International Surface Technologies
istsurface.com

ISTpure
INNOVATION AND LEADING TECHNOLOGY

SOLVENT RECOVERY SYSTEM

SRC 400

WARNING

READING THIS MANUAL IS INDISPENSABLE FOR CORRECT AND SAFE USE OF THIS APPARATUS. THIS MANUAL MUST BE PLACED IN AN ACCESSIBLE LOCATION FOR OPERATOR REFERENCE

INSTRUCTION MANUAL

2019-04-23

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LIMITED WARRANTY

ISTpure warrants all equipment led in this manual which is manufactured by ISTpure and bearing its name, to be free from defects in material and workmanship on the date of sale by an authorized ISTpure dristibutor to the original purchaser for use. Notwithstanding any special, extended or limited warranty published by ISTpure will, for a period of TWELVE (12) months from the date of sale, repair or replace any part of the equipment determined by ISTpure to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with ISTpure 's written recommendations.

This warranty does not cover, and ISTpure shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non- ISTpure component parts. Nor shall ISTpure be liable for malfunction, damage or wear caused by the incompatibility with ISTpure equipment with structures, accessories, equipment or materials not supplied by ISTpure , or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by ISTpure .

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized ISTpure dristibutor for verification of the claimed defect. If the claimed defect is verified, ISTpure will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser, transportation prepaid. If the inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

ISTpure's sole obligation and the buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought forward within one (1) year of the date of sale.

ISTpure MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IN CONNECTION WITH ACCESSORIES, EQUIPMENT, MATERIALS OR COMPONENTS SOLD BUT NOT MANUFACTURED BY ISTpure . These items sold, but not manufactured by ISTpure (such as electric motors, switches, hose, etc.), are subject to the warranty, if any, of their manufacturer. ISTpure will provide the purchaser with reasonable assistance in making any claim for breach of these warranties.

LIMITATION OF LIABILITY

In no event will ISTpure be liable for indirect, incidental, special or consequential damages resulting from ISTpure supplying equipment hereunder, or the furnishing, performance, or use of any products or other goods sold hereto, whether due to a breach of contract, breach of warranty, the negligence of ISTpure , or otherwise.

Report all accidents or "near misses" which involve ISTpure products to :

- Technical Assistance

The following items are not covered under the ISTpure warranty policy :

- Parts or chassis replacement due to normal wears.

Report all accidents or negligence involving ISTpure products to our Service Department :

1 877 629-8202

1. SYSTEM DESCRIPTION

The solvent recovery system is designed to process waste streams generated at client facility. Different components of system are Distillation Vessel, Air Cooled Condenser, Feed Pump, Solvent Discharge Pump, Solvent Collection Tank, Oil Expansion Tank and Main Electrical Junction Box.

The solvent recovery system can hold upto 100 gallons (approx.) of waste. It is recommended to follow important instructions/steps diligently to run the system effectively with less interruptions.

IMPORTANT INSTRUCTIONS

- Solvent Recovery System has one fill pipe to feed waste into distillation vessel. Fill pipe should be placed in waste drum before starting a cycle.

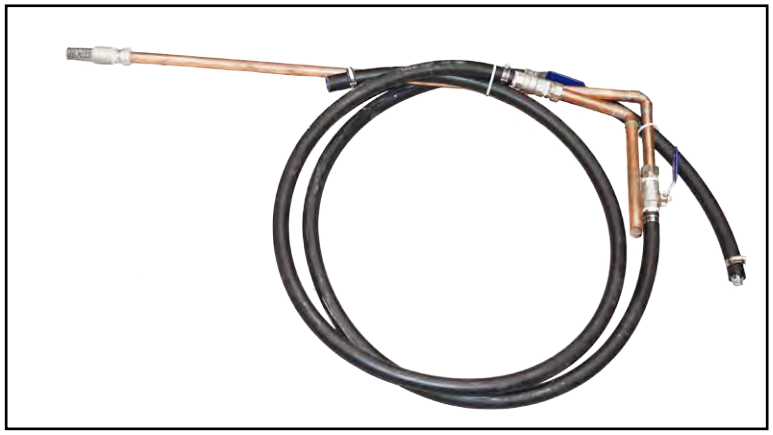


Fig. 1 - Fill pipe

- Different waste streams should be collected separately and labelled properly to prevent any cross contamination.
- To collect recovered solvent, solvent collection pipe should be placed in clean/collection drum or tote.

Fig. 2 - Sludge Discharge Float Switches

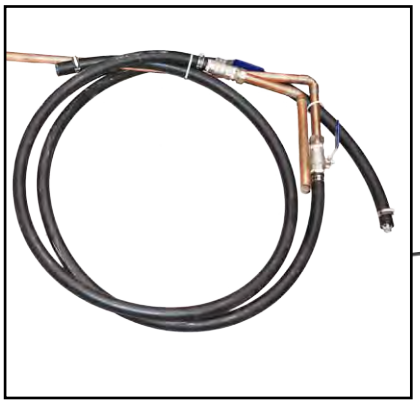


Fig. 3 - Solvent Discharge Pipe

2. SAFETY

GENERAL SAFETY

- Personal Protective Equipment such as safety glasses, safety helmet, respirator and apron are required while operating the equipment.
- Wear gloves when handling feedstock and recovered solvent.
- The distillation vessel will become HOT as the cycle progress, DO NOT TOUCH distillation still and be aware of all safety signs on vessel.
- DO NOT insert hand through the drain valve. Bottom drain valve operates automatically to discharge hot sludge (please refer to image below).

Fig. 4 – Critical Safety Sign

- The operator should monitor the information on PLC touch screen at regular intervals to avoid any inconveniences.

3. VOC'S EMISSION REDUCTION

GENERAL SAFETY

Sources of emission

- Drain Valve located at the bottom of distillation vessel
- Venturi
- Drums used for storing waste and recovered solvent
- Emission resulting from sludge discharge at the end of the cycle
- Leakage in interconnected pipelines
- Opening of Pressure Relief Valve (SV)
- Through the space between lid and main vessel shell if the lid is not set/closed properly.

Strategies to reduce emissions

- Ventilation ducting must be placed in the room where the system is installed. It should be located near the ground level as solvent vapors are heavier than air and tend to settle at the bottom.
- Pressure Relief Valve (SV) should be vented outside in the unlikely event of its activation to vent excess pressure.
- Venturi outlet should be vented outside.
- Regular inspection of the equipment and interconnecting pipelines to ensure that there is no leakage.
- To ensure minimum emissions during sludge discharge, the unit should be allowed to be cooled after the cycle is finished.

4. PROCESS DESCRIPTION

Each cycle consists of following steps:

- Fill- Feed is injected into distillation vessel by air operated diaphragm feed pump.
- Heating- Heat will be supplied to the system using high temperature heat transfer fluid to evaporate solvent from the waste stream. Heat transfer fluid is heated using electric heater.
- Distillation- The temperature of mixture inside the still is raised to the boiling point of solvent and hence solvent vapor will be formed and accumulated in the top portion of distillation still.
- Cooling/Condensing- Solvent vapor will travel through the pipeline at top that connects to Air Cooled Condenser. Hot vapor will pass through the tubes of the condenser and condensed product will be colllected into Solvent Collection Tank by gravity. Operation of solvent discharge pump is controlled by high level float (HLSS) and low-level float (LLSS).
- Sludge Draining- At the end of every cycle the sludge is drained (after cooling down) into sludge collecting drum. The operator must ensure the availability of empty sludge collection drum and should place it underneath bottom drain valve.
- Next Cycle Run – After sludge discharge, operator should open access door located in front and scrape the sludge that is left over from previous cycle and should ensure that heat transfer area is cleaned thoroughly before running next cycle

5. RECOMMENDED OPERATING PROCEDURE

PREPARATION

- Place the chemical totes close to the feed inlet side of the system
- Insert the fill tube in the waste drum or tote
- Place the clean, empty collection drum or tote close to the solvent discharge side of the system
- Place the discharge hose into the clean solvent collection container. Make sure that the hose is clamped securely so that it does not pop out as it will move when liquid is being pumped through it
- Make sure the valves are in proper positions as per table in the STARTUP section of the manual.
- Place empty drum underneath bottom drain valve for sludge collection.
- Place high level float into sludge collection drum.

PROGRAM

- If running in Automatic mode, check the program settings in each of the phases. Make sure that the phases, temperatures, timers and vacuum are set properly.

BATCH MODE

Enable 

in Phase 1

Disable 

on subsequent phases

CONTINUOUS MODE

Enable 

on Phase 2

Enable 

in the subsequent phases where continuous fill is desired.

Assign a Boildown phase where 

is disabled and therefore, the unit will just process what is inside the boiler vessel.

START

Once the settings are done, press the 

button.

5. RECOMMENDED OPERATING PROCEDURE (CONT'D)

END OF CYCLE

- The unit will stop automatically once the program ends.
- After cooling down phase, sludge will be discharged into collection drum automatically through air actuated ball valve (STV) located at the bottom, if automatic sludge discharge is enabled in cool down set-up screen.

Fig. 5 – Pneumatic Drain Valve (STV)

6. PROCESS PARAMETERS SETTINGS

To run the cycle efficiently without any process disturbances following settings are recommended;

SETUP SCREEN	ACTION
PRIME TIME (S)	VAC OFF DELAY
FILL WATCHDOG (M)	VAC ON DELAY
THB SETPOINT (F)	
SOLVENT DELAY TIME (M)	
SOLVENT WATCHDOG (M)	
THV COOLING	
COOLING COND	

*TBD- To be decided

PHASE	P1	P2	P3	P4	P5	CD
PHASE (ON/OFF)	ON	ON	TBD	TBD	ON	ON
LOW VACUUM	-15"	-15"	-15"	-15"	-15"	-15"
HIGH VACUUM						
FILL (ON/OFF)	ON	ON				
OPT 11						
HEAT (ON/OFF)		ON	ON	ON	ON	
THC SP (F)						

PHASE	P1	P2	P3	P4	P5	CD
AEP (ON/OFF)		ON	ON	ON	ON	
AEP SP (F)						
PHASE TIME (M)	0.5	TBD	TBD	TBD	TBD	60
FD TIME (M)	1.0	1.0	1.0	1.0	1.0	
THS FILL (F)	250	250	250	250	100	
THV FD (F)	250	250	250	250	100	
SLUDGE						TBD

7. TECHNICAL DATA

SPECIFICATIONS		
Physical Specs		
	Metric	**English US**
Total Capacity	380 Liters	100 US Gal
Operating Capacity (max)	190 Liters	150 US Gal.
Vessel Diameter	0.787 m	31"
Heating Surface Area	m2	36 ft2
Max Width (W) (4)	1.12 m.	45"
Max Height (H) (4)	2.2 m.	88"
Max Length (L) (4)	1.85 m	74"
Heating Characteristics		
Thermal Oil Specs	410° F Max	210° C Max
Operation		
1) Fill – auto-fill & manual fill – batch and/or continuous operation.		
2) Vacuum - Liquid ring with buffer column and auto discharge by air pump (3)		
3) Discharge clean solvent - automatic by pump		
4) Residues – manual (pump optional)		
5) Alarms- over fill, boil over, lack of purge, over temperature, batch end		
Construction & Design		
Electrical	MetLab certified. Class 1, Div 1, Group D	
Mechanical		
Structure	304 SS	
Condenser	304 SS	
Insulation	1" Fiberglass	
Scraper	On RSI-Q models only	
Discharge of Residues	Tilt, Manual Valve, or by optional pump	
Utilities		
Electrical Specifications (5)		
Electrically Heated Version	20 KW Voltage 440 -3-60 Hz	Total Amps: 27
Water		
Pressure	NA	NA
Temperature	NA	NA
Consumption	NA	NA
Pipe Size	NA	NA
Compressed Air		
Pressure	600 kPa	85 psi
Consumption		10 cfm
Pipe Size		3/8"
Performance (2)		
Output	80 lph	20 gph
Max Sludge Capacity	10 L	3 gal

The rating of the branch-circuit overcurrent protective device shall be 150% of the rated current of the unit. If 150% of the current rating does not equal a standard rating, per the Electrical Code, then the next lower standard rating shall be provided.

6. PROCESS PARAMETERS SETTINGS

GENERAL INFORMATION

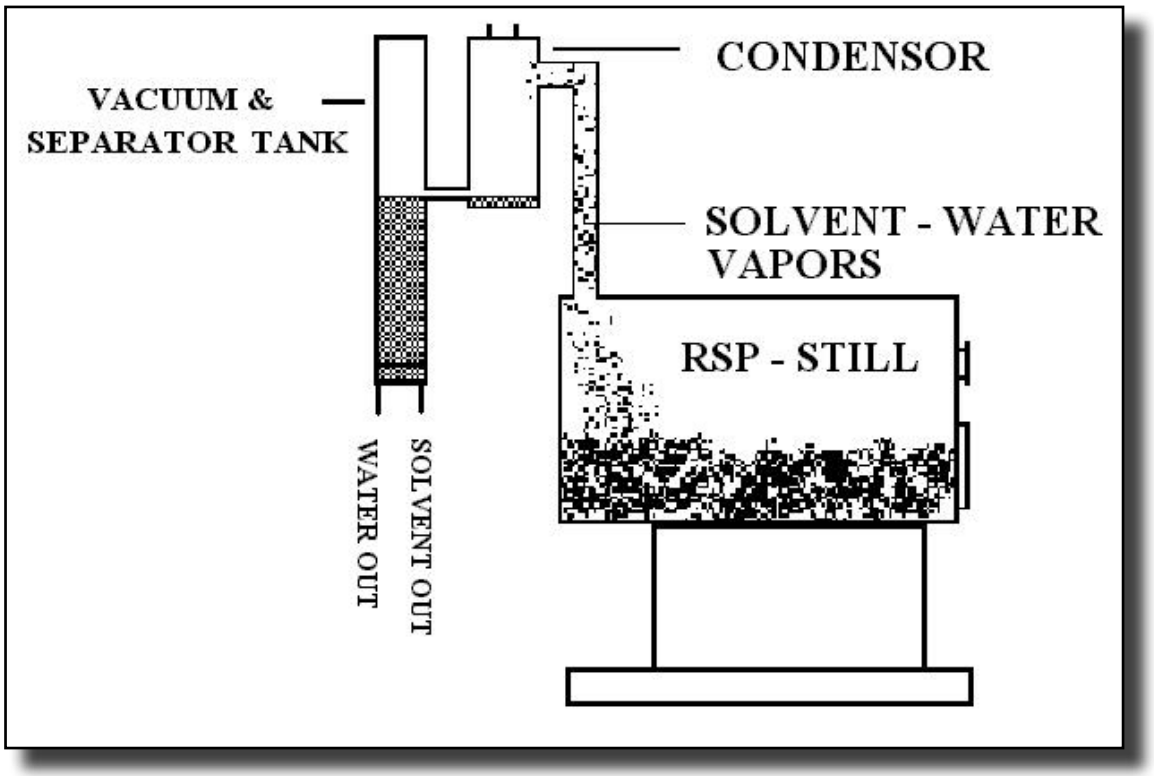
OPERATION PRINCIPLE

The boiling of the contaminated fluid takes place in a boiler surrounded by a jacket containing a heating medium (either steam or thermal oil heated by electric element(s)). The vapors generated in the boiler are directed to a condenser where the vapors are converted to a liquid (see the figure below). Prior to beginning actual distillation, it is important to understand certain basic principles and guidelines. The following sections cover important concepts, terms and safety procedures that you must be familiar with prior to using the unit.

WARNING Prior to beginning operation it is imperative to completely read through this manual.

The "RSI" units are designed to distill for reuse flammable and non-flammable solvents having boiling points up to 180° C. The unit separates the contaminants (such as inks, oils, grease, etc.) from the original solvent, which once recycled can then immediately be directed for re-use. Generally, the distillation process will not alter the characteristics of the solvents.

The contaminates remain in the bottom of the boiler and can be easily discharged and disposed of using accepted local, state or federal governmental guidelines for your type of waste.



VACUUM & ATMOSPHERIC DISTILLATION PRINCIPLES

GENERAL INFORMATION

The solvent boiling temperatures shown in the tables at the end of this manual are boiling points evaluated at atmospheric pressure (1000 hPA or 760 mm Hg). It is well known that as the pressure is reduced, the boiling point of any liquid is reduced. Therefore, when a vacuum is created inside the distillation chamber the boiling point of the liquid(s) to be distilled is considerably reduced. Generally, as a rule of thumb distilling solvents with RSI units that operate under properly operating vacuum will lower the boiling point by about 30 % (evaluated at approximately 25" Hg).

When are the criteria for determining whether to use atmospheric or vacuum distillation?

Below are a few guidelines that may answer this question:

1. When processing solvents with high boiling points.

2. When processing a solvent with an auto ignition point close to the boiling point. One of the most common solvents that has these features is white spirit. This solvent has its boiling point at 150-190° C and its ignition point at 254° C.

3. Contaminants that disintegrate at high temperatures.

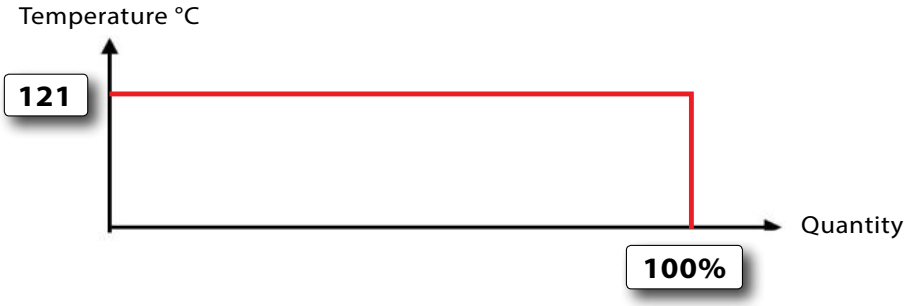
4. When processing chlorinated solvents, atmospheric pressure distillation allows only a partial recovery of these solvents; at the end of the process the residues can still contain approximately 20 % of the solvent. This happens since as the distillation process progresses, the percentage of oil residues and sludge to solvent in the boiling chamber increases and hence the boiling point of the mixture increases. These solvents have a specific critical temperature that once exceeded may provoke the decomposition of the solvent and cause the formation of hydrochloric acid. This in turn will cause the solvent to be acidic and make re-use of the product undesirable. Operating at atmospheric pressure only approximately 80 % of the solvent can be distilled without going above the critical temperature. With vacuum distillation it is possible to achieve a higher yield without reaching the critical temperature.

VACUUM & ATMOSPHERIC DISTILLATION PRINCIPLES (CONT'D)

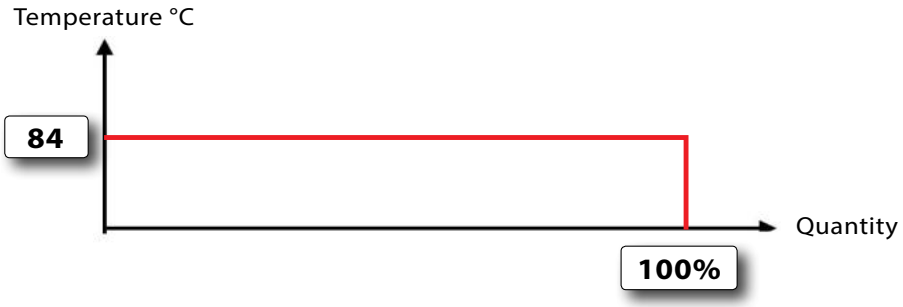
EXAMPLE:

Product to be distilled: ..... Perchloroethylene
Boiling point at atmospheric pressure: ..... 121° C
Boiling point under vacuum conditions (223 hPA) ..... 84° C
Critical temperature of decomposition ..... 150° C

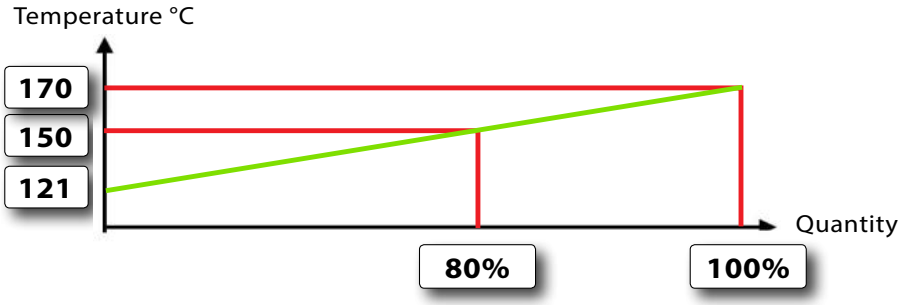
A- Boiling range of clean perchloroethylene at atmospheric pressure: 1000 hPA



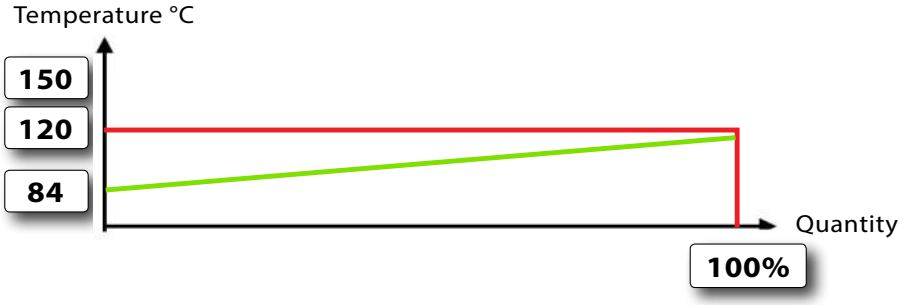
B-Boiling range of clean perchloroethylene at vacuum condition: 223 hPA



C-Boiling range at atmospheric pressure (1000 hPA) of a mixture of 90 % perchloroethylene plus 10 % oil.



D- Distillation temperature under vacuum conditions (223 hPA) with a mixture of 90% perchloroethylene plus 10 % oil.



VACUUM & ATMOSPHERIC DISTILLATION PRINCIPLES (CONT'D)

GRAPHS (A) & (B):

The distillation temperature of a clean solvent remains the same until the whole cycle is completed.

GRAPHS (C) & (D):

The distillation temperature of the contaminated solvents increases during the process. This variation depends on the degree and type of contamination.

GRAPH (C):

Once temperature of 150° C is reached only 80 % of the perchloroethylene will be recovered. Going above this temperature will risk in rendering the distillate acidic.

GRAPH (D):

Operating under vacuum conditions, close to 100 % of the perchloroethylene will be recovered with a maximum distillation temperature of 120° C, well below the critical temperature of 150° C.

MATERIAL SAFETY DATA SHEET (MSDS)

Deliveries of solvents or diluents must be accompanied by safety data sheets (MSDS) on which you will find, physical and chemical properties, classification, labeling, toxicity, pertinent legislation, explosion limits, rules for storage, transport and treatment and any safety measures to be taken. It is important that operators of the recycling units be familiarized with all the MSDS sheets for which solvent will be recycled.

To be able to work safely with the distillation unit it is necessary to know in advance the physical and chemical properties of the products to be treated. Negligence in this matter can cause fire and explosion.

DEFINITIONS

SOLVENT:

Liquid that, without reacting chemically, dissolves other substances (solutes) forming a solution.

DILUENT:

Mixture of solvents.

DENSITY OF THE VAPOR PHASE:

Depending on the solvents relative vapor densities with respect to air (valued at 1), these can be divided into the following categories:

“heavy” when their relative density is higher than 1.1 “light” when their relative density is lower than 0.9

This parameter is important for determining the extent of the danger area and for ventilation purposes.

FLASH POINT:

This is the minimum temperature at which, above the surface of a solvent, the solvent will emit a sufficient vapor concentration that would ignite in the presence of a spark orl.

AUTO-IGNITION TEMPERATURE:

All flammable solvents have a specific auto-ignition temperature. The auto-ignition temperature is the minimum temperature at which the solvent, in contact with air burns spontaneously and without the need for an external ignition source (spark or flame). Toprevent auto-ignition, the maximum surface temperature when the machine is functioning should never be higher than the auto-ignition temperature of the treated solvent.

WARNING **Not adhering to the above can result in a fire and/or explosive situations.**

MATERIAL SAFETY DATA SHEET (MSDS) (CONT'D)

HEAT OF VAPORIZATION:

The heat of vaporization gives an indication on the speed of the evaporation process and hence of the hourly production of the machine. The heat of vaporization is the amount of energy needed to transform one kilogram of material from liquid phase into the gas phase. It is expressed in kcal/kg. For example:

TRICHLOROETHANE ..... 57 kcal /kg
ACETONE ..... 128 kcal/kg
WATER ..... 540 kcal /kg

Note that the distillation rate of a solvent is not a function of the temperature but rather of the heat of vaporization. The higher the heat of vaporization, the lower the rate of distillation.

DENSITY:

The density of a liquid is the weight in kilograms of one liter of material. It is expressed in kg/dm (1 liter = cubic decimeter). This is a useful quantity when two non-miscible liquids must be separated mechanically. The bigger the difference in densities, the faster and easier is this mechanical separation.

SOLUBILITY IN WATER:

To separate a solvent mechanically from water, it is first necessary to know the solubility of the solvent in water.

DISTILLATION TEMPERATURE:

The boiling point of a liquid is the temperature at which the liquid is transformed into gas at atmospheric pressure (1013 hPa). A solvent normally has one specific and constant boiling point. A mixture of solvents has a temperature range at which it boils. A dirty solvent normally boils at a higher temperature, depending on the type and number of contaminants. It is emphasized here that the boiling point is independent of the heating source. However, the higher the temperature of the heating source is above the boiling point of the solvent, the faster the distillation process will be. In certain situations, it is common practice to set the heating medium temperature 30 to 40° C above the boiling point of the solvent. Although production can be augmented by setting the heating medium temperature at a higher level, this can lead to foaming, which in turn can lead to fouling of the condenser and of the produced distillate. Eventually this can even lead to blocking of the condenser.

WARNING **Not adhering to the above can result in a fire and/or explosive situations.**

MATERIAL SAFETY DATA SHEET (MSDS) (CONT'D)

ACIDITY:

Distillation chambers on all standard ISTpure machines are made of stainless steel AISI 304. Condenser coils are made of copper. Copper condensers are suitable for the distillation of neutral liquids. Stainless steel AISI condensers (optional) are available for the distillation of neutral and slightly acidic solvents. In the case of significant acid levels please consult factory prior to use.

Solvents such as ketones, alcohol, esters, aromats are normally pH neutral when they are newly bought. However, they can become acidic for the following reasons;

Through oxidation due to long and/or wrong storage.

- Before a distillation especially when the solvent has been stored for a long time, the acidity (pH) should be checked.

Acidification during the distillation process.

- Thermally unstable solvents: Acidification can occur above a certain temperature (critical temperature). Ask your supplier if your solvent has such a critical temperature.
- Acidification due to contaminants within the solvent mixture. This can also° Ccur particularly during the drying phase of the distillation.

A good habit is to regularly check the pH of the distillate.

Halogen solvents, even when stabilized, are susceptible to acidification during distillation. A stainless steel AISI 304 condenser should be used for distillation of these solvents (see table B – non-flammable solvents). If possible, the distillation has to be performed under vacuum and one has to pay attention to the reported temperature. Check the pH regularly, and neutralize the solvent when necessary.

The warranty on the distillation unit is not valid when it is used for distillation of acidic solvents.

CONTAMINANT IDENTIFICATION

Knowing the contaminants in the solvents to be distilled is equally important as knowing which solvents you are to be processing. This is important both for knowing how to distill the product as well as for safety concerns. For safety aspects, see the chapter "DANGEROUS CHEMICAL REACTIONS", particularly risks connected with Nitrocellulose. Two general types of contaminants are normally present in solvent mixtures to be recycled. These are liquid contaminants and solid contaminants**.**

LIQUID CONTAMINANTS

The most common liquid contaminants are oils, inks and water. The presence of liquid contaminants during distillation may lead to contamination of the distillate. For different types of oils and inks with a particularly high boiling temperature, this problem normally does not° Ccur, and the process of separation may be affected with simple distillation.

With the presence of water, one must pay close attention to the distillation behavior, particularly to the formation of azeotropes. It may be necessary to use a fractional distillation unit. If in doubt, consult factory.

MATERIAL SAFETY DATA SHEET (MSDS) (CONT'D)

CONTAMINANT IDENTIFICATION (cont'd)

SOLID CONTAMINANTS

The most common solid contaminants are; resins, pigments, paints, polymers, glue, powder and grease. Note that in certain cases, paint residues can give off coloring to the distillate towards the end of the distillation cycle. However, this light coloring should not in most cases cause any problems in the re-use of the distillate.

Before emptying the machine make sure that the temperature of the machine is lower than 50° C.

To shorten the waiting time, it is possible to add as an option a heating fluid medium cooler.

Consult factory for details.

DANGEROUS CHEMICAL REACTIONS

The chemical substances that are normally treated (hydrocarbons, chlorinated hydrocarbons, esters, glycols, ketones, alcohols) and most of the common contaminants (pigments, glues, inks and oils) can be heated up to the maximum working temperature of the distillation unit without any problem. One must pay close attention to the presence of other substances that can undergo dangerous chemical reactions or that can cause fires or explosions.

Dangerous situations can occur because of:

1. Reactions due to the presence of peroxides. These can be formed with the presence of oxygen and in the absence of stabilizers during the storage of certain solvents. Solvents such as: tetrahydrofuran, ethyl ether and ketones.
2. Explosions by heating of nitro-substances (such as nitro-methane, nitro-aromats) or nitrate containing substances (such as nitric acid esters).
3. Explosions due to the presence of nitrocellulose.
4. Presence of metal complexes that can be explosive in dry form.
5. Fire and explosion danger due to the presence of strongly oxidizing substances.
6. Nitric acid, chromates, perchlorates in presence of substances that can oxidize.
7. Possibility of catalytic reactions in the solvent due to the presence of rust, azo-substances, color pigments, or the possibility for decay of certain substances (cancerogenous aromatic amines from azo-substances). Special attention must be given to the presence of substances that can lead to fire or explosion by chemical reactions.

In the presence of any of the above-mentioned substances consult factory to design an appropriate unit.

RISKS CONNECTED WITH NITROCELLULOSE

NITROCELLULOSE	Combination product of cellulose and a mixture of nitric and sulfuric acid.
USE	During production of paints, varnishes and inks.
USED PERCENTAGE	The percentage of nitrocellulose present on dry basis is usually between 2 % and 30 %.
SECTORS	Nitrocellulose is mainly present in wood paints, leather treating liquids and in printing inks.
REACTIONS	In dry form heated up to 100° C it decomposes, forming nitric fumes. Explosion temperature: 170-180° C.
SAFETY	In case of decomposition or ignition of nitrocellulose, only fire extinguishers with water can be used (foam, carbon dioxide and chemical extinguishers cannot be used.)
DISTILLATION	When nitrocellulose containing material must be distilled, following rules must be adhered to: 1. The machine must never work above a maximum temperature of 150° C. 2. Working between 100° C and 150° C the distillation must stopped when the residue is still in liquid form. 3. If a dry residue is desired, one must work at temperatures lower than 100° C, possibly under vacuum.

CLASSIFICATION OF RESIDUES

The distillation residues consist of concentrated mixtures of solvents and contaminants. They are considered as waste and must be processed according to local regulations. For official classification of the waste, contact an authorized laboratory for analyses of the residue and obtain instructions as to disposal by the local environmental authorities. If in doubt use a licensed hazardous waste disposal company to dispose of your residues.

PROCESS DESCRIPTION

For simplicity, the working cycle of the ISTpure machines will be divided into two stages: stage 1 will be distillation while stage 2 is drying.

STAGE 1 – DISTILLATION

With a simple distillation it is possible to separate volatile substances (solvent and diluents) from non-volatile (resins, pigments, glues, etc.) or hardly volatile substances (oils, inks, etc.). The process consists in the boiling of the mixture of solvents and contaminants; only the volatile fraction evaporates and is condensed, while the contaminants remain in the bottom of the boiler shell as residues. Determining parameters are pressure, temperature and time.

1) ATMOSPHERIC DISTILLATION

The distillation process is normally performed at atmospheric pressure. The boiling points as mentioned in Table 7 are all evaluated at atmospheric pressures of (760 mmHg). When to use atmospheric distillation?

a. Inevitable if a solvent with a low boiling solvent must be distilled, like methylene-chloride or acetone with boiling points of 42 and 56° C. If vacuum distillation were to be used, it would be impossible to condense the distillate with an air-cooled condenser and very difficult with a water cooled one (a chiller would have to be used).

b. Inevitably when the product foams too much during vacuum distillation.

c. It is advised for solvents with boiling points between 70 and 170° C.

In the case where the liquid to be processed is a mixture of two solvents: say for example, one with a boiling point of 60° C and a second with a boiling point of 180° C. If one attempts to distil everything in one phase, the thermostat would have to be set to 200° C. During distillation, the first solvent would probably create a lot of foaming and eventually boil over. This problem is easily solved by first distilling at a temperature of 80 to 90° C, followed by a second distillation phase at a working temperature of 200° C.

2) VACUUM DISTILLATION

Lowering the pressure lowers liquids' boiling points. The lower the pressure, the lower the boiling point of the liquid. By creating a vacuum inside the boiler chamber, reaching a pressure of about 150-200 mmHg, the boiling point will be lowered by about 30 to 40%. In certain cases, it is necessary to use vacuum distillation. When to use vacuum distillation?

a. It is advised for solvents with boiling points above 170° C.

b. It is necessary for distilling solvents with boiling points above 200° C.

c. It is necessary for distilling solvents that have boiling points close to their auto-ignition temperature. A common case is white spirit solvents that have a boiling point of 190° C and an auto-ignition temperature of 254° C.

d. When distilling halogen solvents. Above a certain temperature they decompose forming hydrochloric acid. Due to this acidification the distillate will not be suitable for re-use. With a vacuum distillation this problem is avoided.

e. When the residues decompose or carbonize at atmospheric distillation temperatures.

PROCESS DESCRIPTION (CONT'D)

When not to use vacuum distillation?

The use of vacuum distillation can also lead to unwanted side effects such as increased foaming during distillation. If the machine is equipped with an air-cooled heat exchanger, only solvents with boiling points over 100° C can be distilled under vacuum. For example, Acetone has a boiling point of 56° C at atmospheric pressure. Under vacuum Acetone will distill at 39° C. Considering that the condenser is air cooled it will be necessary to have ambient air around 15° C (60 oF) otherwise partial condensation may° Ccur and vapors will exhaust through the vacuum ports. If for some reason it is necessary to distill low boiling solvents under vacuum, a water-cooled chiller in closed circuit must be used.

3) ATMOSPHERIC AND VACUUM DISTILLATION

When to use both atmospheric and vacuum distillation?

a. When distilling a solvent mixture consisting of both a low boiling point (40° C to 60° C) component and a high boiling point component (higher than 200° C).

b. When the mixture produces too much foam during vacuum distillation.

In these cases, the first phase of the distillation is performed under atmospheric pressure, while the second phase is performed under vacuum. During the change from atmospheric to vacuum conditions it may be necessary to first cool down the unit to the desired distillation temperature to prevent boiling over.

STAGE 2 –DRYING

The second stage is basically an extension of the first one. Here in the drying stage the objective is to minimize the residues while safely extracting the maximum amount of solvent. During the drying stage parameters can be varied, depending on specific cases.

A dry residue can be obtained with the right combination of temperature, vacuum, time and mixing. A change in one of these parameters can sometimes be corrected by changing another. However, it is not always evident by which amounts these changes will compensate for one another and what consideration must also be given to secondary effects.

a. Temperature: the working temperature is higher than the distillation temperature and normally not lower than 160 to 180° C.

b. Vacuum influences the drying process in a drastic way. Usually in the drying stage working under vacuum is preferable

c. **The cycle time** will depend on the concentration of the contaminants. Following the completion of the bulk distillation, the distillation time should be augmented by another 15-30 minutes at the same temperature.

PROCESS DESCRIPTION (CONT'D)

STAGE 2 –DRYING (CONT'D)

Following are possible scenarios of distillation and drying stages:

DISTILLATION: ..... AT ATMOSPHERIC PRESSURE

DRYING: ..... N/A

When processing solvent streams with boiling points lower than 60° C, contaminated with liquid products.

DISTILLATION: ..... AT ATMOSPHERIC PRESSURE

DRYING: ..... UNDER VACUUM

When processing solvent streams with boiling points lower than 60° C, contaminated with solid products.

DISTILLATION: ..... UNDER VACUUM

DRYING: ..... N/A

When processing solvent streams with boiling points between 60-200° C, and polluted with liquid products.

DISTILLATION: ..... UNDER VACUUM

When processing solvent streams with boiling points between 60-200° C, and polluted with solid products.

In the last phase of the drying of paint residues the distillate can become lightly colored. This is due to the physical phenomenon of entrainment of the pigments. The light coloring has no significant influence on the quality of the distillate and in most cases, may be used again. If for some reason, a perfectly clean distillate is desired, one can shorten the distillation time or lower the vacuum. Due to this the amount of solvent that remains behind in the residue will of course increase.

HOW MANY TIMES CAN A SOLVENT BE DISTILLED?

The distillation process consists of two distinct steps, evaporation followed by condensation. During evaporation the distance between the molecules is increased by the energy given in the form of heat. During condensation this energy is removed, and the intermolecular distance is restored. This process will not alter the physical-chemical properties of the solvent involved and therefore it is theoretically possible to repeat the distillation process an indefinite number of times. In the case of solvent mixtures, a fraction of the low boiling substances is lost during use due to natural evaporation. During distillation a fraction of the high boiling solvents can get lost because they remain in the residue. In practice the low and high boiling fractions of the mixture will decrease in percentage. It is therefore good practice to dilute the distillate regularly with fresh product.

SAFETY CONCERNS

OVERPRESSURE

The distillation process should normally° Ccur at atmospheric pressure or under vacuum. Any pressure of more than 1.1 bar(gauge) within the distillation chamber is abnormal condition. In such an abnormal event a safety valve located on the body of the distillation chamber will permit gases to escape to the atmosphere. Pressure Release Valve (PRV) should be vented outside. If vapors do escape, power to the machine must be stopped immediately and the cause of the overpressure must be remedied prior to reusing the unit. Overpressure situations can° Ccur due to the presence of an obstruction between the pipe leading form the distillation chamber – through the condenser – and the clean solvent outlet (possibly caused by dirt). Regular inspection of the equipment and interconnecting pipelines to ensure that there is no leakage. Boil-over of the solvent or foaming can also cause over-pressure situations and fouling of the conduit between the solvent vapor tube inside the distillation chamber and the clean solvent outlet. Regardless of the cause the unit must not be operated if an overpressure situation° Ccurs until the problem is corrected. Ventillation ducting must be placed in the room where the system is installed. It should be located near to ground level as solvent vapors are heavier than air they tend to settle at the bottom. Under vacuum operation, provision must be made to connect vent pipe to venturi, which generates higher level of VOC's during its operaion.

FOAM FORMATION

All solvents will produce some foaming during distillation. To ensure a clean distillate the foam level should never reach the pipe leading form the distillation chamber (vapor tube) to the condenser. For this reason, the maximum loading capacity of the boiler depends on the model; generally, not more than 40 to 60% of the total geometrical volume of the distillation chamber. The difference between filling capacity and this geometrical volume is in most cases large enough to be able to work satisfactorily. The most important factors for the formation of foam are:

1. Physical and chemical properties of the solvent / waste mixture.
2. Working under vacuum increases the potential for the formation of foam. The deeper the vacuum, the larger the potential for the formation of foam.
3. Temperature of the heating jacket.
4. The bigger the difference between boiling point of the solvent and temperature of the heating oil in the jacket, the larger the potential for the formation of foam.
5. Physical and chemical properties of the contaminants. Depending on the solvent and the process parameters, foam formation can depend strongly on the nature of the contaminants. For example, paint residues of the same type but of different color can have different foaming characteristics.

To be able to work correctly, test should be performed first. Pay attention to the distillation behavior of different products and catalogue the products. Prevent mixing of products with different boiling and distillation characteristics.

SAFETY CONCERNS (CONT'D)

FOAM FORMATION (CONT'D)

In case of exceptional foam formation, one can try to reduce it in the following ways:

1. Let the dirty solvent rest for 48 hours before distilling it.
2. Load the boiler with less solvent than usual; in this way the formation of foam will be less and there is more free space above the liquid in the distillation chamber.
3. If one works in batch under vacuum, it should be tried (if possible) to do the first part of the distillation under atmospheric pressure and the last part under vacuum.
4. Lower, depending on the boiling point of the solvent, the temperature of the heating jacke
5. Use an anti-foaming solution with distillate prior to starting distillation.

The above-mentioned measures can of course dramatically influence the hourly production of the distillation unit.

DRYING

During the drying stage the temperature is normally increased to facilitate the removal of trapped solvent remaining in the residue. Attention must be paid in this stage to the possible decomposition of the solvent. Always consult the safety data sheets and check the acidity of the distillate after the first distillation cycle.

Also during the drying stage, there may be increased risks connected with nitrocellulose and other dangerous chemical reactions. For this reason, it is important to know the components of the solvent mixture you will be processing. Also make sure that the distillation and drying process does not lead to acidification of the contaminants and thereby of the produced distillate.

SAFETY RULES

General Safety Rules:

- Keep work area clean
- Keep children away from equipment. Visitors should be kept away from the work area.
- Know what you will be processing in the unit.

Personal Safety:

- Use proper safety equipment such as gloves, apron, respirators, face shield and safety glasses. Stay alert. Use common sense.
- Do not overreach.
- If eye meets solvent, quickly rinse thoroughly with water.
- The operator should monitor the information on PLC touch screen at regular intervals to avoid any inconveniences.
- DO NOT operate scraper while the manway door is open.
- DO NOT insert hand through the drain valve.

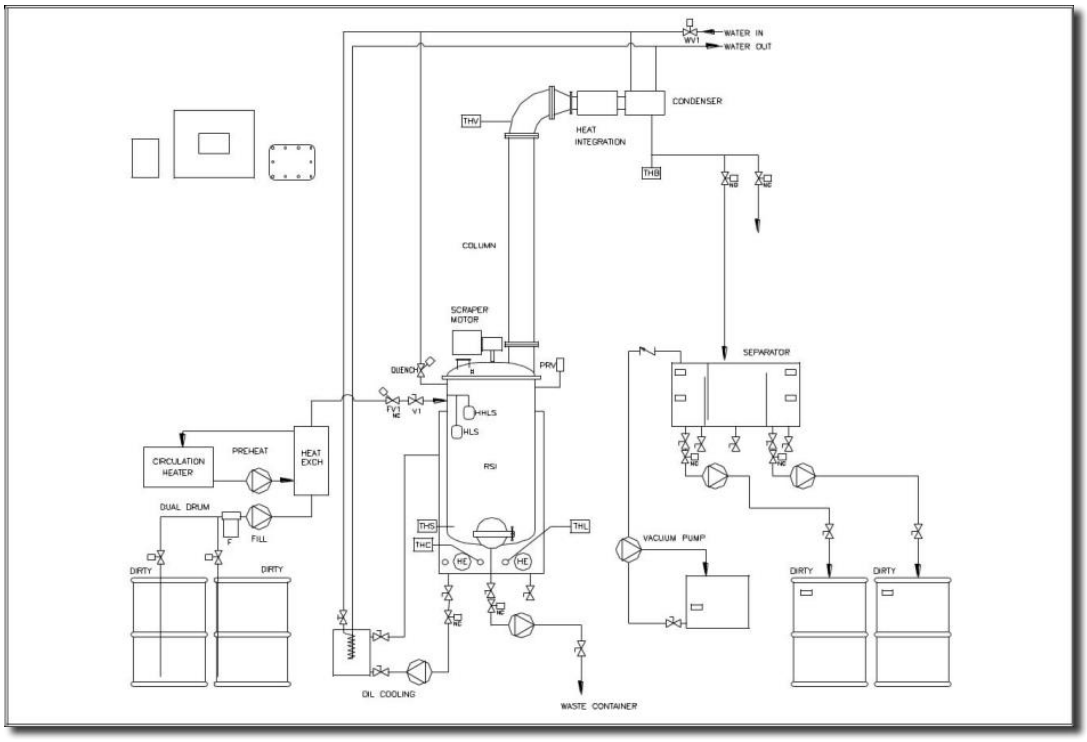
Unit Use and Care:

- Do not force the unit beyond its designed rate. The use of any other accessories not specified in this manual may create a hazardous condition.Disconnect the main power supply before servicing or when not in use. Alteration or modification of the unit may result in a dangerous situation. All repairs should be done only by trained technicians. Contact ISTpure Environmental for technical support. Do not bypass safety interlocks.
- Surface may be hot. Use protective equipment when working with the unit. Before using the solvent recycler, make sure that all safety devices are in perfect operating condition.
- Become familiar with the controls and their functions before commencing work. Be careful when you load and unload the solvent in the unit. Make sure you don't splash or spill the contents on the workshop floor.
- Do not use electrical tools around the unit.

Fire extinguishing equipment must be installed in the same room or close to the unit in case of emergency. Installation sites must permit personnel to easily and quickly move away from danger zones in case of an emergency. Do not process solvent that may include reactive chemicals such as **Nitrocellulose** unless the unit is specially designed and built for it. **Nitrocellulose** which is an ester of cellulose and nitric acid and is a component in many lacquers, inks, adhesive and cements cannot be recycled. It automatically **ignites** at 135°-166°C (275°-330°F) and can be extremely volatile. It is important to clean the boiler thoroughly after each cycle, as a build up of residue will stop the transmission of heat and cause a malfunction.

If repairs are necessary, shut off the power supply IMMEDIATELY. Do not smoke, cause sparks or use open flames near the recycler. This unit is for use in a 40°C (104°F) environment with no forced ventilation. Under these conditions, the unit shall be spaced a minimum space according to national regulation from potential sources of ignition such as electrical receptacles, switches, pilot light fixtures, contacts and other similar equipment that can produce sparks. If the equipment is used in higher ambient temperatures an increase in spacing from sources of ignition shall be considered.

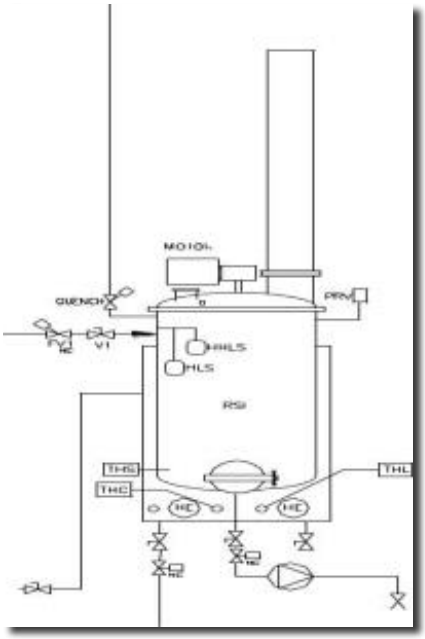
EQUIPMENT DESCRIPTION



DISTILLATION VESSEL

The distillation vessel, also known as the boiler, is the process tank into which the dirty liquid is pumped. Standard material used for its construction is 304 SS. Surrounding the main vessel is the heating jacket in which the heating medium (oil, or glycol, or steam) is heated by the heater.

Inside the distillation vessel, you can find the vapor inlet tube, fill line outlet, high level float switch (HLS), High High-Level float switch (if applicable), scraper (if applicable), and THS temperature probe (if applicable).



EQUIPMENT DESCRIPTION (CONT'D)

HEATER

Available heating options are oil, glycol, and steam. Regardless of the heating method, the unit will always use indirect heating to get the liquids to boil. That is, the heater heats the heating medium inside the heating jacket which in turn transfers the heat to the liquid being processed. Temperature control is done using the PLC and temperature probe (THC) in the heating jacket.

Oil Heated:

Thermic oil heated is the most common and probably the most robust way of heating the system. It consists of the heating elements submerged in the thermal heat transfer oil. This is the most common way of heating mainly because higher temperatures can be used compared to other methods of heating.

Glycol Heated:

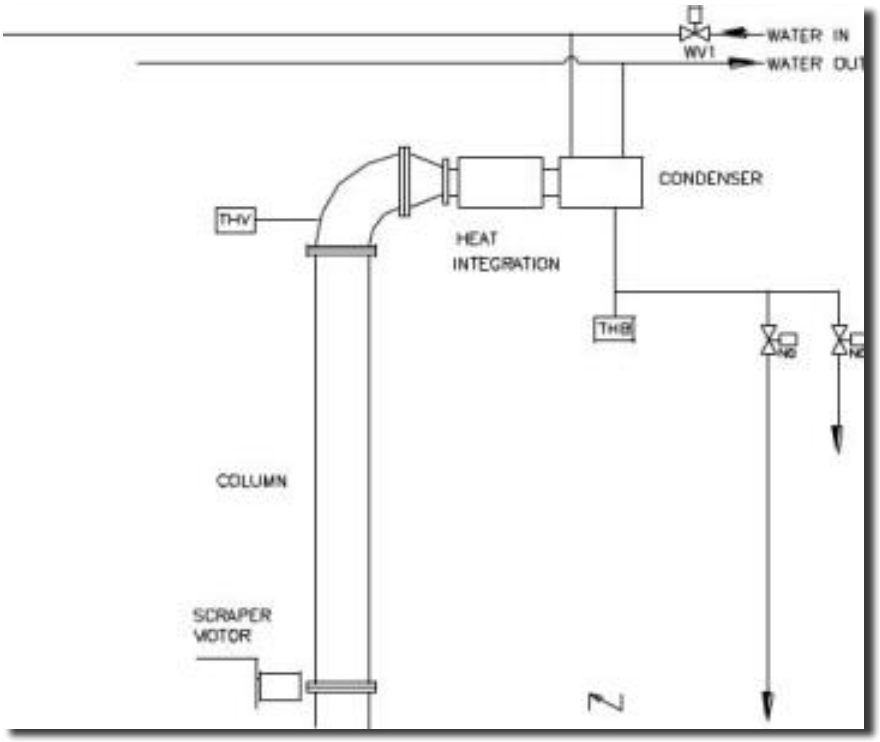
Here, glycol is used in the heating jacket to heat the system. This also has the heating elements submerged in the glycol. Because of the steam pressure generated when glycol is used, this method is limited to temperatures only up to about 120° C.

Steam Heated (S):

Steam is the third option for heating the system. This option uses steam produced by a steam boiler. Steam enters the specially made heating jacket as hot vapors and exits as water. Temperature control is achieved by regulating the steam pressure in the heating jacket.

CONDENSER (W)

Hot solvent vapor turn back into liquid as it is cooled down by the condenser. The condenser consists of coiled, finned tubes inside of which runs cooling water or glycol/water mixture. The vapor outside the tubes touches the colder fins of the tube and turns back into its liquid state (condensate). The condensate then flows out of the condenser and into the receiving tank.



EQUIPMENT DESCRIPTION (CONT'D)

AIR COOLED (A):

Ambient air is used to cool the solvent vapours. Fan operated condenser is used to cool the coils containing hot vapors.

VACUUM (V / VT):

Vacuum, or negative pressure, is used in some distillation processes to lower the boiling point of solvents that have high boiling points. To generate vacuum, air venturis, water venturis, or liquid ring vacuum pumps are used.

VACUUM TANK:

The vacuum tank is a tank or chamber into which the condensate flows. Unlike the separator, this usually has only one chamber. A liquid level sensor inside this chamber activates the discharge pump allowing the unit to transfer liquid to containers even under vacuum.

FILL SYSTEM (AF):

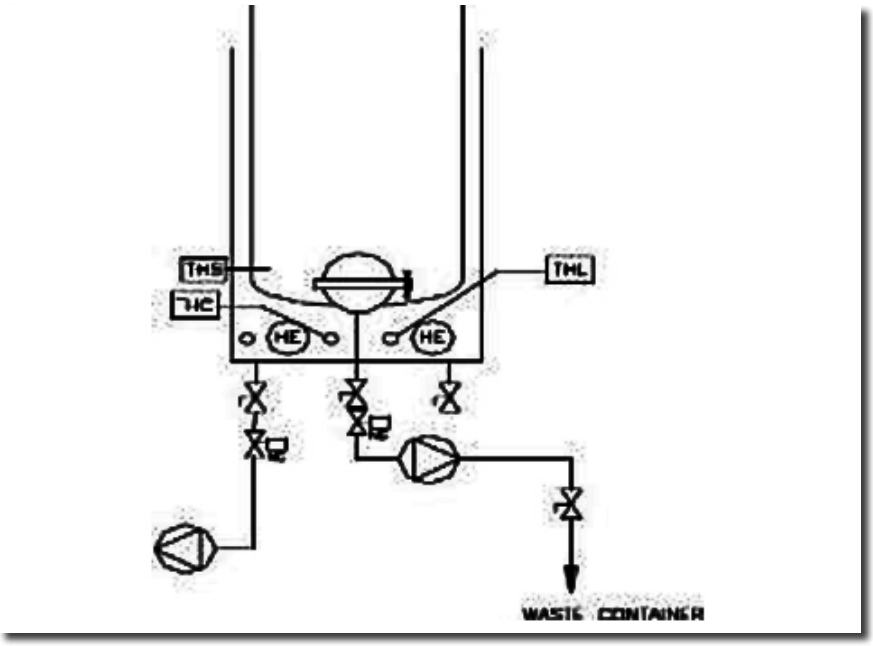
At the start of each batch, the fill pump turns on automatically to fill the chamber up to the high-level float switch (HLS). Then it goes to the next phase where it starts heating up. A watchdog timer starts at the same time as the pump and an alarm (FILL FAIL) is activated if the set time on the watchdog timer has elapsed and the level has not reached the float switch.

Filling can be done only once at the beginning of a batch, or the operator may choose auto-refill which tops up the chamber as the float comes down when the level drops. If multiple batch mode is selected, the unit will fill up at the beginning of each batch until it has done the set number of batches.

/* Please add drawing for fill system loop*/

SLUDGE DISCHARGE (SD):

Sludge can be discharged automatically at the end of a batch either by using a pump or gravity drain into a drum below.



INSTALLATION

Under normal operating conditions the RS units, by their presence or operation, will not add any hazard to a location that is rated Class I Division I or higher. Nonetheless, it is important to fully understand the operation of the unit, its' limitations and potential hazards. For these reasons reading this manual as well as considering factors such as adequate ventilation, spill control and containment overflow discharge and potential cross contamination of water systems, Federal, State and local regulations is essential. Training and knowledge of the equipment its proper use, limitations and safety concerns is a must for all users of this equipment.

The RSI units are designed and certified to operate in a Class I, Division I, Group D location or higher (less hazardous), which means that the units are built to be capable of functioning in an area with a continuously hazardous atmosphere. Choosing a location to install your recycling unit must consider factors such as safety, production flow, accessibility, ventilation, local fire regulations as well as federal, state or local laws regarding the installation of recycling equipment. It is highly recommended that the installation of these units be executed by a certified and qualified contractor who is familiar with fire hazard regulations.

LOCATION – GENERAL GUIDELINES FOR ALL MODELS

Please note that the listed guidelines are only indicative and can differ from the effective regulations in your area. It is advised to consult your local authority having jurisdiction for official guidelines.

1. Rooms with sufficient ventilation. Sufficient ventilation is defined as those that create sufficient changes of air per hour minimum in the room where the unit will be operated.
2. The openings of the air channels must be placed in such a way that the evacuation of emerging vapours does not cause any form of danger.
3. If the room is mechanically ventilated one must make sure that the air circulation is in operation prior to operating the distillation unit.
4. Accessibility around the machine for repairs and maintenance must be considered.
5. It is imperative to install adequate fire extinguishing devices in suitable places.
6. Signs such as the ones shown below must be posted in the recycling area.
7. In units equipped with an internal scraper caution must be taken by the operator not to operate the scraper with the clean-out door open.
8. If the unit is located outside, it should be sheltered from weather, and caution must be taken to observe allowable operating temperature ranges (see specifications).
9. If you have any doubt as to regulations and installation guidelines, it is recommended that these issues be determined with the help of an expert with expertise in the field of safety & security and specific knowledge of the rules and regulations governing your location.

WARNING

READING THIS MANUAL IS INDISPENSABLE FOR CORRECT AND SAFE USE OF THIS APPARATUS. THIS MANUAL MUST BE PLACED IN AN ACCESSIBLE LOCATION FOR OPERATOR REFERENCE

INSTALLATION (CONT'D)

IMPORTANT INSTRUCTIONS

- **Site Considerations** - Equipment to be installed in explosion proof zone to avoid any ignition of flammable solvent vapours.
- Explosion proof area should be designed taking into consideration about various standards set by Fire and Safety, Local Regulatory Authorities and Good Engineering Practice.
- **Ventilation** – Recommended ventilation of 18 m^3 / hr or 1 ft^3/min.
- **Vacuum Venting** – This should be directed towards out doors and must be done as per good engineering practice.
- **Spill Control** – Refer to instructions mentioned in Dual Drum section. Provisions must be made to capture the spill, also spill kit station must be located at various points in processing facility.
- **Solvent Storage and Handling** – Solvent should be stored and handled skilfully as its vapours in small concentration could lead to fire/explosion.
  - Proper label must be placed on the storage drums to differentiate solvent drums from the rest of inventory.
  - Drums when filled should be sealed properly to avoid any escape of solvent vapours.
  - Operator should wear Personal Protective Equipment while loading/unloading solvent drums.
  - Containers should be bonded and grounded while dispensing.
- **Other Possible Ignition Sources** – Regular inspection of the facility should be conducted to mitigate any futuristic explosion source.
  - Possible sources are open flames, hot surfaces, ovens, furnaces, heating equipment, smoking, cutting/welding, sparks, grinding, etc.

CONNECTION

The connections of electricity, water etc. – must be executed by authorized and competent personnel only. Local, State and Federal regulations must be respected.

ELECTRICAL CONNECTIONS

The RS units are provided with a remote-control box which is installed in a non-hazardous area and connects to the recycling unit which may be in a hazardous area.

Connection between the control box and the recycling unit involves several control wires as well as power wires. The interconnection wires are clearly marked and labeled. They must be cabled according to the norms of the location they are going through.

- Check that electrical circuits have not been damaged during transport. Check that all terminal screws are tight within the control box.
- Check if the voltage and the frequency correspond with the voltage and frequency as shown on the identification plate of the machine.

Verify proper electric power requirements with those marked on the nameplate of your unit. On all three phase units verify proper phase connections by making sure rotation are in the direction marked by the arrow on motor housing(s). If rotation is incorrect then interchange phases L1 and L2. Always place high power leg on L3.

Electrical installation must be executed by a qualified electrician according to local regulations.

Consult electric diagram if there are any options which require the removal of jumpers

The rating of the branch-circuit overcurrent protective device shall be 150% of the rated current of the unit. If 150% of the current rating does not equal a standard rating, per the Electrical Code, then the next lower standard rating shall be provided.

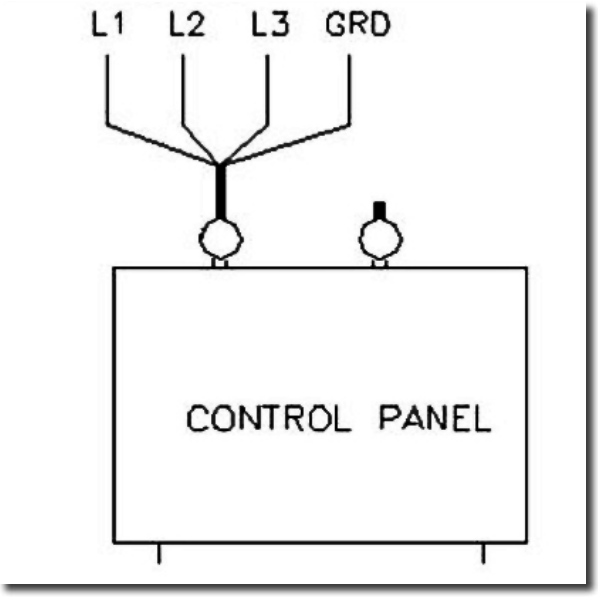
GROUNDING

Grounding of the power supply and the unit is essential.

NOTE: Connect the frame of the machine and all other components to the main ground with a copper cable. All metal vessels as well as solvent reservoirs operating with the unit must be connected to the ground.

Test the ground connection by making sure that there is no difference in potential (voltage) between the ground and any metal parts of the machine. Use the following parameters as a guideline:

The measured resistance must be at least 100 milli Ohm. This must be checked every year.



CONNECTION (CONT'D)

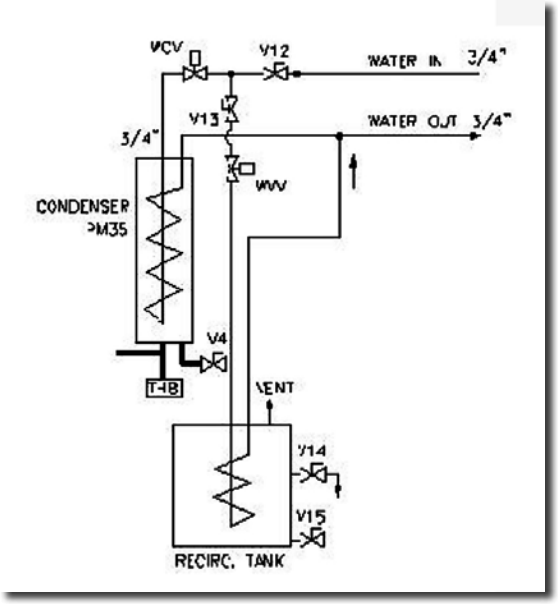
WATER CONNECTIONS (Only for machines with a water-cooled condenser (W))

1. The supply and the outlet of the water are indicated with WATER IN and WATER OUT stickers. Connect to water source and water outlet as indicated.

2. The feed lines must be of at least 3/4" diameter.

3. To ensure proper operation of the condenser, water pressure must not be lower than 2 bars (30 psi) and the temperature of the water not higher than 20° C. (68oF).

4. If the unit is located outdoors or in a non-heated location, the tubes must be insulated to prevent them from freezing in the winter. Also, make sure that there is a valve and a manual tap on the water feed line to empty the condenser in wintertime.

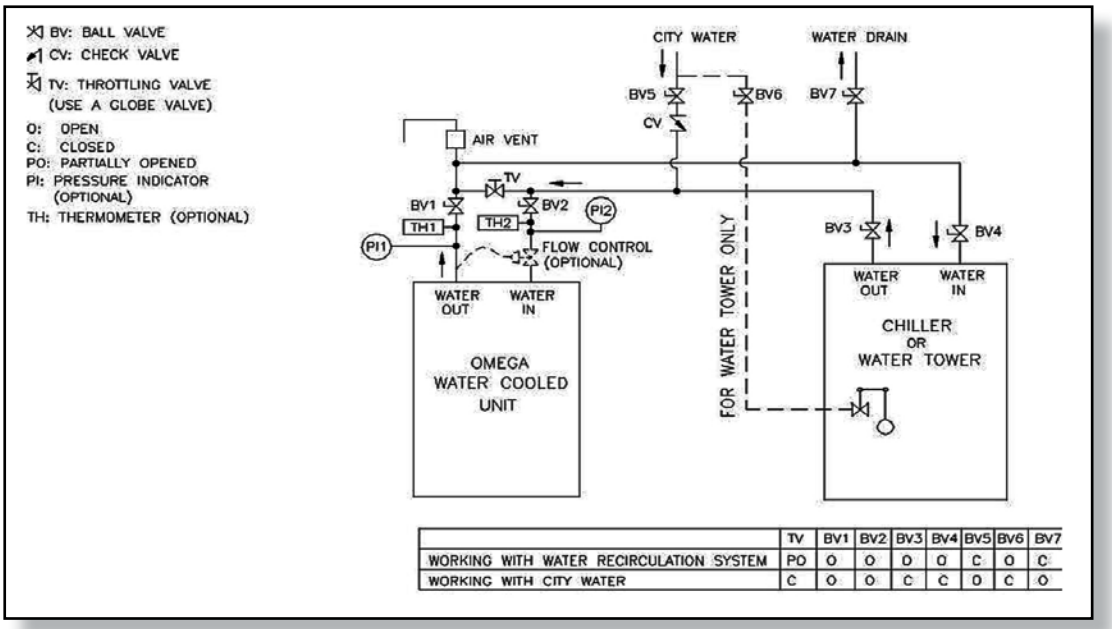


COOLING WITH A CHILLER (OPTIONAL)

Cooling with a closed water circuit is an ideal solution for lowering the costs of the distillation as well as having the following advantages:

- Better condensation on a liquid cooled surface.
- Possibility to control the temperature of the distillate depending on the use. Less loss of solvent due to natural evaporation.
- No danger of freezing water lines in wintertime.

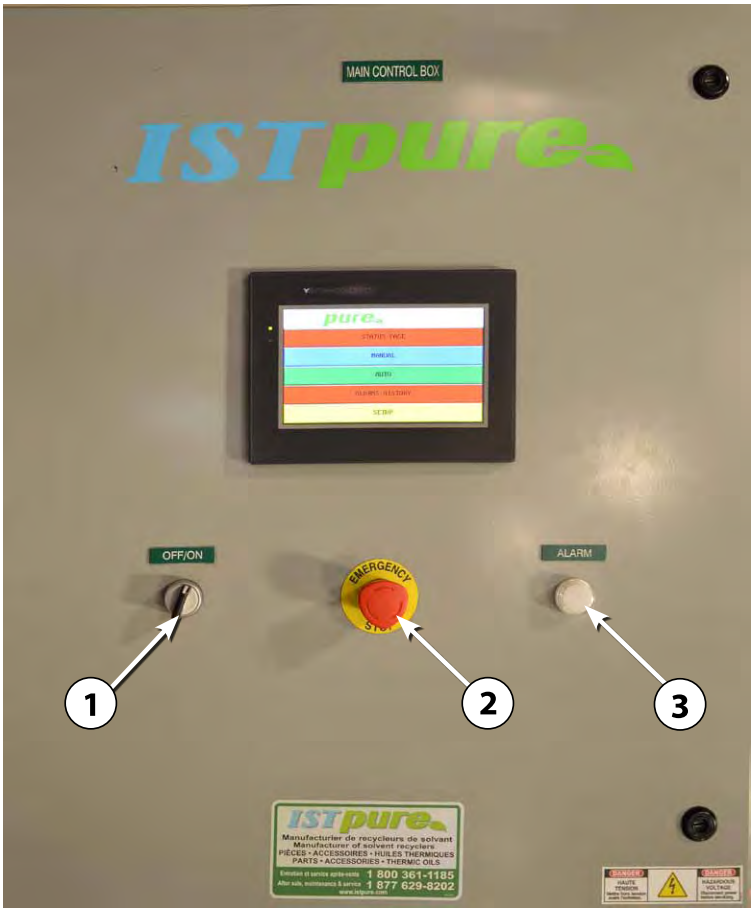
For further details on how to size the chilling unit, please consult ISTpure or your local distributor.



	TV	BV1	BV2	BV3	BV4	BV5	BV6	BV7
WORKING WITH WATER RECIRCULATION SYSTEM	PO	O	O	O	O	C	O	C
WORKING WITH CITY WATER	C	O	O	C	C	O	C	O

CONTROLS

If you are not familiar with the control panel the manual switches and the significance of the indicator lamps, then the following description of the controls and the indicator lamps will help you prior to the actual start-up.



CONTROLS

POWER ON/OFF (1)

The switch turn on and off the PLC. Touch screen would still be powered up even when the switch is turned to OFF.

EMERGENCY STOP (2)

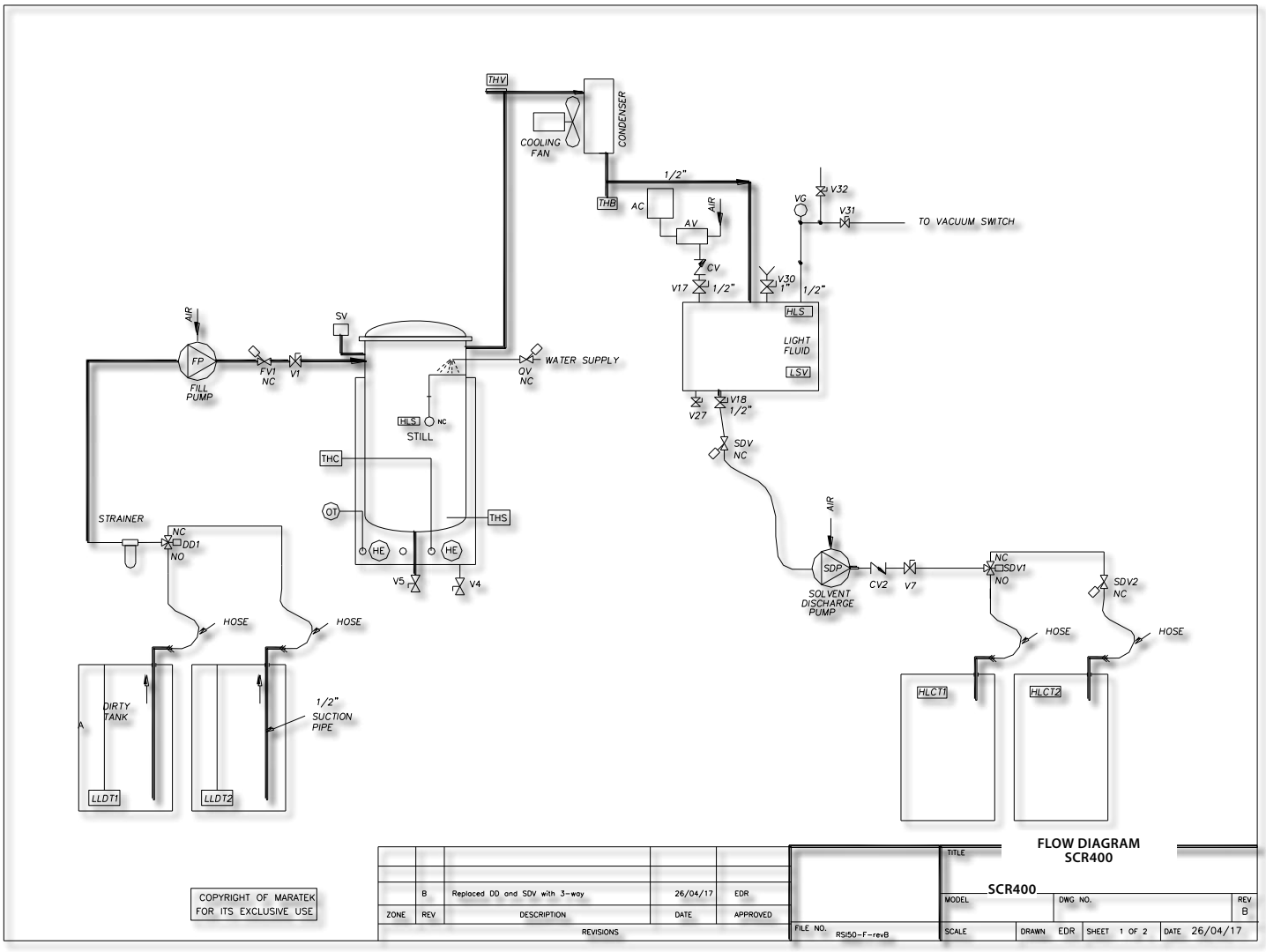
Whenever this switch is pressed all functions (except for the cooling system) are stopped. The outputs are released only once the switch has been replaced to its normal position and no other alarm is triggered. In any event this switch is to be used in emergency situations only. Once this switch has been de-activated the operator must start again from the start-up mode screen to resume the cycle.

ALARM (3)

Whenever the unit's horn sounds – for whatever reason – this button when pressed will silence the horn. Generally, when the horn sounds, an accompanying message is displayed on the LCD screen. By pressing the horn switch the message will not be removed.

PROGRAM SETUP

To properly understand the SSC unit and prior to start-up it is recommended to properly understand the SSC flow and various components as shown in the diagram below.



The SRC400 is an explosion proof still designed to distill mixed wastes (such as oily water, ink / water etc.), using vacuum. The unit can operate in batch or continuous fill modes. Contaminated waste solvent is transferred from the dirty drum (or container) to the still through a fill pump and a fill valve (FV1 and FP) and into the still.

Vacuum in the still is generated by a vacuum pump (VP). The condensate is cooled by water (cold water supplied by the customer).

The contaminated waste stream in the still is heated and vaporized. These vapors are condensed in the condenser and into the Vacuum Tank. When the level in the tank reaches LLST, the Solvent Discharge Pump (SDP) turns on and pumps out the condensate to a collection container.

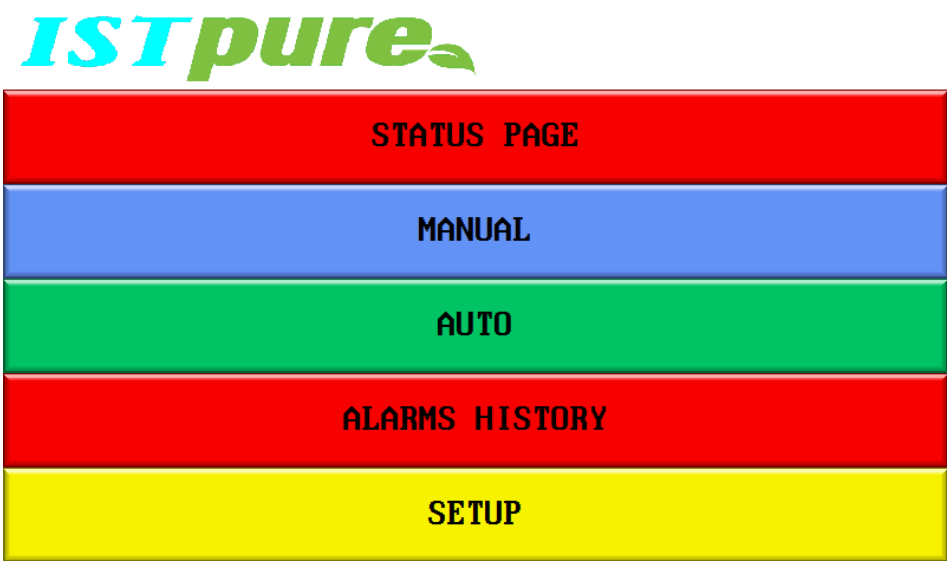
PLC CONTROLLER

The PLC controller controls all functions, both automatic and manual, on the SCR400. It consists of a Direct Automation DL 06 PLC with a thermocouple expansion module as well as a 6-inch C-More LCD color touch monitor.

GENERAL DESCRIPTION:

All functions (save for the emergency stop switch) are entered through the color touch monitor, whether in Auto or Manual mode. It is advisable to touch this screen with clean hands and never with a sharp object. If this is difficult to enforce a protective cover for the color touch monitor is available.

Both manual operation and automatic functioning of the unit is performed through the PLC unit. Upon start-up a “Mode Selector Screen” will give the operator the following choices:



By pressing this button, the screen changes to the STATUS PAGE.

By pressing this button, the screen changes to the MANUAL Mode Page.

By pressing this button, the screen changes to the Automatic Mode Page.

By pressing this button, the screen changes to show the history of the alarms activated.

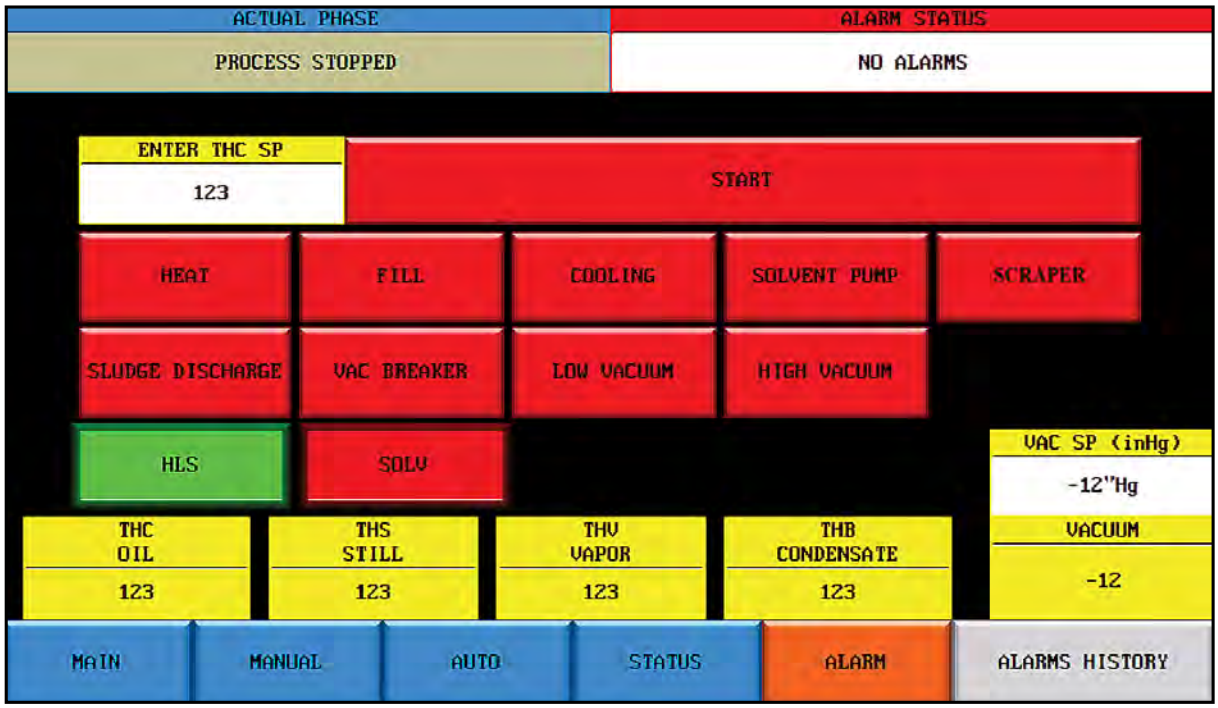
By pressing this button, the screen changes to the Setup Page.

PLC CONTROLLER (CONT'D)

MANUAL OPERATION

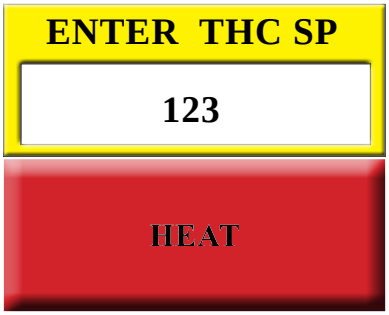
Once the operator selects to operate the unit in manual operation then the operator will have access to activating the outputs manually by pressing on the touch screen a button corresponding to the output. If the output is off the button will be black, if it is on the button will be green.

Typically the manual screen, once selected will look as follows:



Pressing the START button will permit the usage of the manual switches. When pressed button color will change to green and will display STOP. Now pressing the STOP button will deactivate all activated manual switches and the button will then change color to black and display START.

Note: Do not attempt to start unit in both Manual mode and Automatic mode at the same time.



When the "HEAT" switch is activated, the operator must also enter the desired heat set-point (called THC set-point) . By pressing the button beside THC SP button, a screen is brought up for the operator to enter the value of THC (THC is the heating medium temperature setting, above which the heating elements are switched off). Once THC value is entered (refer to this value as THCENT), the screen will revert to the "MANUAL MODE" screen. Note that once the THC value is entered the PLC will maintain this value in memory. The heating elements will cycle continuously on and off around the temperature of THCENT until either the heat switch is turned off or manual operation is ended. Note, the operator is able to change the value of THCENT during the cycle by pressing on the "HEAT" switch, thereby turning it off, pressing it again thereby prompting the THC set screen once more.

PLC CONTROLLER (CONT'D)

FILL

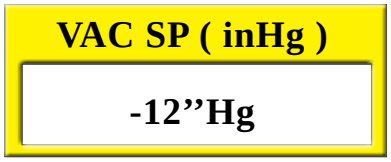
Activates fill valve and pump. When manual mode is started, and fill switch is activated, the fill system stays on at all times. Only once fill switch is turned off or manual mode is ended does the fill system turn off.

COOLING

Activates condensate-cooling system. When manual mode is started, and condensate cooling system switch is activated, the condensate cooling system stays on at all times. Only once condensate cooling system switch is turned off or manual mode is ended does condensate cooling system turn off.

LOW VACUUM

Activates the low vacuum feature which controls the vacuum at the pressure set by the operator using



HIGH VACUUM

Activates the vacuum pump which will remain on regardless of the vacuum pressure.

SOLVENT PUMP

Activates solvent pump in manual mode. This feature can be used to pump out residual solvent from vacuum tank after cycle is completed.

SLUDGE DISCHARGE

Activates sludge discharge pump in manual mode. This facilitates discharge of residual oil accumulated in distillation chamber after solvent is distilled.

VAC BREAKER

When operated in manual mode, this feature will close vacuum breaker valve thereby forming a close loop system to achieve

SCRAPER

Activates scraper when operated in manual mode.

PLC CONTROLLER (CONT'D)

Pressing this button will switch LCD screen to display the MAIN menu page.

Pressing this button will switch the LCD screen to display the MANUAL menu

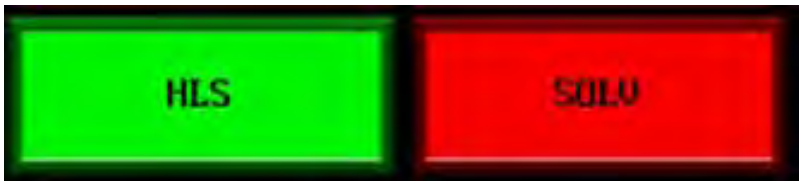
Pressing this button will switch LCD screen to display the AUTOMATIC menu page.

Pressing this button will switch LCD screen to display the STATUS menu page.

Whenever the unit's horn sounds – for whatever reason – this button when pressed will silence the horn. Generally, when the horn sounds, an accompanying message is displayed on the LCD screen. By pressing the horn switch the message will not be removed.

Shows active alarm.

FLOAT STATUS INDICATORS



The status of the floats is indicated by the circles: Green indicates that the float is up, red the float is down.

Liquid level inside the boiler vessel.

Liquid level inside the vacuum tank (or separator).

AUTOMATIC OPERATION

Before describing operation of the automatic screen, understanding automatic cycle operation is crucial and will help in understanding the SCR400 automatic functions. Automatic operation will be covered below in detail.

Automatic Operation

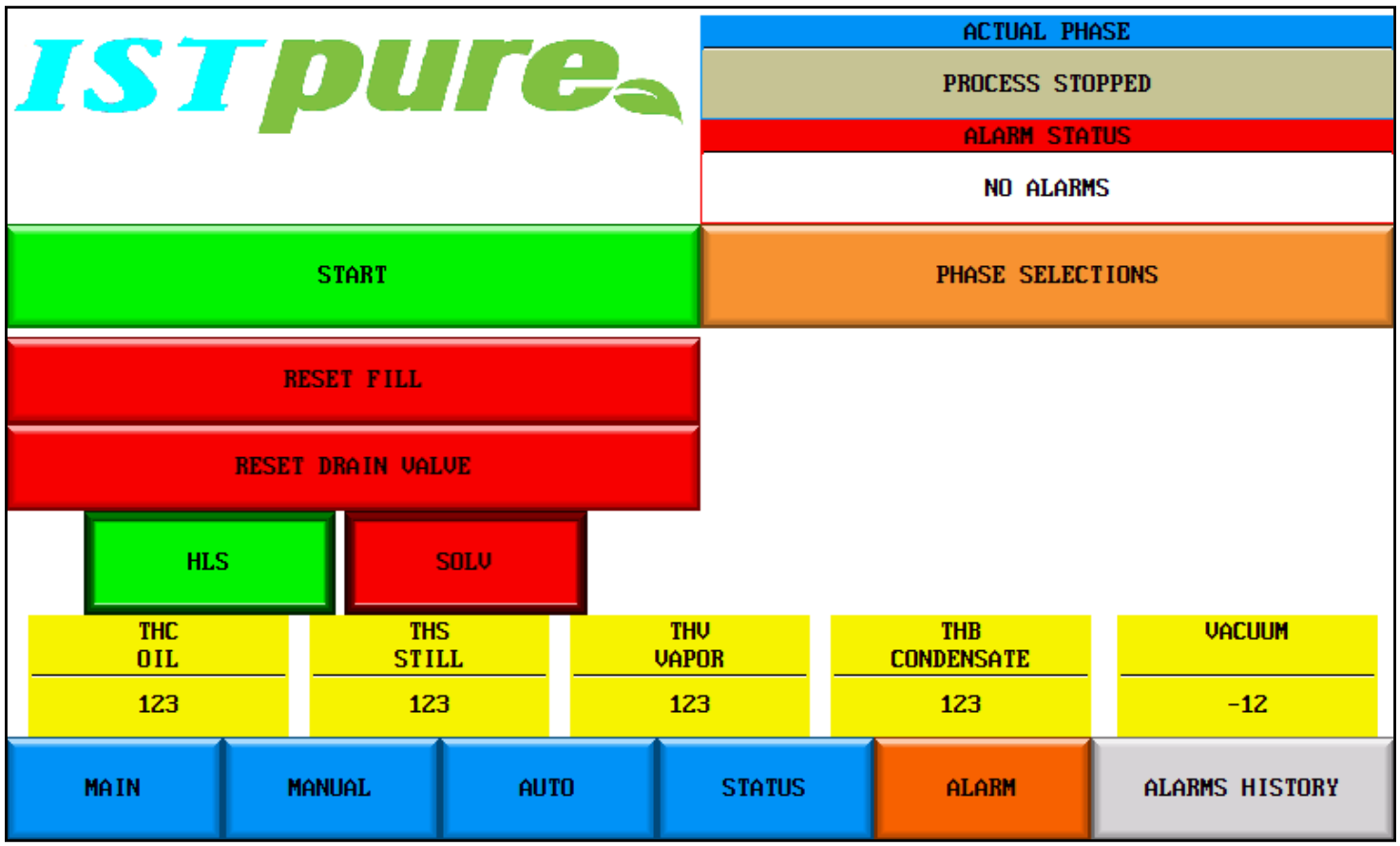
A program cycle can consist of 5 distinct phases plus a cool-down phase. Each phase – except for the cool-down phase - can be selectively chosen to be ON or OFF.

At the start of the cycle the PLC looks at Phase 1, verifies if this phase was selected to be ON or OFF. When a phase is selected to be ON, then the PLC will proceed to perform functions selected in that phase. Once an ON phase is completed, the PLC moves on to the next phase that has been selected to be ON.

When a phase is selected OFF then the PLC moves to the next phase with an ON selected.

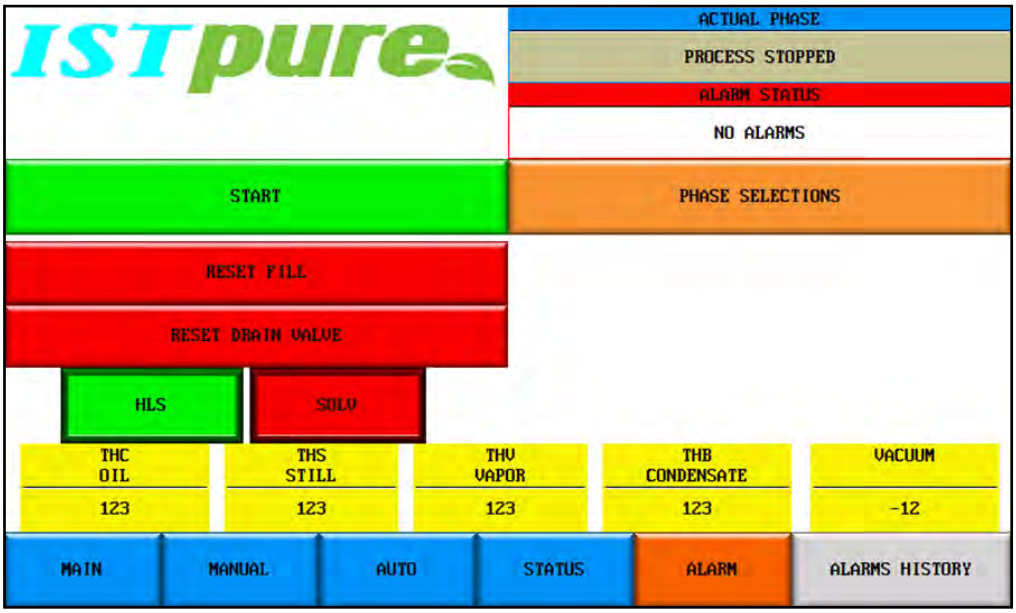
After having gone through all the ON selected phases (maximum of 5), the PLC will perform the functions dictated by the cool-down phase.

Typically the AUTOMATIC OPERATION SCREEN will look as follows;



AUTOMATIC OPERATION (HMI SCREEN)

On the AUTOMATIC page there are operational buttons as well as displaying information useful to the operator. Displayed information includes temperatures THC, THS, THB and THV, as well as a float status bar. For more information on these, consult the description in the MANUAL page section.



Functions of the buttons available on the Automatic Operation screen are described below:

Pressing the START button will initiate the start of an automatic cycle – as described in the flow chart above. When pressed button color will change to green and will display STOP. Now pressing the STOP button will stop the automatic cycle, reset all timers and counters and the button will then change color to red and display START.

Note: Do not attempt to start unit in both Automatic mode and Manual mode at the same time.

This button will only be visible when there is a fill fault. Pressing the button will reset the fill timers and enable the operator to start filling the equipment again.

This button will only be visible when there is a solvent discharge pump fault. Pressing the button will reset the timers and enable the equipment to continue with the process.

Pressing this button will switch LCD screen to display the MAIN menu page.

Pressing this button will switch the LCD screen to display the MANUAL menu page.

AUTOMATIC OPERATION (HMI SCREEN)

Pressing this button will switch LCD screen to display the AUTOMATIC menu page.

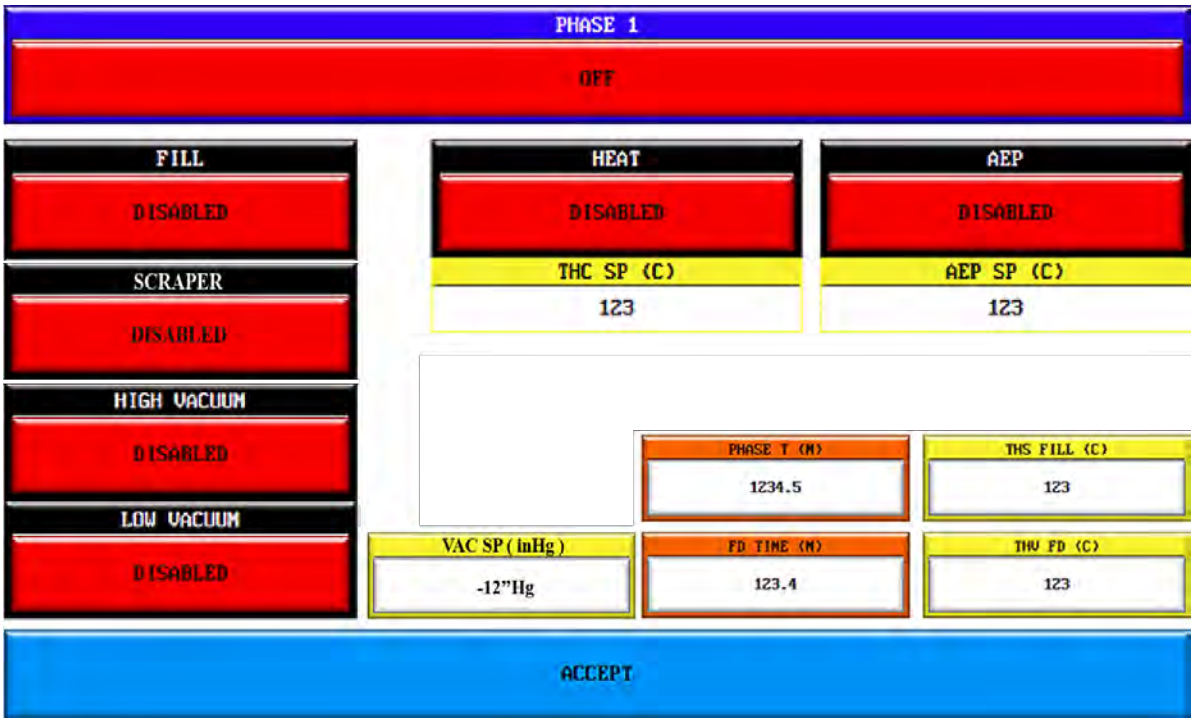
Pressing this button will switch LCD screen to display the STATUS menu page.

Whenever the unit's horn sounds – for whatever reason – this button when pressed will silence the horn. Generally when the horn sounds, an accompanying message is displayed on the LCD screen. By pressing the horn switch the message will not be removed.

Pressing the PHASE SELECTION button will switch the LCD to the screen which enables the operator to set the parameters in each phase of the process.

Since the programming page for PHASE 1 through to PHASE 5 are identical in appearance, a description of the buttons for PHASE 1 only will be described below. Remember that functions selected in a phase are independent of functions selected in other phases. Also, once phase functions have been programmed and phases have been enabled, the PLC will retain this selection in memory, until changed by the operator.

Typically the PHASE 1 PROGRAMMING PAGE will look as follows:



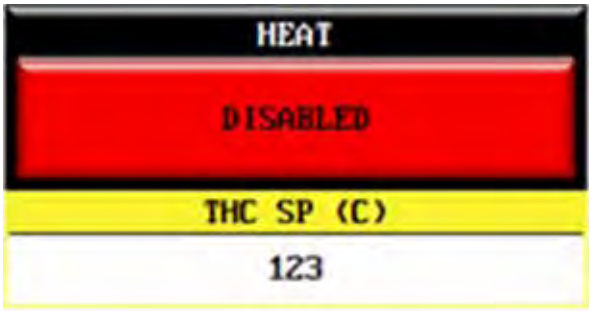
The functions of the buttons are described in detail on next page.

AUTOMATIC OPERATION (HMI SCREEN)

By pressing the PHASE 1 button the operator can enable or disable this phase. When enabled, button text will read ON and the background will be green. When pressed again, button text will read OFF and background will be red. When the phase is enabled PLC will proceed to perform functions selected in this phase for the time entered in PHASE TIME or the AEP condition has been met (see below for more details on PHASE TIME and AEP).

Whenever a phase is enabled, a value must be entered for the PHASE TIME. The time is entered in minutes, up to a maximum of 400 minutes per phase. Once time has elapsed the PLC will move to the next enabled phase (or the COOL DOWN phase). The actual phase time duration may be shortened with the use of the AEP function - when enabled.

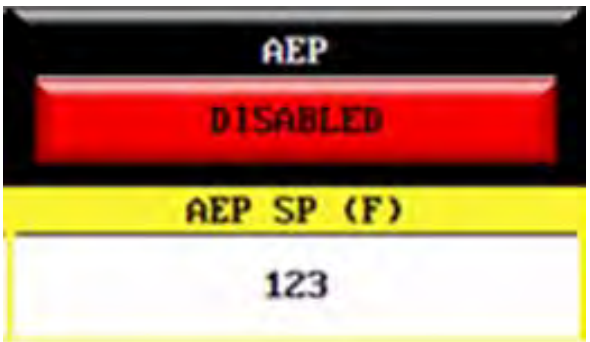
Note that in Phase 1, Phase Time only start counting down once the HLS float goes up.



When selected the heat function will be activated during the duration of this phase and background color of button will change to green.

When the "HEAT" switch is activated, the operator must also enter the desired heat set-point (called THC SP). By pressing the THC SP button, a screen is brought up in order for the operator to enter the value of THC (THC is the heating medium temperature setting, above which the heating elements are switched off). Once THC value is entered (refer to this value as THCENT), the screen will revert to the Phase page screen. Note that once the THC value is entered the PLC will maintain this value in memory for this phase.

The heating elements will cycle continuously on and off around the temperature of THCENT until the phase is ended.

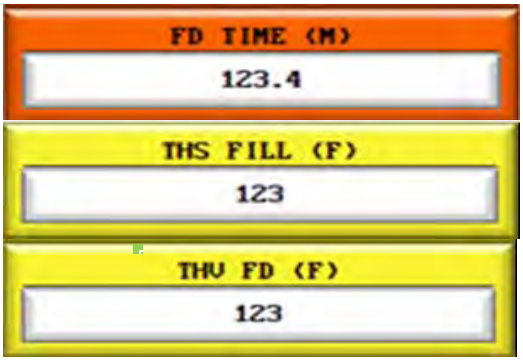


AEP is an acronym for "Automatic End of Phase". A phase can be ended in one of two ways, namely by the expiration of the time entered in the PHASE TIME or – when selected – with the AEP option. Basically, by selecting the AEP function the operator will need to enter a value for AEP SP. For Phases 1 to 4, the program looks at the liquid temperature (THS). If the liquid temperature becomes higher than the AEP SP for the current phase, then the phase will be ended, regardless of time left in this phase. Therefore, to determine what temperature to set for AEP SP, the operator must know the temperature at which the liquid should be boiling. Once all of the lower boiling point liquids have evaporated, then the temperature should rise to get to the boiling point of the next liquid.

For Phase 5, the program looks at the temperature of the vapor (THV). In this phase, the AEP SP is set to a value below the boiling point of the liquids. If THV falls below the AEP SP, then the phase will be ended regardless of time left in the phase.

AUTOMATIC OPERATION (HMI SCREEN)

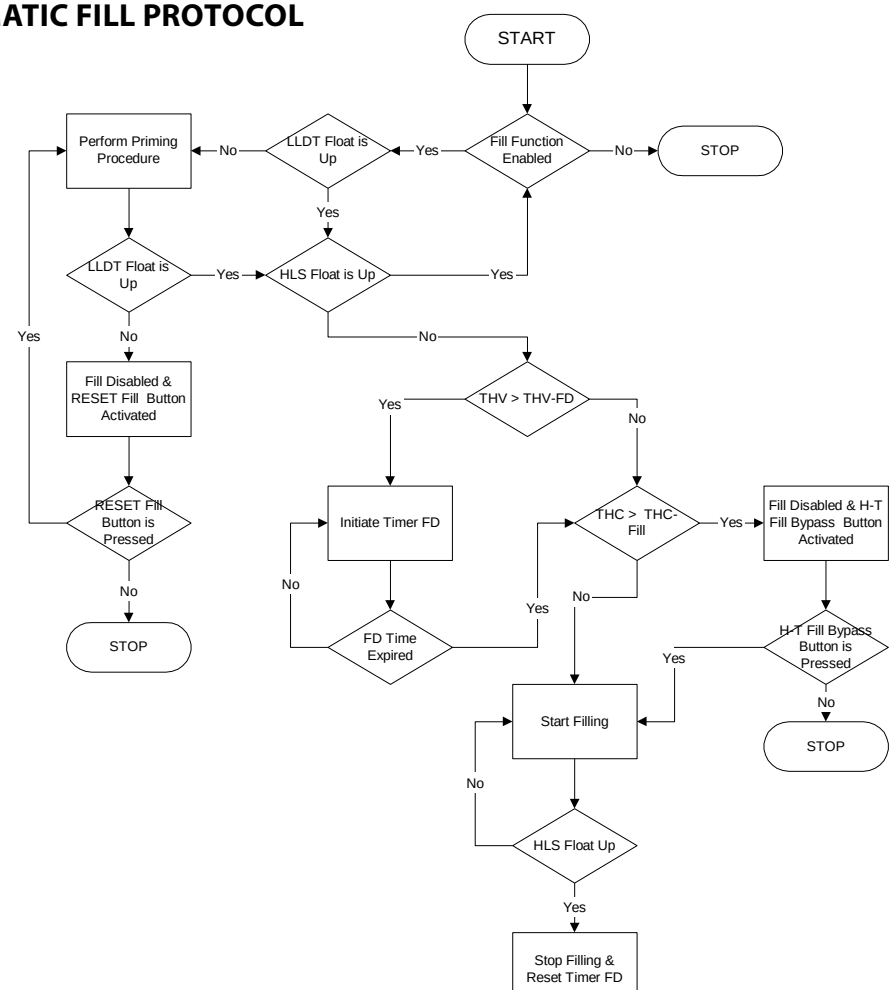
Pressing this button will enable the fill function to operate through the whole phase. This can be used to fill the equipment once for a batch process or filling ca be enabled in other phases which continually tops up the unit whenever the HLS float goes down.



When selecting a fill to operate during a phase the operator must also enter values for THC FILL, THV FD and FD TIME. These parameters – located on this page and described in more detail further on - are essential for proper fill operation and will be valid during this phase only. See SCR400 Automatic Fill Protocol flow chart below.

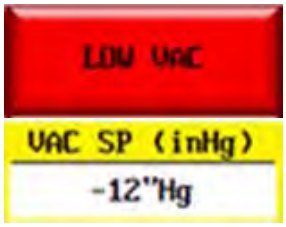
The logic behind the automatic fill protocol is best described by the flow chart below.

SS SYSTEM AUTOMATIC FILL PROTOCOL



AUTOMATIC OPERATION (HMI SCREEN)

Activates scraper when operated in manual mode.

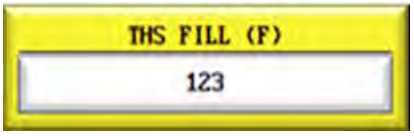


Pressing this button will enable the fill function to operate through the whole phase. This can be used to fill the equipment once for a batch process or filling ca be enabled in other phases which continually tops up the unit whenever the HLS float goes down.

Enables the unit to generate vacuum as high as possible.

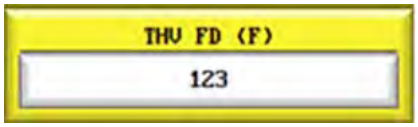
The setpoint entered here is the amount of time before the fill pump starts.

Temperature in Distillation Still



This setpoint is the temperature of the liquid inside the vessel (THS) above which fill will be disabled. It is usually set about 10 degrees higher than the boiling point of the lowest boiling liquid. **NOTE: To prevent flash boiling, this setpoint should be determined carefully.**

Vapor Temperature in Vapor Pipeline

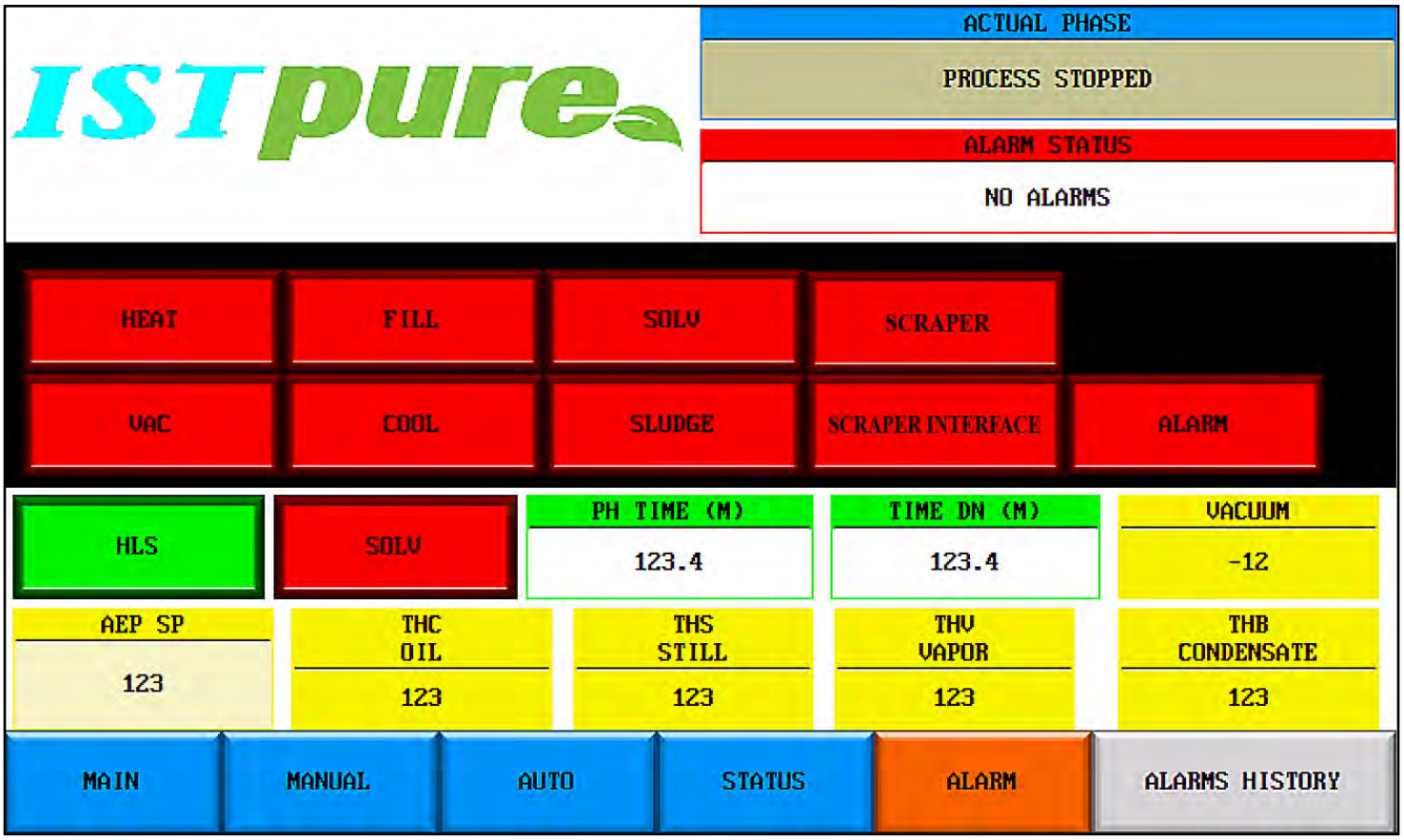


This setpoint is the temperature of the liquid inside the vessel (THV) above which fill will be disabled. It is usually set about 10 degrees higher than the boiling point of the lowest boiling liquid. **NOTE: To prevent flash boiling, this setpoint should be determined carefully.**

RS 5-PHASE MAIN CYCLE PROGRAM (CONT'D)

STATUS SCREEN:

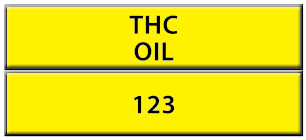
The STATUS screen provides useful information of the unit's progress in the cycle. This screen is useful for determining status of the unit as well as troubleshooting. Typically the screen will look as follows:



Information provided on this screen includes status of floats, outputs status and temperatures as well as the progress of the program in the cycle. Such information may be useful to technicians when troubleshooting the units.

The STATUS screen provides useful operational information. It informs the operators in which phase in the automatic cycle the PLC is in; which outputs are on (green) and which are off (red). It also provides the operator with the duration programmed for the phase as well as the time elapsed in that phase.

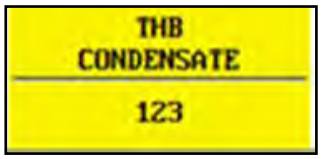
Similar to the automatic and manual pages the operator can see temperatures THC, THV, THS and THB, as well as the THC set-point for the HEAT function and the THVAEP set-point for AEP function – if enabled in that phase. Float status and reset switches are also available to the operator.



Temperature of the oil (or heating medium).

RS 5-PHASE MAIN CYCLE PROGRAM (CONT'D)

Temperature of the vapor.



Temperature after the condenser.

Temperature inside the distillation vessel.

These indicators show red when the float is down and green when up:

Level sensor inside the distillation vessel.

Liquid level inside the vacuum tank (or separator).

The following indicators show the status of the outputs:

Indicates status of the Heating Elements. It is red when off and changes to green when it is on.

Indicates status of the Fill Pump. It is red when off and changes to green when it is on.

Indicates status of the Condenser Cooling System. It is red when off and changes to green when it is on.

Indicates status of the Sludge Discharge Valve. It is red when off and changes to green when it is on.

RS 5-PHASE MAIN CYCLE PROGRAM (CONT'D)

Indicates when an alarm condition has° Ccurred. It is red when off and changes to green when activated.

Indicates whether the vacuum is running or not.

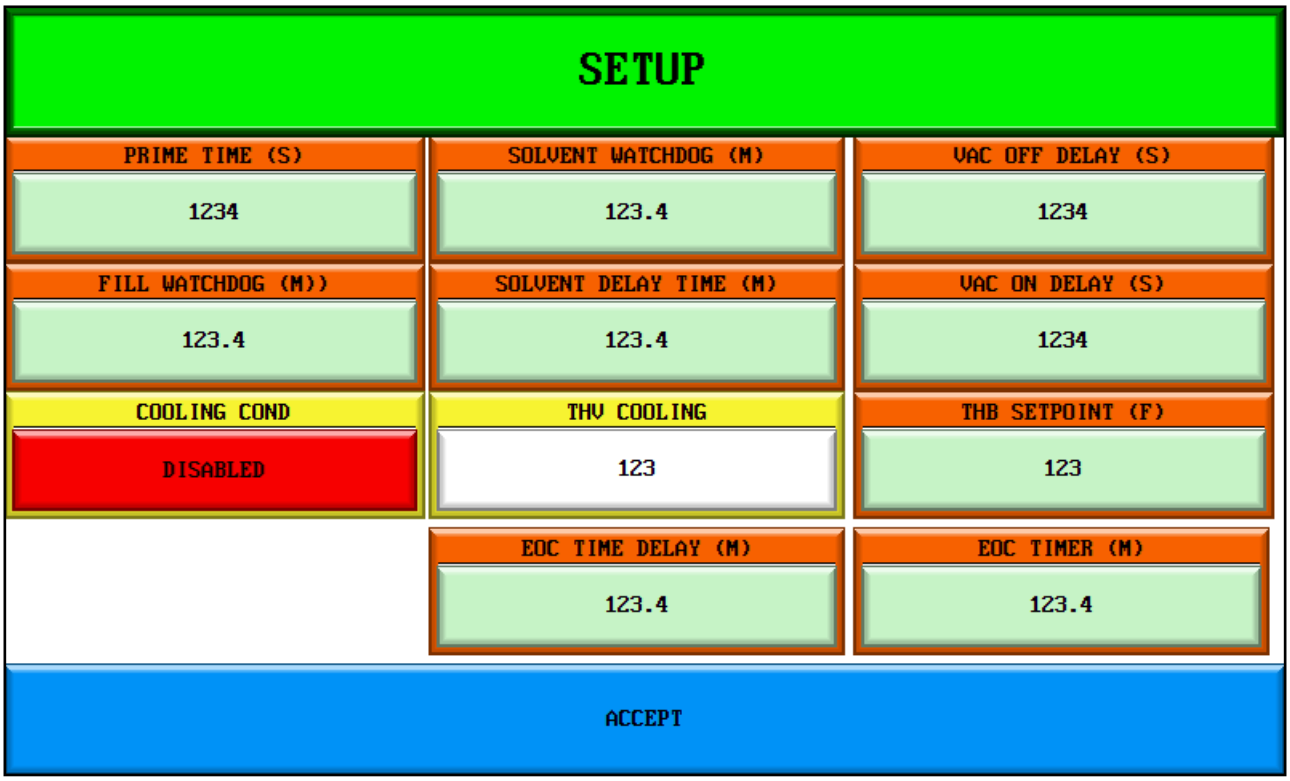
Indicate operation of scraper. Red light indicates «OFF» and green light indicated "ON"

Scraper is interlocked with access door located on distillation chamber. Green light indicates access door is not closed properly or its open, this is safety feature which will prevent operation of scraper when door is open.

SETUP SCREEN:

The SETUP screen is a screen that is for the use of qualified technicians only.

Pressing on the corresponding symbol and entering the value in the pop-up numerical keypad can change any value. Care must be taken in entering these values since they will affect the units cycle. It is recommended to consult with your distributor or an ISTpure technician prior to changing settings values.



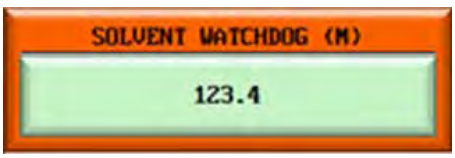
RS 5-PHASE MAIN CYCLE PROGRAM (CONT'D)

SETUP SCREEN (CONT'D):

The value entered for the PRIME TIME is the amount of time that the program will turn on the pump to fill the fill tube when the LLDT float is down.

The value entered for the FILL WDT Button will determine the maximum amount of time the fill pump is permitted to be on before an alarm is sounded.

SOLVENT DELAY TIME is the time delay for the discharge pump to turn on after the low-level solvent float (LLS) rises up.



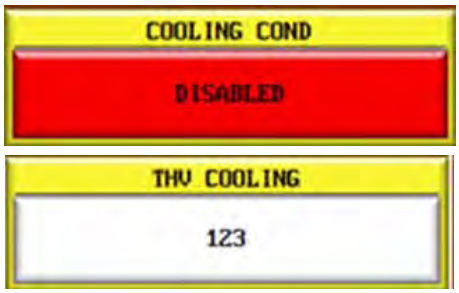
SOLVENT WATCHDOG is a timer that starts when the solvent discharge pump starts running. When the set time elapses before the pump stops, an alarm will be activated.

VAC OFF DELAY is the delay timer before the vacuum pump turns off.

The value entered for the THB SET-POINT will determine the maximum temperature for THB before an alarm is sounded.

RS 5-PHASE MAIN CYCLE PROGRAM (CONT'D)

SETUP SCREEN (CONT'D):



COOLING COND, if enabled, will delay the start of the condenser cooling fan until the vapor temperature reaches above the value set in THV COOLING

EOC TIME DELAY is the time the operator allows the unit to process before the program starts determining if the production rate is already too low.

EOC TIMER looks at the time between activations of the Solvent Discharge Pump. If it is taking too long between pump outs, then the program will skip to COOLDOWN Phase.

Once all parameters have been entered, the operator can press the ACCEPT button to store the settings in the PLCs' memory and return the screen to the previous page..

ALARMS

GENERAL ALARM PROTOCOL

The alarm protocol runs continuously in the background. It operates regardless of whether a cycle is in automatic or manual modes. There are three basic types of alarms – and corresponding actions taken when an alarm is detected by the PLC; namely a General Fault, a Specific Fault or a Non-Fatal Fault.

When an alarm is detected the LCD displays a message corresponding to that alarm. The duration and frequency of displaying the message on the LCD will depend on the alarm type. The message will remain on the screen until the alarm condition that triggered it has been addressed.

Finally, a record of the alarm is logged into the alarm history page for the operator to consult. The ALARM HISTORY page is a useful and powerful tool for trouble shooting.

The three different types of alarms are described below:

1. General Fault: When this type of fault is detected, all outputs, except the cooling system is disabled. The LCD will display the appropriate fault message until the specific alarm problem is dealt with and disappears.

2. Specific Fault: When this type of fault is detected, only a specific output is disabled. The LCD will display the appropriate fault message until the specific problem is dealt with and disappears.

3. Non-Fatal Fault: When this type of fault is detected, no outputs are disabled. The LCD will display the appropriate fault until the specific alarm problem is dealt with and disappears.

The table below will summarize the different alarms. Note that the «ALARM TYPE» column refers to the three different types of faults or alarms as described on the previous page.

ALARM #	PLC ALARM MESSAGE	DESCRIPTION	ALARM TYPE
1	FILL FAIL	FILL WDT Timer as set in setup page has expired. **Occurs when Tfillwdt has expired.** **Action taken by PLC: Fill function is disabled.** **To Reset:** This alarm is reset with a reset button on PLC screen.	2
2	OUT 1 FAIL	OUT1 DV WDT Timer as set in setup page has expired. **Occurs when Twdvwdt has expired.** **Action taken by PLC: Disable unit by disabling heat and all vacuum outputs.** **To Reset:** This alarm is reset with a reset button on PLC screen. Resets timer Twdvwdt .	2

ALARMS (CONT'D)

GENERAL ALARM PROTOCOL (CONT'D)

The table below will summarize the different alarms. Note that the «ALARM TYPE» column refers to the three different types of faults or alarms as described on the previous page.

ALARM #	PLC ALARM MESSAGE	DESCRIPTION	ALARM TYPE
3	**OUT 2 FAIL**	OUT2 DV WDT Timer as set in setup page has expired. **Occurs when Tdsvwdt has expired.** **Action taken by PLC: Disable unit by disabling heat and all vacuum outputs. .** **To Reset:** This alarm is reset with a reset button on PLC screen. Resets timer Tdsvwdt.	**2**
4	**BOIL OVER**	PLC has detected a temperature on the outlet of the condenser higher than that set by THB SETPOINT **Occurs when THB goes above THBset.** **Action taken by PLC: Disable unit by disabling heat and all vacuum outputs .** **Reset:** This alarm is reset when THB goes below THBset.	**1**
5	**E-STOP**	**Occurs when the SR relay is de-energized (when input I0 goes from low to high). This can be caused by either one of the following three situations:** **1.Pressing the emergency stop switch on the front panel.** **2.Loss of air purge to the control box.** **3.Thermal high limit switch detected a temperature of the thermal oil jacket above 215 °C.** **Action taken by PLC: Disable unit by disabling heat and all vacuum outputs .** **Reset:** This alarm is reset when input I0 on PLC goes from high to low. This will only° Ccur if none of the above three situations are true.	**1**
6	**HIGH LEVEL TANKS**	PLC has detected that the level in a collection container is high **Action taken by PLC: Disable unit completely by disabling all outputs.** **Reset:** This alarm is reset when input signal for the collection containers goes from high to low	**3**

START-UP

HEATING FLUID CHECK

Depending on the SCR400 model there may be various types of heating systems such as Thermal Oil, Steam or Water / Glycol heating medium. Determine the type on your specific unit and consult the appropriate section below.

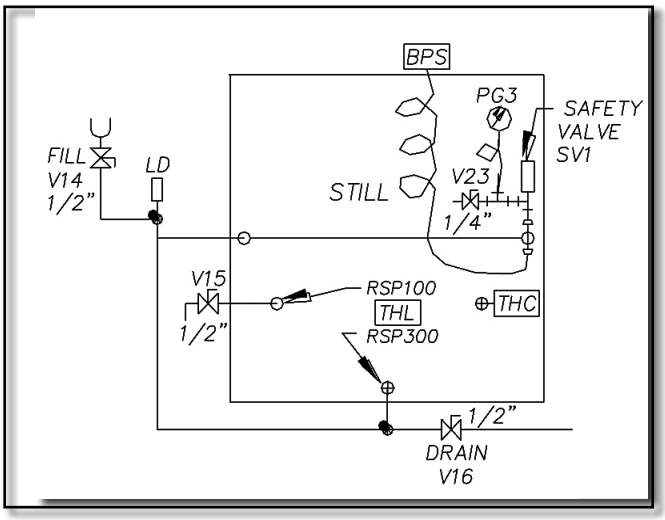
THERMAL OIL HEATING JACKET

No intervention is needed with a thermal oil heated SCR400 unit. These units are shipped from the factory filled with the correct amount of thermal oil and ready to operate. Simply verify that there is thermal oil in the thermal oil jacket by observing the level of oil as shown on the thermal oil level indicator located on the side of the thermal oil heating jacket. Remember that the thermal oil will expand when it is heated and therefore the thermal oil level will fluctuate depending on its temperature. Respect for the maximum oil level must be determined when the thermal oil is hot – or after at least two hours of operation of the unit

WATER / GLYCOL HEATING JACKET

Certain SCR400 model stills are surrounded with a heating jacket filled with a Heating Medium Fluid (HMF), generally consisting of a mixture of 50% water and 50%. glycol. SCR400 units are shipped from the factory filled and ready to operate. However, if the jacket HMF is emptied or HAF leaked. Follow the procedure below to refill. In any event it is advisable to ascertain that there is the correct quantity of HMF prior to starting the unit.

Note: The valves numbers referred to in the following text refer to the diagram to the right only and may not be similar to the general flow diagram with this manual. Open the HMF fill valve V14 and level valve V15. Pour the HMF in the funnel above valve V14 until HMF flows out through valve V15.Once the HMF comes out through valve V15 close both valves V14 and V15.



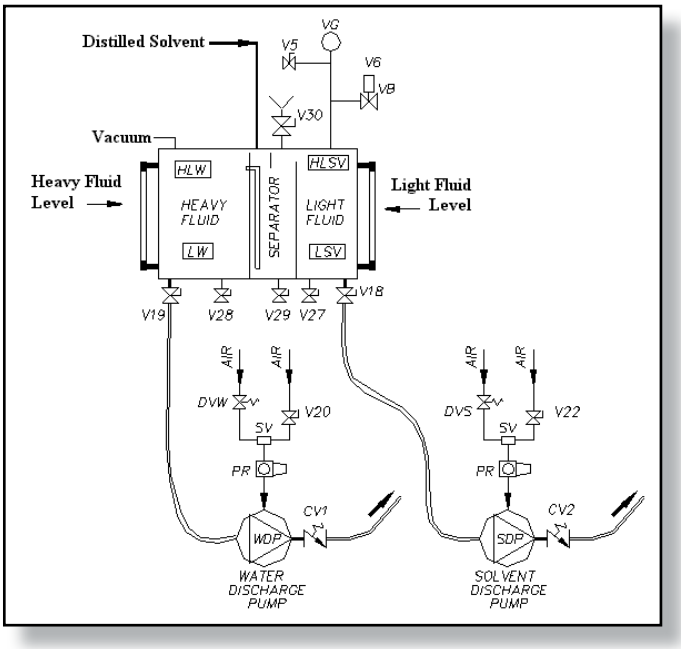
START-UP (CONT'D)

Following the HMF verification we proceed to priming of the two discharge pumps as well as the fluid separator. For these procedures you will need to have compressed air available to the unit.

Discharge Pump and Separator Priming (optional):

At the first start-up and whenever fluid types are changed the separator as well as the discharge pumps must be primed.

Note: *The valves numbers referred to in the following text refer to the diagram to the right only and may not be like the general flow diagram with this manual.*



If the two fluids are solvent and water, with the solvent being lighter than water, proceed to prime the separator as follows:

1. Open Valves V18, V19 and V30.
2. Pour water into separator through valve V30 until water appears at the Heavy Fluid Level indicator.
3. Pour solvent into separator through valve V30 until solvent appears at the Light Fluid Level indicator.
4. Close valve V30; valves V18 and V19 remain open.

After priming of separator, the two discharge pumps must be primed. To do this compressed air must be available to the unit. Follow the steps below to prime both the Solvent Discharge Pump (SDP) and the Water Discharge Pump (WDP):

1. Water separator is already primed and valves V18 and V19 are open.

2. Activate WDP by opening valve V20. Close valve V20 five seconds after liquid comes out from the Heavy Fluid Outlet.

3. Activate SDP by opening valve V22. Close valve V22 five seconds after liquid comes out from the Light Fluid Outlet.

START-UP (CONT'D)

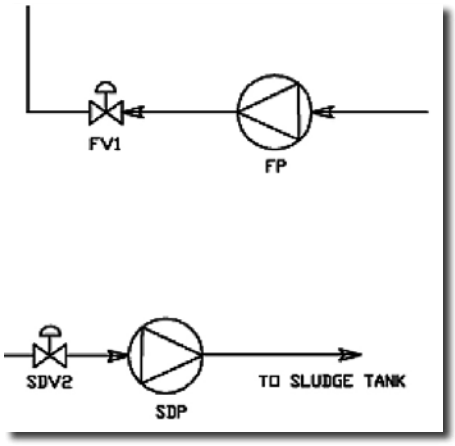
FILL SYSTEM PREPARATION:

For SCR400 Units Equipped With The Auto Fill System.

Note: The valves numbers referred to in the following text refer to the diagram to the below only and may not be similar to the general flow diagram with this manual.

Install the fill system as follows:

1. Insert the fill stem assembly suction pipe into the dirty tank. It is advisable that the bottom of suction pipe always be above any sludge or any type of solid residues that may be located at the bottom of the dirty tank.
2. Connect the supplied hose between the fill stem head and the SCR400 unit. Make sure that the locking clamps are well engaged in the lock position at each end of the hose.
3. Connect the fill system signal cable to the socket located on the right side of the SCR400 control box and marked "LLDT



START-UP (CONT'D)

Prior to turning electric power to the unit make sure that the following points are true:

- All covers, and lids and doors are closed and secure.
- All ball and gate valves are in the correct position as depicted in the table above.
- All switches are in the OFF position.
- Open control box and verify, visually as well as physically that all wires and cable harnesses are tight and have not moved during transport and rigging.
- Verify once more power and ground connections and ascertain at junction box that feed voltage is as marked on nameplate of the unit.

Once the above checks have been made you may turn electric power on the machine as well as other utilities, such as compressed air and water (if required), and proceed to complete the START-UP CHECK LIST.

START-UP CHECK-LIST

1. Open Control box and measure following incoming voltages:

Voltage:	L1-L2	Volts
	L1-L3	Volts
	L2-L3	Volts

If voltage is within the range stated on the machine nameplate then proceed.

2. Verify all secondary voltage from transformer in control box. These are easily measured between terminal blocks 2 and 5.
3. Installation Verification: Verify that all utility (and if applicable refrigeration) connections and parameters have been done correctly.
4. Open all utility valves to the machine water, air (and steam if applicable). For refrigeration units make sure all RotoLock valves have been opened at the refrigeration unit itself.
5. Check rotation of all three-phase motors, such as pumps and refrigeration blower motors. Proper direction is indicated on the housing of each respective motor.
6. Close the electrical control box and verify that the NO-PURGE indicator lamp turns off

STARTING

1. Put the feed drum in place.
2. Insert the fill tube into the feed drum
3. Check that the float switches inside the distillation vessel is clean and moving freely.
4. Place the rec bag inside the vessel and install the rec bag retaining ring.
5. Close the cover and set the locking mechanism.
6. Put the receiving drums in place and connect the outlet hoses to the corresponding drums.
7. Place the high-level float switches on the collection drums.
8. Go to AUTO screen of the HMI
9. Check that the settings for each phase are correct.
10. Press the START button.

PROCESS MONITORING

1. Check that the unit filled up properly.
2. Check that proper vacuum has been achieved
3. Check temperatures.
4. Check for any alarm signals
5. Check liquid levels in each drum

STOPPING

In automatic mode, the unit will stop automatically when the programmed cycle is done.

If for any reason the process has to be stopped in the middle of a cycle, it is recommended that the cooling be kept on cooling any hot vapors still being produced because the unit will still be hot. If the process is running under vacuum, releasing the vacuum will stop the boiling immediately.

MAINTENANCE

Maintenance should be performed regularly and only by adequately trained personnel. Apart from the basic lubrication and keeping the unit clean, the following maintenance should be performed.

DAILY MAINTENANCE

1. Clean daily the inside of the boiler and remove any dirt and deposits that may have formed. Keep a clean surface inside the boiler shell since any dirt and residues will increase distillation time. Only clean distillation chamber when empty, with power off and when distillation chamber is cold.

Before emptying the machine make sure that the temperature of the machine is lower than 50° C.

To shorten the waiting time it is possible to add as an option a heating fluid medium cooler. Consult factory for details

2. Clean fill strainer and/or bag filter daily, or more often if necessary. Open the strainer cover and verify that the strainer is clean. When replacing the strainer cover, make sure that the strainer cover o-ring is in place and properly seals the strainer assembly.
3. Inspect, and clean if necessary all float(s) inside and outside of distillation chamber. All floats must be clean of grime and residues and free to move on their respective stems. Note, if float is physically removed from its stem it must be returned in the same direction for which it was removed.
4. It is advisable to drain and re-prime the separator (if applicable) and both discharge pumps monthly.
5. Purge all water from compressed air coalescing filters. Compressed air fed to unit must always be clean and dry.

WEEKLY & MONTHLY MAINTENANCE

1. Check the oil level in the oil expansion vessel when the unit is cold. If necessary, fill up with proper type of oil. Do not overfill.
2. Drain the liquid from the re-circulation tank, and replace with fresh solvent.
3. Make sure that the path between the vapor tube inside the distillation chamber and the vacuum tank is clean and free of any dirt or residue that can lead to an obstruction.

YEARLY MAINTENANCE or EVERY 2000 WORKING HOURS

1. For thermal oil heated units only.
2. Once a year or every 2000 hours of operation the thermal oil must be changed. This operation must be carried out when the unit is cold.
3. Thermal oil to be used must have the following specifications: A cracking temperature higher than 320° C and a viscosity of about 31 cSt at 40° C and 5,3 cSt at 100° C. Commonly used types of oils: Calflo – AF, Mobiltherm 605 – Essotherm 500 – Shell ThermiaB – Total Seriola 2100.
4. During the use of the unit, carbon-deposits tend to form on the electrical heating element(s). For good heat exchange the heating element(s) should also be removed and cleaned every year. This is best achieved at the same time as a thermal oil change is performed.

TROUBLE SHOOTING:

FAULT	CAUSE	SOLUTION
Fill Fail	Feed drum is empty	Replace drum
	Fill strainer is plugged	Clean the strainer mesh
	Fill line is plugged	Clean out fill line
	Insufficient air supply	Fix or adjust air supply
	Faulty pump	Replace the Fill pump
	Faulty fill valve	Replace the Fill valve
	Dirty float switch (HLS)	Clean the float switch
	Faulty float switch (HLS)	Replace the float switch
High Level Tanks	Drum is full	Replace the drum
	Faulty drum float switch	Check wiring to float or replace the float if necessary
E-Stop	E-stop button pressed	Un-press the E-Stop button
Out 1 WDT	Discharge pump lost prime	Prime the discharge pump
	Pump is too slow	Adjust air pressure to discharge pump
	No air pressure to pump	Fix or adjust air pressure
	Faulty pump	Fix or replace the discharge pump
	Stuck float switch	Clean the float switch inside the vacuum tank or separator
Out 2 WDT	Discharge pump lost prime	Prime the discharge pump
	Pump is too slow	Adjust air pressure to discharge pump
	No air pressure to pump	Fix or adjust air pressure
	Faulty pump	Fix or replace the discharge pump
	Stuck float switch	Clean the float switch inside the vacuum tank or separator
Boilover	Cooling fan not working	Check cooling fan fuse and contactor
	Cooling water not working	Check water supply
	Process producing too fast	Slow down production rate by reducing temperature and/or vacuum
	Contaminant in the waste stream	Restart with new drum of waste
No power	Power not turned on	Check power supply
	Blown fuse or tripped breaker	Replace fuse or reset breaker

TROUBLE SHOOTING (CONT'D):

FAULT	CAUSE	SOLUTION
No power	Power not turned on	Check power supply
	Blown fuse or tripped breaker	Replace fuse or reset breaker
Dirty solvent coming out	Temperature too high	Reduce temperature
	Vacuum too high	Reduce vacuum
	Unstable vacuum	Check and fix compressed air pressure or check vacuum pump water level in the recirculation tank
	Contaminant in the waste stream	Restart with new drum of waste
	Unit is filled to high	Removed some of the liquid inside the distillation vessel
No vacuum	Vacuum pump not working	Fix or replace vacuum pump
	No air to venturi	Check air supply
	Open valve	Make sure all valves are in proper operating positions
	Leaky gasket	Tighten gasket or replace damaged gasket
Low vacuum	Low water level in the recirculation tank	Fill up the recirculation tank to recommended level
	Too much solvent in the recirculation tank	Drain and replace the water in the recirculation tank
	Low air pressure to venturi	Fix or adjust air regulator
	Air leak in the system	Make sure all valves are in proper positions and/or tighten all gaskets
	Faulty vacuum pump	Repair or replace the vacuum pump
Not heating up	Heater breakers tripped	Reset the breaker
	THL activated	Check heater, contactor, and THL thermostat
	No power	Turn on power supply
	Faulty heating elements	Replace heating element
Low production rate	Temperature too low	Increase temperature set point
	Vacuum too low	Increase vacuum set point
	Heating oil level too low	Top up oil level

TROUBLE SHOOTING (END):

FAULT	CAUSE	SOLUTION
Too much sludge	Temperature too low	Increase temperature set point
	Vacuum too low	Increase vacuum set point
	Time too short	Increase process time
	Too much sludge in waste stream	
Purge system fault	Insufficient air supply	Check compressed air supply
	Air leak in the main control box	Tighten lock screw on the control box
	Faulty flow or pressure sensor	Repair or replace sensor
Distillate has a greenish color	Solvent is acidic	Replace the copper condenser with the SS upgrade
	For chlorinated solvent, the temperature is set higher than the critical temperature. Solvent has acidified	Set the correct working temperature
	Acidification has occurred before the distillation	Replace the solvent immediately
Rec Bag is damaged	Working temperature is too high	Reduce the working temperature or use PTFE rec bags
	Solvent is acidic	Distill only pH neutral solvents
Cover gasket swells	The boiler cover is opened when the machine is still hot	Wait until the oil temperature has reached 50 OC before opening the cover.
	The cover gasket is not suitable for the type of solvent processed	Use suitable gasket
Solvent vapor bleeds out of the cover	Worn out gasket	Replace the gasket
	Vapor port is clogged	Wash manifold and condenser by pouring in clean solvent with a funnel or by blowing it out with compressed air
	Vapor condenser is clogged	Replace thee condenser

SOLVENT DISTILLATION TABLES

FLAMMABLE SOLVENTS			
SOLVENT	DISTILLATION TEMPERATURE °C	FLASH POINT TEMPERATURE °C	AUTO-IGNITION TEMPERATURE °C
Acetone	56	-20	353
Amyl Acetate	126-155	39	375
Benzene	80	-11	560
Butanol n.	118	35	366
2- Butanone	80	-7	404
Butyl Acetate	128	23	370
Sec. Butyl Alcohol	101	24	390
Butly Carbitol	234*	99	228
Butyl Cellosolve	173*	67	239
Butyl Cellosolve Acetate	192*	74	280
Butyl Diglycol	234*	99	228
Butyl Glycol	173*	60	239
Carbinol	65		385
Cellusolve	143		235
Cellosolve Acetate	156	47	377
Cyclohexane	81	-18	260
Cyclohexanol	162	68	300
Cyclohexanone	155	44	419
Dichloroethane	84	13	412
1,2 Dichloropropane	56	15	555
Dimenthylformamide (DMF	153	58	445
Ethyl Acetate	79	-3	427
Ethyl Benzene	136	15	380
Ethyl Glycol Acetate	156	52	377
Sim Ethylene Chloride	84		412
Hexamethylene	81		260
n- Hexane	70	-26	240
Isobutyl Acetate	119	22	420
Isobutyl Alcohol	111	28	430
Isopropanol	83	12	400
Isopropyl Acetate	89	4	460

SOLVENT DISTILLATION TABLES (CONT'D)

FLAMMABLE SOLVENTS			
SOLVENT	**DISTILLATION TEMPERATURE °C**	**FLASH POINT TEMPERATURE °C**	**AUTO-IGNITION TEMPERATURE °C**
Isopropyl Glycol	143	43	345
Methyl Acetate	58	-10	475
Methyl Cellosolve	124	38	285
Methyl Cellosolve Acetate	156	46	377
Methyl Glycol Acetate	137-152		380
M.E.K (Methyl Ethyl Ketone)	80	-7	404
M.I.B.K (Methyl Isobutyl Ketone)	117	14	459
Nafta A – Light Fraction	130-165*		245
Nafta B- Heavy Fraction	150-220*		250
n-Octane	126	13	220
Pentanol n	138	49	327
n- Propanol	98	22	371
n- Propyl Alcohol	98	22	371
Turpentine	152-170*	36	250
Toluene	111	4	535
Styrene	146	32	490
White Spirit	150-190*	>30	254
Xylene	140	17	525

SOLVENT DISTILLATION TABLES (CONT'D)

NON-FLAMMABLE SOLVENTS						
SOLVENT	DISTILLATION TEMPERATURE •		SETTING WORKING THERMOSTAT **		SAFETY TEMPERATURE	
	°C	°F	°C	°F	°C	°F
Chloroform	61					
Methylene Chloride *** Dichloromethane ***	40					
Freon 113 ***	46					
Carbon Tertrachloride	78					
1.1.2.2 –Tetrachloro Ethane	147					
Tetrachloro Ethylene-Perchloro Ethylene-Vors – Perstabil – Per	121					
1.1.1. Trichloroethane - 3x1 Methylchloroform – Chlorothene – Baltane- Solvetane – Genklene	74					
Trichloro Ethylene- Tri- Vorclin – Althene – Triklone	87					

- Boiling point under atmospheric pressure (1013 hPA)

** Both for distillation under atmospheric as under vacuum conditions. Under vacuum the distillation temperature can be lowered in case of excessive foaming.

*** Can only be distilled under atmospheric pressure.

WARNING LABELS

Health and Safety Labels:

WARNING LABELS (CONT'D)

Labels for use of Intrinsically Safe Barriers (ISB):

INTRINSICALLY SAFE
FIELD WIRING TERMINALS

INTRINSICALLY SAFE
CIRCUITS

NON-INTRINSICALLY SAFE
CIRCUITS

PROVIDES INTRINSICALLY SAFE CIRCUIT EXTENSIONS FOR USE IN CLASS 1, GROUP D, HAZARDOUS (CLASSIFIED) LOCATIONS WHEN CONNECTED PER PANEL CONTROL DRAWING NO:

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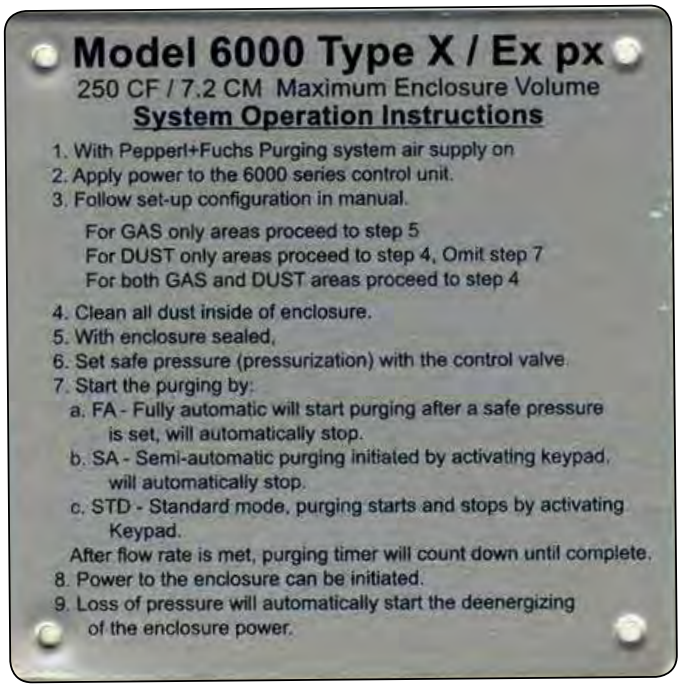
WARNING!
TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING

WARNING!
SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY

WARNING LABELS (CONT'D)

Labels for Purge System:



Nitrocellulose Warning Label

INFORMATION / TECHNICAL ASSISTANCE

ISTpure is a registered trademark of:

International Surface Technologies
istsurface.com

For more information, pricing or technical support, contact your local IST distributor or call / fax to our Consumer Information num-

TEL.: 1 877 629-8202 & 450 963-4400 FAX : 450 963-5122

Or visit us at:
www.istsurface.com

WARRANTY REGISTRATION

ISTpure would like to thank you for your recent purchase of our product line. Please complete the card below and either mail or fax it to our office so that we may start the warranty of your product and keep you up to date on the EPA regulations by fax. Again, thank you for your purchase and if you have any suggestions or comments, please feel free to contact our office.

COMPANY NAME : I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I

ADDRESS : I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I

CITY : I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I   STATE/PROV. : __I__I__I__I__I__I__I__I__I__I __I__I__I__I

COUNTRY : I__I__I__I__I__I__I__I__I__I__I__I__I__I   POSTAL/ZIP CODE : I__I__I__I   I__I__I__I

CONTACT : I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I

TEL. NUMBER: I__I__I__I   I__I__I__I – I__I__I__I__I   FAX NUMBER: I__I__I__I   I__I__I__I – I__I__I__I__I

PURCHASE FROM: I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I

DATE OF PURCHASE: I__I__I   I__I__I   I__I__I__I__I

Month   Day   Year

SERIAL NUMBER: I__I__I – I__I__I__I – I__I__I__I__I   MODEL NUMBER: I__I__I__I__I__I__I

TYPE OF SOLVENT USED: I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I__I

Which factors most influenced your decision to purchase this ISTpure unit?

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SUGGESTIONS ABOUT THE EQUIPMENT:

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IMPORTANT! Please complete and return within 30 days after purchase to activate the warranty.

PLEASE SEND THE COMPLETED FORM VIA EMAIL OR FAX TO :

INFO@ISTSURFACE.COM OR 450-963-5122

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