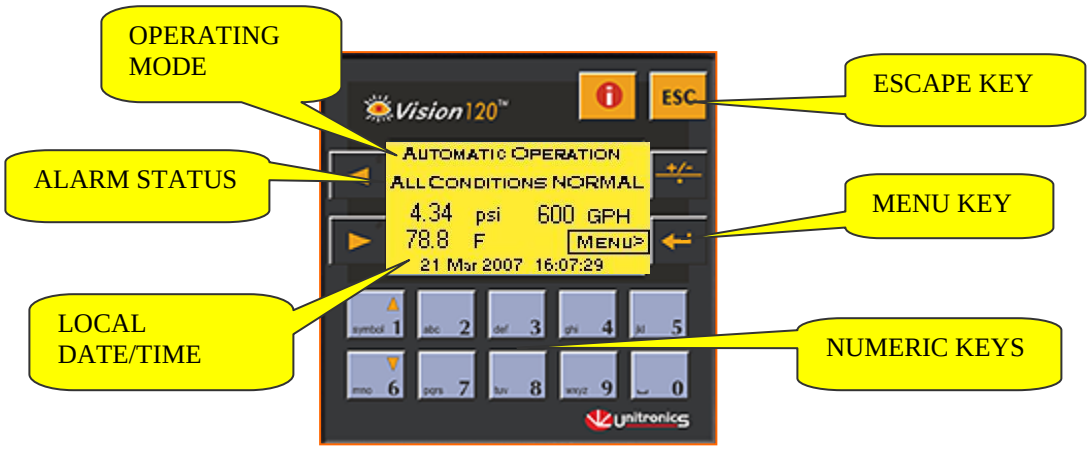

Figure 9.2 System Run Screen

NOTE 24. When on the System Run Screen, pressing the [Enter] key will activate the menu system. The units for the fluid parameters may be changed to metric if required through the Setup Menus described below.

7.1 THE SYSTEM RUN SCREEN

To activate the *"Setup Choices Menu"* from the *System Run Screen* simply press the [Enter] key.

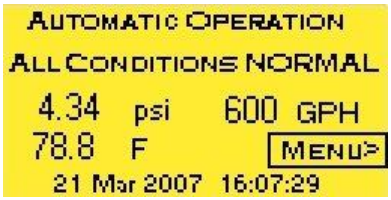

Figure 7.1 System Run Screen

7.2 SETUP CHOICES SCREEN

The function of the main menu is to launch additional viewing screens giving access to additional system data. To change any of the machine's operating parameters one must go to the *Setup Menu.*

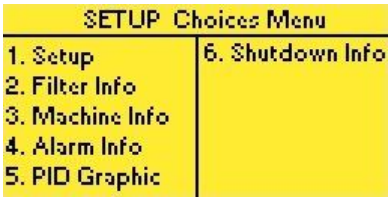

Figure 7.2 Setup Choices Screen

To return to the *System Run Screen* push the [ESC] key. Otherwise, the user can navigate the menu options by pressing the keypad number next to the associated function. From the main menu the options are:

1. Go to the *Setup Menu*
2. *View Filter Information* and reset filter run hours
3. *View Machine information*
4. *View Alarm Information*
5. *View* a graphic representation of the machine's *Piping & Installation Diagram* (P&ID)
6. *View* data captured at the last machine shutdown

7.3 SETUP SCREENS

The *Setup Menu* is accessed by selecting option [1] from the *Setup Choices Menu*. A password is required to enter the *Setup Menu*. Once a password is correctly entered, it will remain valid for 20 minutes. You may leave the *Setup Menu* and re-enter as many times as you like within the 20-minute period and the PLC will not request the password until the 20 minutes have elapsed.

The setup password for all LR20P machines is "**4 0 9 6**". No "Enter" key is required.

Figure 7.3 Enter password Screen

7.4 SET RUN PARAMETERS

From the *Set RUN Menu* the user is allowed to change setup parameters by selecting the following options.

Figure 7.4 Flow Pressure Set Screen

1. *Set Flow* gives access to the requested flow, shutdown pressure, maximum and minimum operating pressures.
2. *Set Filter dP* accesses the maximum pressure differential across each filter.
3. *Set Time* allows changing of the time and date.
4. *Set Temp* gets to the minimum and maximum fluid temperatures.
5. *Cal Sensors* allows calibration of the pressure sensors.
6. *Set Metric* enables selection of English or Metric units for all display and data entry (English units: GPH/psi/°F. Metric units: LPH/bar/°C)
7. *Set Auto Rest* provides access to the various auto restart options.
8. *View Hdwe* brings up several engineering parameters within the control system for viewing

Once in the *Setup Menu*, the user may return to the main menu by pressing the [ESC] key.

7.4.1 SET FLOW/PRESSURE

The first option in the *Set Flow/Press Menu,* "Flow Rate" allows you to set the desired flow rate for the machine. The PLC in your ISOPur machine will always try to run at this flow rate if not limited by some other restriction.

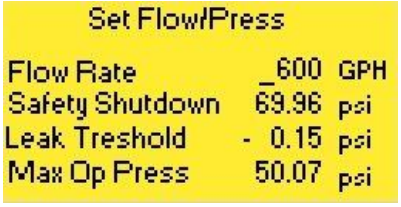

Figure 7.4.1 Flow/Pressure

At times, the machine may slow down its flow rate because it is experiencing a high pressure. This high pressure could be a result of a filter that is nearly full, or from pumping a very high viscosity fluid. If the high pressure is a result of a high viscosity fluid, it is suggested the requested flow rate be lowered to avoid nuisance alarms.

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NOTE 25. It is likely that when attempting to start a machine that is cold or has a very high viscosity fluid for the first time that this phenomena will occur. It is recommended that the desired final flow rate be changed to a set point 50% lower as a starting point until the machine warms up and the fluid loses some of its cold viscosity. The desired set point can then be restored.

At this same screen, several pressure limits for operation can set.

The first is the "Safety Shutdown" pressure. Any time the pump discharge pressure (P_1) reaches this value, the PLC will stop the pump immediately.

The next pressure "Leak threshold" sets the minimum operating pressure that the machine needs to have before normal operation is allowed. Anytime the pump discharge pressure (P_1) drops below this pressure during operation, a leak is suspected and the pump is stopped to prevent loss of the fluid.

The last pressure set point on this screen is the "Max Op Pressure." This set point is the maximum pump discharge pressure (P_1) at which the machine will be allowed to operate. If the pump discharge pressure ever exceeds this setting, the pump speed will be reduced until the pressure set point is reached.

NOTE 26. LR20P machines will experience an "Apparent Viscosity" or the viscosity that embodies the temperature curve for the fluid being processed. Since temperature significantly affects viscosity, the machine may not be able to reach the requested flow rate at high viscosities when operating at the low end of the allowed temperature. This is a normal expectation of proper machine operation.

7.4.2 SET FILTER DIFFERENTIAL DP WARNING LIMITS

The PLC will automatically slow the pump speed if it measures too large of a pressure drop across one of the filter elements. The maximum pressure drop allowed for each of the filters may be set in this menu. The ISOPur machine will slow the pump as needed to keep the pressure drop across the filter at or below this differential pressure set point. The PLC will stop the pump if speed is reduced below 25% of the maximum allowable flow rate to avoid control stability issues.

Figure 7.4.2 Filter Differential Pressure Screen

7.4.3 SET TIME & DATE

The time may be changed in the PLC in 24 hour format. Please note, the date is entered in dd/mm/yy format.

Figure 7.4.3 Set time and date

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7.4.4 SET FLUID OPERATING TEMPERATURE LIMITS

The minimum and maximum fluid temperature between which normal operation will be allowed is set on this screen. If the PLC senses a fluid temperature above the maximum limit, or below the minimum limit the PLC will prevent machine from running.

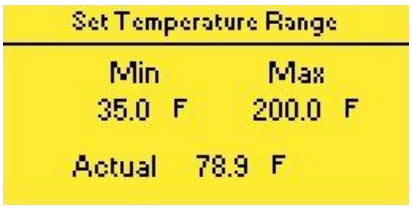
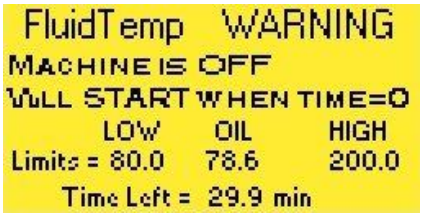


Figure 7.4.4 Fluid Operating Temperature Limits

When the fluid temperature falls below the minimum set point or rises above the maximum set point, the PLC can be cause the machine to go into a "Sleep" state. This parameter is controlled by the settings described in section 7.4.7 If enabled, the PLC will let the machine sleep for 30 minutes. Remaining sleep time is displayed on the screen (at right) while the machine is hibernating.



The PLC will then wake the machine up and run for 3 minutes to bring the oil from the reservoir to measure the temperature in an attempt to restart.

If the fluid temperature has risen above the minimum, or fallen below the maximum, the PLC will restart the machine automatically. If the fluid is still out of limit, the PLC will put the machine back into hibernation for another 30 minutes. This cycle will continue indefinitely until either shutdown by the operator or the temperature rises above the minimum value. For the machine to successfully restart, all safeties must be true.

While this display is active, the operator may override the sleep timer by depressing "ENTER" and the machine will try to restart as if the sleep period had ended. The PLC will not let the machine go into Automatic Operation until the fluid returns within the specified operating temperature range.

7.4.5 CALIBRATE PRESSURE SENSORS

Occasionally, the pressure sensors may drift out of calibration. This does not adversely affect machine operation, but is somewhat disconcerting to see a negative differential pressure across a vessel, for instance.

When this occurs, this screen is used to first View the sensors and visually acknowledge their individual offsets. If any sensor is in a fault condition, it will appear with the word "FAULT" as at right by P_2. The procedure for resetting the sensor offset to ambient is as follows

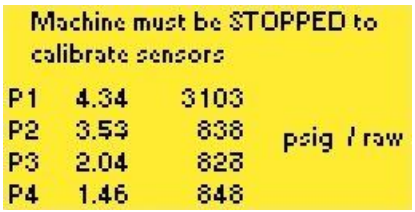


Figure 7.4.5 Calibrate Pressure Sensors

- Shut the machine down. Isolate it from the user equipment by closing both the Inlet and Outlet valves.
- Vent the vessels to ambient pressure. Use a catch can under the vent in case any fluid is expelled.
- Close the vents.
- Then by depressing the "ENTER" key, the sensors will become referenced to ambient and show 0 psi (+/- 0.1 psi) with perhaps a minor noise offset. This is typical sensor pressure display.
- Open both Inlet and Outlet isolation valves.
- Restart the machine

NOTE 27. The PLC will automatically detect a sensor that is not working correctly and learn to ignore it. However, if the pump discharge sensor (P_1) reading is out of range, the PLC will inhibit operation since certain machine safeties are derived from this reading.

7.4.6 SET METRIC OR ENGLISH DISPLAYS

The PLC may be programmed to display all measured data in either English or metric units.

The display is set to English by pressing "0" while this screen is active. Similarly, selecting metric display is accomplished by pressing "1". The screen will indicate the current setting by the displays at right.

When set to English units the display will read flow rate in GPH (gallons per hour), pressure in psi (pounds per square inch), and temperature in °F (degrees Fahrenheit). In metric mode the display will read in flow in LPH (liters per hour), pressure in Bar, and temperature in °C (degrees Celsius). All displayed data as well as keypad entries will be in these respective units.

Figure 7.4.6 English/Metric

7.4.7 SET AUTOMATIC RESTARTS

Loss of AC Power

LR20P machines can be programmed to restart automatically after an input power failure. If this feature is enabled, and if the machine was running in Automatic Operation at the time of a power interruption, it will automatically restart upon restoration of power. Use a zero (0) to inhibit this restart feature or a one (1) to enable it. For the machine to successfully restart, all safeties must be in the safe condition at the time of restart. Default condition is Inhibited (0).

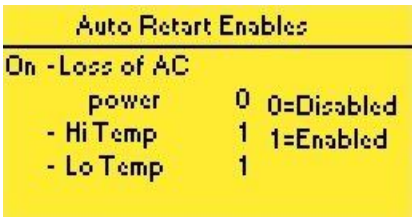


Figure 7.4.7 Auto Restart

Temperature Above or Below Specified Limits

LR20P machines may be set to suspend running if the fluid temperature exceeds two settable parameters, one for the low side and one for the high side. If the Automatic recovery from temperature excursions is enabled, the PLC will shut the machine down when either temperature is exceeded and then automatically restart it every 30 minutes to test the fluid temperature. If the temperature has come back inside the operating envelope, the PLC will automatically return the machine to Automatic Operation. If the temperature has not returned to a safe level, the PLC will again shut the machine down and wait 30 minutes before trying the same operation again. Setting this feature to a "1" will enable the PLC to enter the automatic restart cycle after a hot or cold temperature shutdown.

7.4.8 VIEW HARDWARE

The Operator can use this screen to observe several hardware parameters in the Variable Speed Drive subsystem. The frequency, output current and voltage to the motor, and the motor RPM are made visible here. Also provided are the motor direction of rotation and the temperature inside the PLC case.

Lastly, the fault stack from the VSD is provided indicating the last 3 faults to be registered within the VSD. Typically the VSD only inserts the cause of the last shutdown in the first of these three numbers.

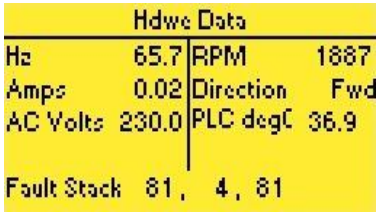


Figure 7.4.8 View Hardware

7.5 VIEW FILTER INFORMATION

Here the run hours logged on each of the filters is displayed, along with the total machine run hours and gallons (liters) processed. The user should record the filter hours in a maintenance log, such as the one in section 4.9 (a blank form to serve as a template for your own system is in section 15). The filter hours should be reset after changing the filter elements to help keep individual performance data. Use Keys 1, 2 or 3 as indicated on the screen to reset the hours on the filters. Resetting the filter hours using the keys will also clear the "change filter" NAG Screen.

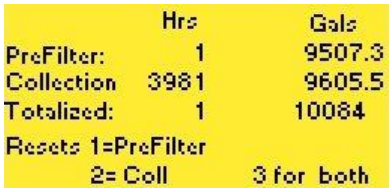
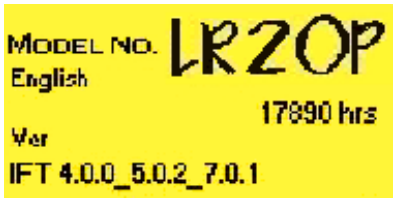


Figure 7.5 View Filter Data

7.6 VIEW MACHINE INFORMATION

This screen shows the model, Display mode and software revision numbers for the ISOPur application IFT 3.0.xx and the PLC O/S 5.yy.



7.7 VIEW ALARM INFORMATION

Selecting this option puts up to a full screen of text on the display. Its content offers a more detailed description of each alarm or event present and suggestions on what to do to clear it. If multiple alarms are present, the machine will automatically scroll through and display each individual alarm at the rate of one alarm per 3.5 seconds.

Should there be additional information available on an alarm condition, it is accessed from this screen by pressing "ENTER". Conditions such as a pressure sensor fault or drive fault will have this secondary screen with additional information.

7.8 VIEW MACHINE GRAPHIC P&ID

This advanced display shows the internal pressures in the machine as well as the flow rate and temperature. The pressures are displayed for the inlet and outlet of each vessel, in the user's specified units. The differential pressures are displayed to indicate the pressure drop across each filter.

P_1	Pump discharge
P_2	Pre-filter discharge
P_3	Charging section discharge
P_4	Collection discharge
Temp	Fluid Temperature
Flow	Flow rate through the ISOPur machine
Vessel dPs	Differential pressure across vessels

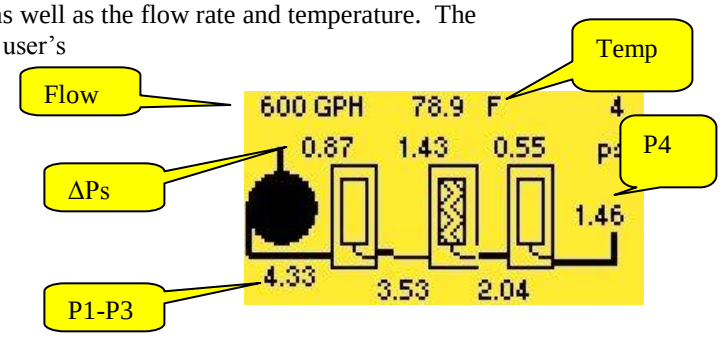


Figure 7.8 **P&ID** Graphic Screen

NOTE 28. High Apparent Viscosity may cause an indication of a high differential and therefore a false indication of a full filter. Determination of when to change a filter should be as described in section 10.2

NOTE 29. Pulling the green button while the machine is running will switch between this display screen and the System Run screen.

7.9 VIEW SHUTDOWN SNAPSHOT

This screen may be accessed through the main menu to show the conditions the last time the machine stopped running. It will also appear any time the machine stops. The [ESC] key will still return to the *Main Menu*.

The "code" is a seven digit number that captures internal operating data that may be helpful in determining the root cause of the shutdown. The single digit after the "/" is the internal operating mode.

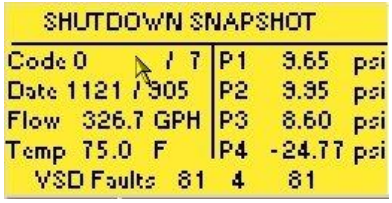


Figure 7.9 View Shutdown

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7.10 View Hi Energy

The Hi Energy Info screen may be used to display the parameters manufactured in the ISOPur High Voltage Power Supply. This screen serves as a simple Diagnostic to quickly determine if the Hi Energy electric fields are being produced.

Figure 8.10 View Hi Energy

8 INITIAL MACHINE STARTUP

The following procedure should be performed prior to the initial startup.

a. Ensure all drain valves are shut.
b. Check for mechanical integrity, conduit connections, latching hardware, security of all switches, door and circuit breakers.
c. Examine the power cable entry and insure that all connections are secure.
d. Ensure that electrical power is energized to the machine.
e. Insure that all valves from the customer's fluid reservoir to the machine and all valves returning the fluid to the reservoir are OPEN.
f. Ensure all air vents on top of the vessels are SHUT.
g. Turn the main power switch on the front door of the enclosure to the ON position.
h. Verify the *Splash Screen* indicates the proper equipment on startup.
i. After the *System Run Screen* appears, use MANUAL MODE to begin filling the system and purging the air from the vessels

NOTE 30. It is important to use MANUAL MODE for purging air since the high voltage will be inhibited for safety

j. MANUAL MODE is engaged by pulling the GREEN Button OUT all the way to the START position and HOLDING it there for 5-7 seconds until the pump begins to run. The GREEN Indicator light will blink at a ½ Hz rate during MANUAL MODE indicating the High Voltage is being held OFF.

NOTE 31. Pump rotation is predetermined at the factory and should never need field adjustment

k. Place a container under sample port located to the left of the 1st vessel. Purge the air from the inlet line by gradually opening the valve to check if air is contained in the fluid. When air stops and fluid begins to escape, slowly close the valve.

NOTE 32. It could take several minutes for fluid to begin entering the vessels depending on the distance from the reservoir and fluid viscosity.

l. When air no longer is coming out of the sample port, allow an additional 30 seconds before leaving MANUAL MODE. Once the time has elapsed, switching to AUTOMATIC is accomplished by PULLING the GREEN Button out.

8.1 ROUTINE START-UP

When the LR20P machine has been filled with fluid, it is ready to begin Automatic Operation. The start-up procedure is as follows.

NOTE 33. The GREEN BUTTON is a 3 POSITION switch. These positions represent START, STOP and RUN. STOP is fully IN against the door. RUN is a single click or PULL OUT away from the door and is a maintained position. START is a PULL OUT away from RUN and is a momentary position with a spring return to the RUN position.

a. Insure that the suction, discharge and any other system valves to and from the customer's reservoir are OPEN.

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b. Ensure that all drain valves and air vent valves on the machine are SHUT.
c. Turn the main power switch to the ON position. Wait for the "*System Run" Screen* to appear.
d. Verify that NO ALARMS are present before proceeding. All alarms must be cleared out before the machine will run.
e. PULL (*out all the way*) AND IMMEDIATELY RELEASE the GREEN Button, to initiate the startup sequence. Observe that the GREEN indicator light begins to flash.
f. The startup sequence will first increase flow smoothly to bring fluid from the reservoir up to the pump. During this time, the GREEN Indicator Light will be flashing at a 1 Hz rate.
g. In Automatic Mode a steadily increasing motor sound and flow indication is used to build pressure slowly on the filters. In this way, it avoids any pressure shock that might dislodge previously trapped debris from the filters.
h. When the requested (or pressure limited) flow has been achieved for a period of about one minute, the PLC will turn ON the GREEN indicator light.

NOTE 34. High viscosity fluids will normally produce higher pressures at the same flow rate than lower viscosity fluids.

NOTE 35. Should the machine encounter an operating pressure greater than the maximum allowed, it will suspend increasing the flow rate and settle out at a "Pressure-Limited" flow rate that is determined by the operator set Maximum Operating Pressure limits. It will signify this by flashing the YELLOW Indicator light and displaying the message "Controlling pressure".

i. Record the steady state pressure, temperature and flow readings for all sensors after the first hour of operation in the machine log.

8.2 RUN AND ALARM BUTTON OPERATION

The GREEN button will start and stop the machine and its indicator light will show when the machine is stopped, running or running without the high voltage energized. The YELLOW button will signal the PLC that a sample is to be taken and will acknowledge alarms while its indicator light will show an alarm condition.

GREEN Button Action	**Running**	**Stopped**
PUSH IN	STOP	N/A
PULL/RELEASE	Swap display screen between "*System Run*" and "*Graphic P&ID*" IF in MANUAL Mode, Switch to AUTOMATIC Mode	START running in AUTOMATIC MODE unless a critical alarm exists.
PULL/HOLD for 5 seconds	N/A	START in MANUAL MODE without energizing high voltage
YELLOW Button Action		
PUSH IN	ACKNOWLEDGE ALARMS	RESET ALARMS

8.3 GREEN (RUN) AND YELLOW (ALERT) INDICATOR LIGHT MEANING

The following table outlines the two indicator lights and their meanings –

Indicator **GREEN**	**YELLOW**	**Condition**	**Action Required**
OFF	***OFF***	• Machine OFF – not running. • Awaiting RUN <OR> • Tripped breaker	• N/A • START Machine • Reset breaker 1 time if corrects, proceed. Otherwise call ISOPur
FLASHING	***OFF***	• Machine is filtering the fluid • TECHNOLOGY OFF	• None if in startup. If condition persists for more than 5 minutes, check fluid viscosity or for other forms of high pressure.
ON SOLID	***OFF***	• NORMAL - Machine is purifying the fluid • TECHNOLOGY ON	• None
FLASHING	***FLASHING***	• Machine ramping toward the requested flow but has encountered a high pressure condition • TECHNOLOGY OFF	• Check conditions in LCD display to determine cause of condition and correct as required.
ON SOLID	***FLASHING***	• Machine is running at a reduced flow point due to a high pressure condition • TECHNOLOGY ON	• Check conditions in LCD display to determine cause of condition and correct as required.
OFF	***ON SOLID***	• Machine is SHUTDOWN due to FAULT	• Check conditions in LCD display to determine cause of condition and correct as required.

8.4 MANUAL SHUT DOWN

When it is necessary to shut the machine down for service or outage or other reason, follow the steps below to assure a safe and orderly shutdown.

NOTE 36. The equipment must be operated or supervised by trained personnel only who are familiar with the safe operation of the machine. ISOPur defers responsibility for the training of all personnel who must interface with the machine to the end user.

NOTE 37. Where applicable according to local codes, the machine shut down procedure must be performed in a way to limit temperature decrease to 50C per hour to minimize physical stress on the machine

The following procedures should be followed for normal machine shut down for any LR20P machine for filter changing or other forms of maintenance.

a. Take readings of all pressures from the *Graphic P&ID Screen* and record in the machine log.
b. Press the GREEN button IN (*all the way*) to shut the machine OFF.
c. Call up the *Graphic P&ID Screen* and observe that the pressure readings go to zero.
d. Turn the Main Disconnect Switch to OFF.
e. Shut the inlet and outlet valves to the reservoir as required.
f. Secure all other valves in the system to and from the target fluid reservoir.
g. Check the machine for any signs of leakage and/or abnormalities and report them to appropriate maintenance personnel as required. Record any unusual findings in the machine log.
h. If the machine is being taken down for service, it must only left after assuring it has been tagged out and all safety devices are in place, intact and functional as per local codes.

8.5 AUTOMATIC SHUTDOWN & RECOVERY

LR20P machines have several control functions that monitor system operation and may at times cause the machine to shutdown. The types of shutdowns are indicated in the table in section 13.1.2.

When the machine shuts down due to any safety related item, it will have its YELLOW indicator light ON SOLID and the LCD display will indicate the nature of the event or condition that caused the shutdown. Good engineering practice is to search out the cause of the shutdown and fix it before attempting restart.

Once the cause of the shutdown has been identified and fixed, the alarm may be CLEARED by pushing the YELLOW Button IN. The Alarm Condition reported in the PLC display should be cleared at this time and the machine is now able to be STARTED.

Depending on the nature of the alarm event or condition, the alarm (either the same one or a new one) may immediately report in and shut the machine down again. Pushing the YELLOW Button IN only clears the logic to allow a restart. It does not fix the cause of the shutdown. If the machine continues to shut down, record the shut down information on the *Shutdown Screen* and call ISOPur.

8.5.1 TEMPERATURE SHUTDOWN WITH AUTOMATIC RECOVERY

If the fluid temperature exceeds the operator set minimum or maximum, the PLC machine will automatically shut the machine down to protect itself from damage due to the excess temperature. If it has been enabled for Automatic Restart after temperature excursions, the machine will first display the screen at right. The PLC display will show a 30 minute timer and the temperature limits. When the timer reaches zero The PLC will restart the machine for a trial period of 3 minutes. During this time the PLC samples the fluid temperature. If at the end of the 3 minutes the temperature has receded back within allowable limits, the PLC will automatically switch to Automatic Mode and continue running.

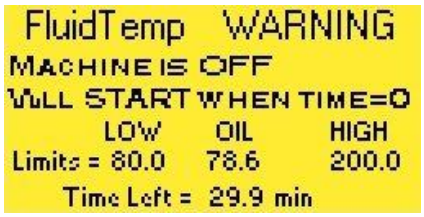

Figure 8.5.1 Temperature Sleep

9 DEFAULT SETTINGS FOR PROGRAMMABLE PARAMETERS

The settings below on the gray background are initially set at the factory. The acceptable range of settings is between the minimum and maximum values beside each default setting.

Parameter Settings			
Parameter	**Default**	Minimum	Maximum
Flow	**120 GPH [2271 LPH]**	30 GPH [114 LPH]	150 GPH [567 LPH]
Shutdown Pressure	**70 psi [4.82 bar]**	0 psi/bar	75 psi [5.17 bar]
Max Operating Pressure	**50 psi [3.4 bar]**	0 psi/bar	60 psi [4.13 bar]
Min Operating Pressure	**0 psi [0.0 bar]**	0 psi/bar	5 psi [0.34 bar]
Maximum Temperature	**200°F [93.3°C]**	35°F [1.6°C]	200°F [93.3°C]
Minimum Temperature	**35°F [1.5°C]**	35°F [1.6°C]	200°F [93.3°C]
Pre-filter Delta-P	**15 psi [1.0 bar]**	5 psi [0.34 bar]	25 psi [1.7 bar]
Collection Delta-P	**10 psi [0.67 bar]**	5 psi [0.34 bar]	25 psi [1.7 bar]
Auto-Restart after power loss	**OFF**	n/a	n/a
Auto-Restart after temperature shutdown	**OFF**	n/a	n/a
US or Metric units	**US**		

10 MAINTENANCE

Generally, LR20P machines require little to no maintenance. At intervals described below, the filter elements should be examined and/or changed.

10.1 GENERAL

The machine should be checked for proper operation a regular intervals. Such inspections must be documented by the operator in accordance with local laws or customer procedures. The first of these inspections must be within 6 months of commissioning and proof of the inspection provided to local authorities on demand as necessary.

All inspection and maintenance should address the following issues as may be required by local authorities-

Checking all connections for leaks and/or signs of corrosion
The tightening of all applicable fasteners or joints as necessary
Examination of local site conditions and all protected zones for safety related obstructions or objects
The presence in good condition of all markings such as temperature, high voltage electrical or hazardous environment
Normal functionality of safety warning devices

All maintenance must be performed by trained persons to all applicable to local and/or national standards in a manner consistent with subjecting the machine to minimum stress. Such service should always be performed in a way to ensure the long term safe keeping of the machine.

Since the machine can operate under pressures as high as 50 psid [3.45 bar-d] the vessels must never be opened while the machine is running or for a minimum of 1 minute after safe shutdown during which pressure in the vessels may still be above ambient. Pressure must be relieved from each vessel by opening the bleed vents before opening the lid or drain valves.

If the machine is to be taken out of service all isolation valves must be shut. If it is to be disconnected from its fluid connections, all connections must be suitably plugged to prevent leakage and ingestion of foreign matter into the machine.

All defective components such as worn out parts, bent or damaged bolts, used seals or "O" rings must be replaced with equivalent parts. Repairs which could compromise the safe operation or structural integrity of the machine (such as welding or major component replacement) must be performed by trained personnel in accordance with local codes.

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10.2 FILTER CHANGE INTERVALS

Filter elements should be inspected and replaced at frequent intervals. ISOPur recommends a rigorous program for oil health care consisting of initial tests to provide the following data –

Submicron particle count / distribution
Varnish potential Indication (QSA, VPI, or other colormetric test)
Protective Additive levels and health (FTIR or other)
Remaining Useful Life (Ruler or other equivalent test)

Based on the findings of these tests, an adequate re-testing program and proper sampling interval can be established.

For new oil, the following interval is recommended inspect start up filters at approximately 800 hours of operation or one month of service, then –

Filter	1st change	Subsequent changes
Pre filter	3 months or 2000 hours of operation	6 month intervals or 4000 hours of operation
Collection Filter	3 months or 2000 hours of operation	6 month intervals or 4000 hours of operation

For older oil or oil that has been over stressed, ISOPur recommends a more aggressive filter replacement scenario until the oil has been cleaned up. This scenario can be as aggressive as below –

NOTE 38. Counting filter changes should only commence after the machine has successfully run for a continuous month without significant pressure buildup across the filters.

Filter	1st three changes	Next 3 changes	Subsequent changes
Pre filter	Monthly or each 800 operating hours	3 months or 2000 hours of operation	6 month intervals or 4000 hours of operation
Collection Filter	Monthly or each 800 operating hours	3 months or 2000 hours of operation	6 month intervals or 4000 hours of operation

After the fluid has reached a cleanliness level of ISO 16,14,13 the filter change interval may be reduced to once per six (6) months.

Should the filters encounter highly contaminated fluid and build up a pressure drop more quickly than the recommended interval, the machine will shut down and indicate a need to change the filter(s) as below in section 10.2.1. Should this occur, the machine may be restarted and an attempt made to return it to automatic operation. If the machine shuts down again after a short time, the filters must be changed.

NOTE 39. Should there be a question as to which interval you should use, contact ISOPur…

10.2.1 CHANGE FILTER NAG SCREEN

LR20P machines contain a built in timer function that will remind the operator when it is time to change filters. The timer is factory set at 3900 hours. When the display shows the following message – alternating back and forth – it is the recommended time to change the filters. To exit this display, the operator presses ENTER and is taken to the *Filter Info Screen* as in section 7.5. Once here, the operator is reminded of the number of hours on the filter and can enter into the machine log the need to change the filters.

If the filters are not changed within 100 operating hours, the CHANGE FILTERS NAG will again appear and must be cleared out by the operator pressing ENTER. This sequence will continue until someone has cleared the operating hours from the *Filter Info Screen*.

The intent of this function is to remind responsible operators when to change filters and encourage them to record the accumulated filter data at each change.

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10.3 CHANGING FILTERS

When the decision has been made to change a filter (either the Pre Filter or Collection Element) ISOPur recommends that both elements be replaced at the same time to save labor hours. When preparing to change the filters on an LR20P machine, first assemble the following tools –

1 new Pre Filter Element
1 new Collection Element
1 clean 5-gallon catch bucket or pail to hold drained fluid
2 plastic disposable bags for old filters
2 tie wraps for bags
9/16" Open End Wrench
1" Open End Wrench
Pen or pencil
Machine log

The following steps should be used to change the filter elements –

a. Insure that all valves to and from the fluid reservoir are SHUT.
b. OPEN the Sample Port Valve on the left hand vessel and use a catch can to capture any fluid that expels as any remaining pressure is released from within the vessels. Leave this valve OPEN for now.
c. Use a catch can of sufficient volume – at least 1 liter – and drain fluid from the first vessel at the fluid drain plug on the bottom using a 9/16" open-end wrench. Open the plug slowly so as not to be surprised by a large out rush of fluid. Hold the fluid in the catch bucket for later replacement in the vessel. If local codes prohibit reuse, the fluid may be disposed of at the end of the change out.
d. Continue to drain off enough fluid (about ½ liter) to lower the level inside enough to enable removal of the filter bowl with as little spillage as possible.
e. Use two hands to loosen the filter bowl and remove it from the head. Use a 1" wrench on the hex shape on the bottom of the bowl if required to loosen the bowl.
f. Drop it down so that the top of the element and bowl clears the vessel head and set it upside down in the catch bucket until most of the fluid has drained into the bucket.
g. Remove the filter element from the bowl. Use a sharp object to pierce the element and twist it back and forth or otherwise pry it upward to dislodge it from the bowl if necessary.
h. Transfer the used element to one of the plastic bags and tie it shut with a tie wrap.
i. Examine the "O" rings on the bowl. Replace if worn or damaged.
j. Place the new Pre Filter element in the Pre-filter bowl.
k. Moisten the "O" rings on the bowl with fluid from the catch bucket and raise it back up and engage the threads in the head. Tighten to 20in-lbs using the 1" wrench as required.
l. Replace the 9/16" drain plug and tighten.
m. Repeat steps c-l for the Collection element.
n. Close the sample port valve.
o. OPEN the isolation valves at all points between the reservoir and the machine.
p. Turn the Main Disconnect switch on the front door of the enclosure to the ON position.
q. After the *System Run Screen* appears, engage MANUAL MODE as below to begin filling the system and purging the air from the vessels.

NOTE 40. MANUAL MODE is engaged by pulling the GREEN Button out(to the START position) and HOLDING it out for 5-7 seconds until the pump begins to run

r. When both vessels have become full of oil, the change out is complete. To switch the machine to Automatic Operation, PULL and immediately RELEASE THE GREEN Button. The machine will now continue up to its Automatic mode flow set point.
s. When the desired flow has been achieved for about one minute, the PLC display will turn the GREEN RUN Indicator ON constant.
t. Make the appropriate entries in the machines' logbook and clean up the area. Dispose of used filter elements according to local codes.
u. Use the PLC to call up the *Filter Info Screen* and reset the run hours and for each filter that was changed.

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11 MAINTENANCE TIPS

11.1 AIR IN SUPPLY LINE

If the pump is making intermittent noise (a slight hammering) there may be air getting into the supply line. To test for this, open the sample port and see if there are air bubbles coming out in the flow. If there are bubbles present, there is likely a suction leak. ISOPur pressure tests every machine to 80 psi during final test. It is therefore highly unlike that the ISOPur NPT joints are allowing air to get in. It could be a pump seal leak or more likely a union or hose joint leak on the supply piping.

To isolate this problem, use the following procedure –

a. Check for obvious leaks around all joints leading to the pump.
b. Make sure the machine is at ambient pressure by closing both the suction and discharge valves and open the sample port valve in front of the Pre-filter vessel.
c. Call up the appropriate screens as in section 7.4.5 and calibrate the pressure sensors when the sensors read zero psi.
d. Close the vent valve.
e. Open the inlet valve on the LR20P machine.
f. Start the machine and let it run up to speed. While it is accelerating, pull the GREEN Button to bring up the *Graphic P&ID Screen* and monitor P_1. Let the pump run for no more than one minute in this condition since it is probably not getting good lubrication.
g. If there is a leak in one of the LR20P machine joints, or the pump, P_1 will raise up in pressure to a few psi. If this is the case, stop here and check the joints and the pump for leaks.
h. If it stays near 0 psi, the problem is upstream of the ISOPur inlet valve. If this is the case, proceed as follows
i. If the machine is situated with its pump inlet below the fluid level in the reservoir, this is a "flooded situation." As long as all upstream valves between the reservoir and the pump are OPEN, there should eventually be a visible leak from one or more joints on the inlet side that are below the fluid level. This may take a while to develop, and may only appear as a small drip.

If the pump inlet is above the fluid level, or if there is need to speed the detection of a suction leak, two people are needed to perform the following procedure –

j. Clean and dry all fittings, valves, etc. upstream of the Pre-filter vessel to the reservoir.
k. Drain about 2 liters of fluid from the Collection vessel.
l. Station one person at the customer isolation valve where the fluid supply is drawn from the reservoir. The second person is at the LR20P machine with the machine running.
m. Call up the *Graphic P&ID Screen*.
n. Slowly close down on the LR20P machine's outlet isolation valve at the point where the fluid leaves the machine until pressure starts to build. Continue to close the outlet valve slowly until about 50 psi is showing on P_1.
o. Have the person at the reservoir valve ready, then, in close synchronization, perform the following three actions – all within 1-2 seconds of each other. Use 2-way radios for communication as necessary to enable the synchronization –
p. Close the outlet valve all the way.
q. Close the valve at the supply from the reservoir all the way.
r. Shut the machine down by pushing the GREEN RUN Button IN.

This will isolate the LR20P machine from the reservoir with about 50 psi against an air pocket (like the bladder in a well pump tank) in its fluid path from the reservoir to its outlet valve. Pressure will slowly distribute all the way back to the inlet isolation valve at the reservoir. Wherever there is a leak, it will eventually drip out due to the applied pressure.

11.2 SERVICING WYE STRAINERS

The Wye strainer on the ISOPur LR20P machine serves an important function – to protect the pump from large foreign debris. It however can be a source of irritation on the suction side of the fluid path if not serviced when needed. Since there is no real foolproof way to know if the strainer's element has captured any debris, ISOPur recommends pulling the element out and servicing it on every other filter change for mature installations – or once a year – when the fluid level will already be down. If your specific installation has a high debris level it may be necessary to service the element more frequently.

If the need for service arrives out of synch with a filter change, here is a quick tip you can try to shortcut a lot of work.

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a. Isolate the incoming and outgoing fluid paths completely from the reservoir.
b. Loosen the element retention plug (the 1 ¼" hex size).while holding a small catch pan under it to contain the fluid that will leak out when the element is removed.
c. Service the element as necessary saving some portion of any debris discovered for simple analysis.

When ready to re-install the element,

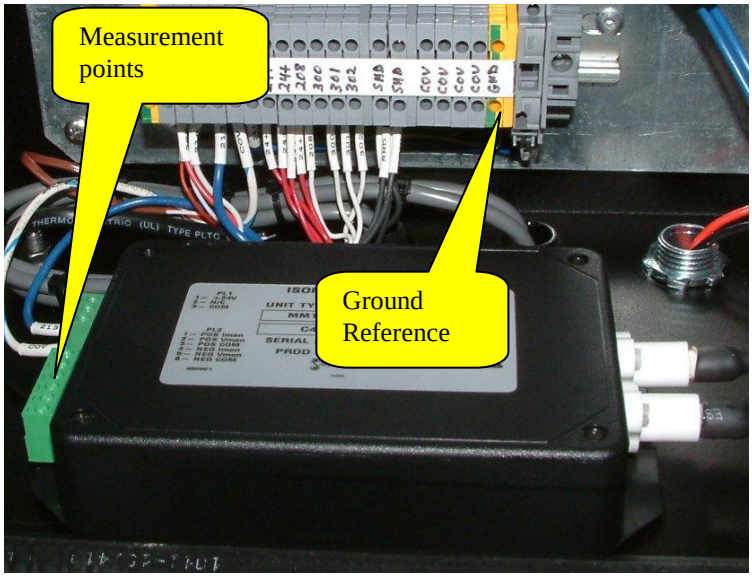
d. Replace the serviced element and retention plug.
e. Tighten the retention plug.
f. Clean up any spilled fluid or debris and discard according to local codes.
g. Open the isolation valves.
h. Return the machine to service.

11.3 GROUND FAULT INTERRUPTER's & VARIABLE SPEED DRIVE's

ISOPur uses a Variable Speed (re frequency) Drive [VSD] in its LR20P machines to drive the pump motor. VSD's, as they are often referred to, are basically incompatible with Ground Fault Interrupters. Since the VSD uses a frequency to drive the motor that can vary from 0 – 240 Hz, it must manufacture its own internal power rail from which it is able to create the power supplied to the motor. There are numerous advantages to this technique, and one known drawback. The internal power rail of the VSD, about 320 VDC, causes a temporary current imbalance that will frequently trigger the sensitive circuits of the Ground Fault Interrupter [GFI] therefore causing its breaker to trip. If a GFI circuit must be used, ISOPur recommends an isolation transformer between the Motor Control Panel and the ISOPur machine.

11.4 CHECKING ISOPUR TECHNOLOGY OPERATION

Checking ISOPur Technology operation is somewhat involved, and should only be attempted by trained personnel experienced with digital voltmeter operation and proper probing techniques for acquiring voltage readings inside a live control.



The following are voltage monitoring points and their expected values. If any reading is outside the normal range by more than 20%, call ISOPur with the data for analysis.

NOTE 41. All measurements must be made with the machine running and the high voltage energized. Points should be measured with a Digital Voltmeter (DVM) with minimum input impedance of 20 Megohms/volt.

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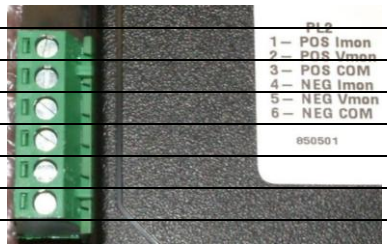
The procedure is as follows –

a. Open the control enclosure. This will require shutting down machine operation since the Main Disconnect Switch is interlocked to prevent opening while powered up, so notify any local authorities of the intended service action.
b. Once inside the enclosure, twist the Main Disconnect Switch's extension rod to apply power to the machine.
c. Pull the GREEN Button OUT to start the machine and let it run up to speed.
d. Wait for the high voltage to come ON before taking any readings, ensure either by the green LED on the high voltage relay or by having the GREEN Indicator Light ON.
e. Push the Black DVM lead into the reference ground point as shown in the picture above.
f. Readings on pins 1 and 2 are in DC volts for channel 1.
g. Readings on pins 4 and 5 are in DC volts for channel 2.
h. Use the Red lead of the DVM to probe the pins listed below, one at a time. Since the right most digit on the DVM may be dithering, allow enough time in taking the reading to determine the average.
i. Pins number 1 and 5 should read as a negative voltage. Pins 2 and 4 should be a positive voltage.
j. ISOPur suggests capturing these data points in the machine log using a table like the one below. This way a historical log may be kept.

Date				
Pin number			Expected Range	Actual Reading
1			-1.3 to -1.5 VDC	
2			6.5 to 8.5 VDC	
3			Positive common	
4			1.3 to 1.5 VDC	
5			-6.5 to -8.5 VDC	
6			Negative common	

12 RECOMMENDED SPARE PARTS

The following are a minimum of spares that should be kept at the site where an LR20P machine is installed and operating.

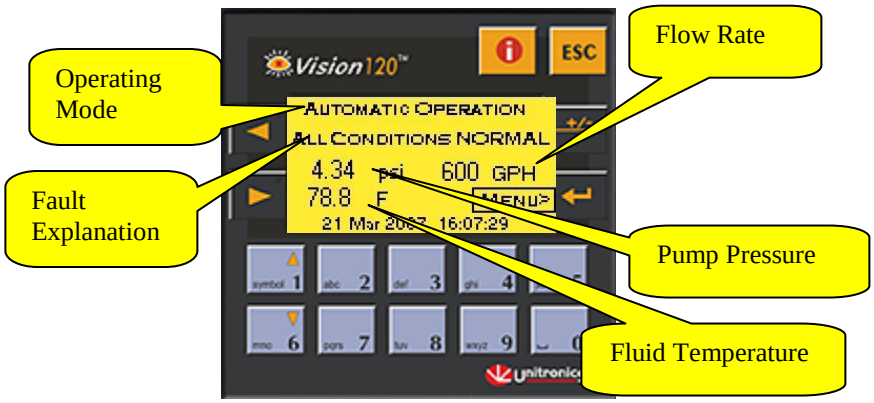
Item	Description	P/N	No
1	Pre-Filter	PLR20-001	2
2	Collection Filter	CLR20-001	2
3	O-Ring	ME-OR-2-367-Viton	2

13 MACHINE INDICATORS

The primary interface between a human and the machine is the PLC. Operation of the machine using the PLC keypad and display is detailed in this section.

13.1 LCD SCREEN ALARM AND STATUS INDICATIONS

The PLC screen is designed to provide additional information to users on the occurrence of faults or shutdowns.



13.1.1 OPERATING MODE INDICATIONS

NAME	DESCRIPTION
STOPPED	Machine is stopped. See Alarm Status for description as to WHY.
Drive Fault	Machine has been shut down by the Variable Speed Drive.
Automatic Operation	The machine is Purifying fluid at the requested flow rate. TECHNOLOGY is ON.
Restricted Flow	The machine is running at a reduced flow rate because of the presence of a high pressure. Check the Alarm Status for more detail as to the source of the limiting condition.
Manual Operation	The machine is passing fluid through the filters at ½ flow rate in a time restricted (<20 min) Manual Mode. ISOPur TECHNOLOGY is INHIBITED.
Temperature Sleep	The machine measured a fluid temperature outside the specified limits and is HIBERNATING. It will automatically restart after a waiting period (~30 min) and try to run again if fluid temperature permits.

13.1.2 ALARM STATUS INDICATIONS

The following descriptions are to be used in conjunction with the field on the Main Screen that indicates Alarm or Alert conditions.

NOTE 42. The display will cycle through all active alarms. There may be more than one alarm condition present. Operator should make note of all alarms present.

PLC Display	Description
All Conditions NORMAL	There are no alarms present.
Check Prefilter	A high pressure drop was measured across the pre-filter. It is likely to need changing. The PLC is now controlling the pump pressure to keep the pressure drop across the pre-filter from exceeding the specified limit.
Check Collection Filter	A high pressure drop was measured across the collection filter. It is likely to need changing. The PLC is now controlling the pump pressure to keep the pressure drop across the collection filter from exceeding the specified limit.
Flow Reduced below 25%	The PLC has reduced the flow rate below 25% of the maximum flow rate, due to one of several possible high pressure conditions such as filter clogging. Check for any downstream obstruction or source of blockage to locate the cause of the condition and repair or remove.
- Air Bubbles – Or + Air Bubbles +	The PLC has sensed negative transients on P_1 indicative of air bubbles traveling in the fluid. Check suction side connections for a suction leak.
Manual Mode Time Out	Manual mode has run for its maximum duration of 20 minutes. The PLC has shut the pump down. Restart in either manual or normal mode as required.
VSD Comm. Fault	Communication was lost between the PLC and the variable speed drive (VSD). Check circuit breakers protecting the VSD, inspect and re-seat the communication cable connectors and restart. If condition persists, call ISOPur.
Drive Faulted	The variable speed drive has encountered a fault and has stopped. This is most likely due to an over current condition in the motor possibly caused by high viscosity fluid or a worn pump/motor bearing. It is also possible to experience this type of fault on local reduced power lines or brown-outs. Allow sufficient time to cool down and restart. More information can be accessed form the Alarm Screen. If condition persists, call ISOPur.
PLC Battery Low	The internal battery of the PLC is low, and needs replacement. Contact ISOPur.
HIGH Fluid Temp	The fluid temperature is above the specified maximum limit for safe operation. Machine will not run until temperature has come down below the maximum temperature set point. If configured, the PLC will automatically restart to sample the temperature and continue running when the temperature has reached a safe level.
LOW Fluid Temp	The fluid temperature is below the specified minimum limit for safe operation. Machine will not run until temperature has come gone above the minimum temperature set point. If configured, the PLC will automatically restart to sample the temperature and continue running when the temperature has reached a safe level.
High Pump Pressure	The PLC has shut the machine down due to excessive pump pressure. This may be due to clogged filters, high fluid viscosity, closed valves, low temperature or any form of system flow restriction.
Low Pump Pressure	The PLC has shut the machine down due to very low pump pressure. A leak is possible. This may also occur if the fluid viscosity is very low. Check system for leaks.
Pres. Sensor Fault	One or more pressure sensors has a faulty reading. The specific sensors with faulty readings are identified on the *Alarm Data Screen* and also on the *CAL Sensors Screen*. The offending sensor(s) need to be replaced in order to resume proper operation.
Pump Pressure Control	The PLC is using the P_1 pressure control the pump speed to keep from exceeding the maximum operating pressure as specified. This condition may be due to full filters, or high viscosity or a partially shut valve. Check downstream of the pump for blockages or wait until the fluid warms enough to lower the viscosity.
FAULTY P_1 Sensor	The P_1 sensor is exhibiting a faulty reading. The machine will not start until this condition is cleared up since safe operation depends on the P_1 reading. Replace the P_1 sensor in order to resume normal operation. If no spares are available, use P_4 as a temporary sensor and plug

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	the P_4 port with a ¼" plug.
Unable to control dP-PREF	The PLC has detected a faulty reading on P_2 making it impossible to perform dP_{1-2} control. This is a compound fault that results first from a high dP_{1-2} followed by a P_2 sensor failure. The PLC will likely shut the machine down in this double fault condition. Replace the P_2 sensor and check the Pre Filter element for clogging. Replace as necessary.
Unable to control dP-COLL	The PLC has detected a faulty reading on either the P_3 or P_4 sensor making it impossible to perform dP_{3-4} control. This is a compound fault that results first from a high dP_{3-4} followed by a P_3 or P_4 sensor failure. The PLC will likely shut the machine down in this condition. Replace the offending P_3 or P_4 sensor and check the Collection Filter element for clogging. Replace as necessary.
Ext Digital Override ACTIVE	The customer supplied external 24 volt signal has gone active and caused the machine to shutdown. The external signal must be returned to its INACTIVE state in order to restore machine operation.

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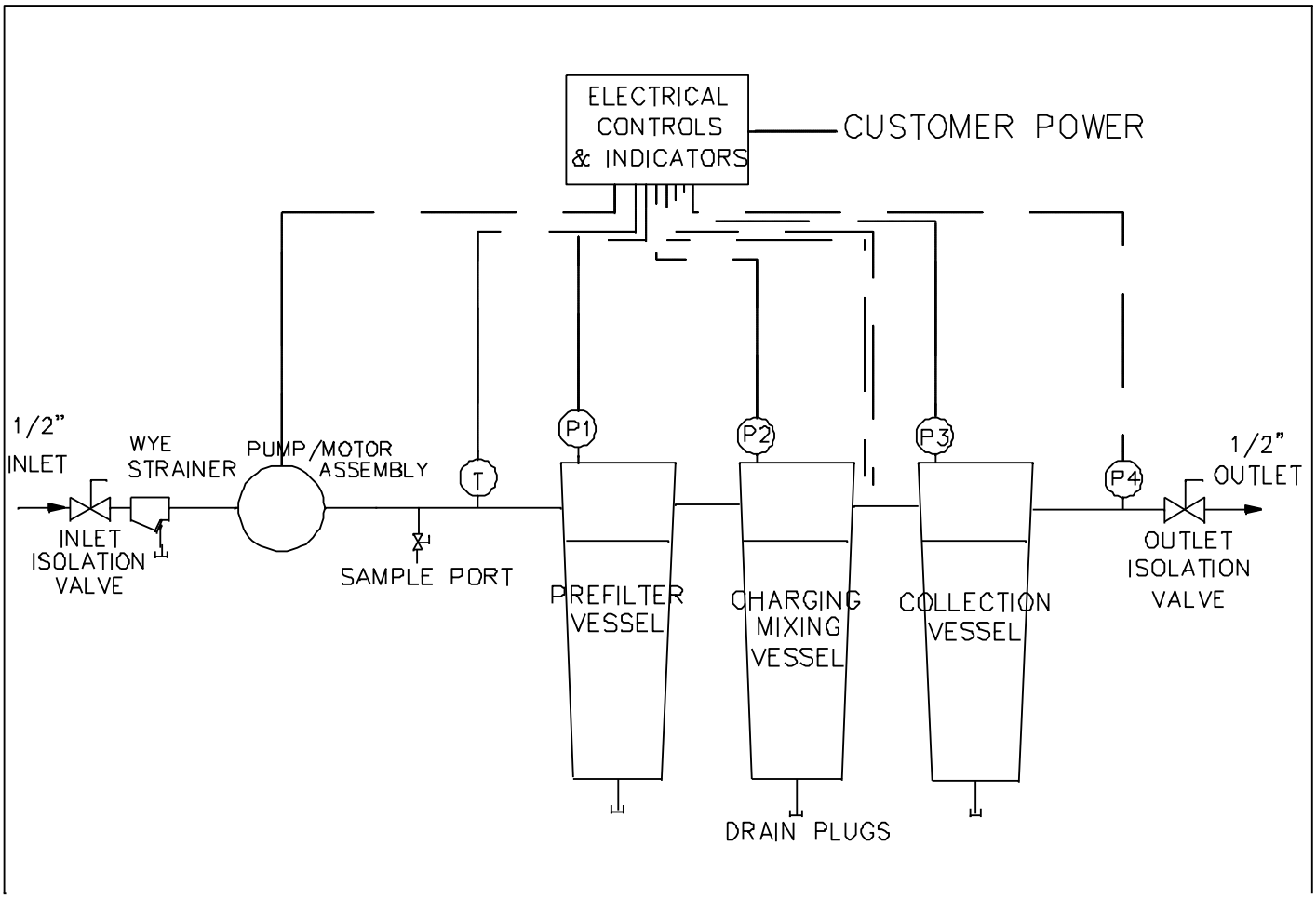
14 PIPING & INSTALLATION DIAGRAM (P&ID)



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15 APPENDIX A: BLANK FORM FOR USE AS MACHINE LOG

Item	*Data*	*Comments*
ISOPur Model #		
Serial #		
Voltage		
Phase		
Breaker rating/number/location		
Design Flow Rate		
Piping run from inlet to tank		
Pressures P_1-P_4		
Piping run from outlet to tank		
Pre-filter #		
Filter hours at change		
Collection Element #		
Filter hours at change		
Machine hours at last change		
Fluid Type		
Fluid Manufacturer		
Fluid Brand name		
Viscosity @40°C		
Reservoir Size		
Fluid added since last filter change		
Fluid Temperature		
Starting Fluid Particle Data		
1 Month Particle Data		
3 Month Particle Data		
MAINTENANCE LOG	***OBSERVATIONS / NEEDS***	***ACTIONS***

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