

Installation & Operation Instruction

Acpac Tecumseh Semi Hermetic VSD Packaged Condensing Units - EC Fans

Model - APS56ML2-1VSD with EC Condenser Fans

Index

1. Safety warnings for end users, installation, and maintenance personnel
2. End user information
3. Installation instructions
4. Maintenance and decommissioning guidelines
5. Equipment, Installer and Commissioning Details

This document should be kept with the installed Acpac unit.

1. SAFETY WARNINGS FOR END USERS, INSTALLATION AND MAINTENANCE PERSONNEL

DANGER - High Voltage - this condensing unit contains electrical parts, isolate the power supply before working on this unit. All field wiring must be carried out by a licensed electrical contractor and all wiring must be in accordance with the equipment specification, local and national codes.

DANGER - Moving Machinery – this condensing unit has moving parts which may start and stop without warning.

CAUTION - Auto Start – this unit and its moving parts can start automatically without warning.

CAUTION - High Pressure – this condensing unit contains high pressure refrigerant and oil.

CAUTION - High and Low Temperature Surfaces – during normal operation and during fault conditions some components will reach high and/or low temperatures.

CAUTION - Sharp Edges – this condensing unit contains parts with sharp edges, appropriate personal safety equipment must be worn.

Only fully qualified licensed personnel should install service or carry out maintenance to this condensing unit.



2. END USER INFORMATION

Design usage

This condensing unit is designed for commercial refrigeration duty within the limits of the published application data, ambient temperature range, refrigerant type or types and electrical specification. This unit is not intended for environments that are corrosive or flammable including marine environments. If subjected to corrosive environments this unit should receive additional protection/s.

Maintenance intervals

It is good practice to have regular preventative maintenance performed to ensure this condensing unit continues to perform efficiently.

Only fully qualified licensed personnel should carry out maintenance to this condensing unit.

3 to 6 monthly – dependent on location and duty

- Air cooled condenser check, clean as required
- Operational checks including but not limited to electrical connections, voltages, amperages, pressures, temperatures including compressor superheat, discharge temperature, unit sub-cooling, refrigerant leak check, moisture indicator check and compressor oil level.

Use of genuine spare parts from Actrol is recommended.

Decommissioning

This condensing unit contains refrigerant and oil that is harmful to the environment; these must be recovered and returned to an approved recycling or destruction facility.

Only fully qualified and licensed personnel should carry out decommissioning of this unit.

It is illegal to vent some types of refrigerant to the atmosphere.

3. INSTALLATION INSTRUCTIONS

Safety first

- All refrigeration and electrical work must be carried out by fully qualified and licensed personnel.
- Personal safety protection equipment must be worn when working with this condensing unit.
- Refer to the safety warnings in “Section 1” of this instruction.

Initial inspection and damage notification

This unit must be inspected for damage **‘before’** installation and any damage found reported to Actrol so appropriate action can be taken.

Lifting and handling of unit

Ensure this condensing unit is balanced when lifting as the weight is not centred.

Design conditions and refrigerant type

Confirm the application is to operate within the published design limits before installing this unit. Ensure the refrigerant type matches the published data, **‘flammable refrigerants or ammonia refrigerant must not be used’**.

Oil Type

POE (Polyol Ester) oil is used to lubricate this compressor. Only use POE oil of the correct viscosity as listed in the compressor data when adding or replacing oil.

Positioning and Mounting of Unit

Clearance dimensions

- Avoid short cycling the condenser air by ensuring no obstruction of the discharged air.
- A minimum of half one fan diameter clearance must be allowed between the condenser coil and a wall on the inlet air side/s for correct air flow.
- Safe access for service and maintenance must be provided including clear access to all serviceable components within the unit
- A minimum of 800mm clearance should be provided adjacent all removable panels.

Noise considerations

- Consideration should be given to ensure noise from this unit will not be of concern to surrounding sound sensitive environments. Information on noise control is available from Actrol.

Mounting and fixing

- This condensing unit must be installed level on the horizontal plane.
- The unit is to be fixed to a solid base using anti vibration mounts or rubber pads.

System pipe sizing and design

Pipe Sizing

Every installation is different, so the field pipe sizes may differ from the unit connection sizes. Please select appropriate pipe sizes using published pipe sizing information or contact Actrol for advice.

Holding pressure

This unit has a holding charge of nitrogen which must be released in a safe manner.

Maximum design and test pressure

This condensing unit is designed for a maximum design pressure (PS) of 31bar.
Test pressure of the suction side must not exceed 20.5bar as indicated on the compressor name plate.
If a pressure relief device is fitted it must be set no greater than 31bar (1 x PS) in accordance with ISO-5149.

Oil return

Pipe design must allow for adequate oil return to this condensing unit, the use of "P" traps and double risers may be required; all horizontal sections of the suction line must fall towards the condensing unit.

Soldering

Nitrogen must be used when soldering the field pipe work to stop the formation of copper oxides.

Pressure testing

The entire system must be pressure tested and any leaks repaired prior to charging with refrigerant.

Pipe insulation

The suction line must be adequately insulated to minimize heat absorption into the return vapour. The National Construction Code of Australia lists the minimum insulation R Values for refrigerant pipes.

Electrical connection

- A licensed electrical contractor must carry out all electrical work.
- All electrical work must meet local and national requirements.
- Care must be taken to ensure no damage is done to internal unit components when mounting the electrical isolator.
- An electrical diagram is attached to the inside of the service panel.
- The control safety circuit must not be bypassed.

Commissioning and start up

Visual pre-start checks

A visual check must be carried out to ensure the unit has been installed with the correct companion equipment and in the correct location.

All pipe work and electrical work must be complete and safe.

All electrical connections must be checked for tightness as connections can loosen during transport.

The yellow compressor anti vibration transport mounts must be removed before starting the compressor.

Crank case heater

The crankcase heater must have power applied for a minimum of 12 hours prior to starting the compressor.

Evacuation

A vacuum of less than 500 microns must be achieved and held before breaking the vacuum with liquid refrigerant into the liquid line.

Safety pressure switch settings

Use a temperature pressure chart to determine the pressures to set the high and low safety pressure switches on this condensing unit. The pressures must be set within the limits shown in the compressor application envelope.

The HP safety switch must set at less than 0.9 x PS (0.9 x 31 bar = 27.9 bar).

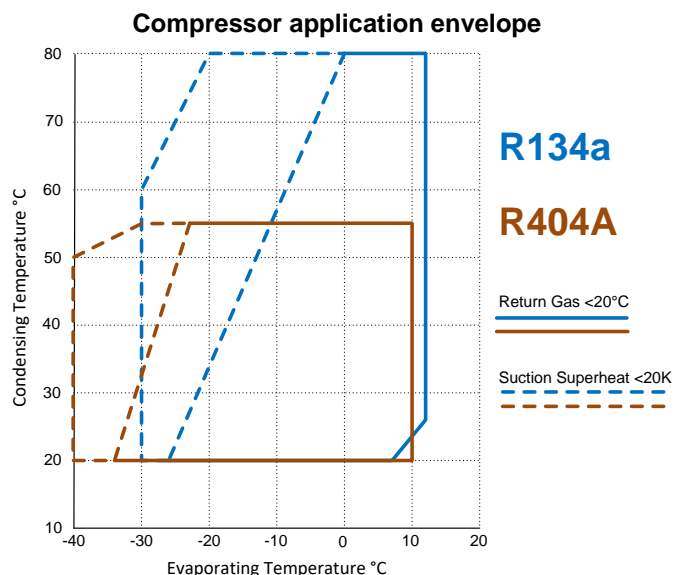
The compressor must never operate in a vacuum as internal parts will overheat and arcing between the electrical terminals will occur within the compressor.

System charging

The vacuum should be broken by charging liquid refrigerant into the liquid line.

Fine tuning the refrigerant charge can be achieved by adding small quantities of liquid into the suction service valve port while the compressor is running.

Under no circumstances should excessive liquid refrigerant enter the compressor.



Variable speed drive (VSD) overview

The variable speed drive (VSD) is located behind the protective panel at the rear of this unit.
The VSD will adjust the compressor speed to maintain the suction pressure at the target pressure.
The VSD has one low pressure and one high pressure probe.

The VSD has the following safety features,

High Limit Pressure Safety (HLPS)

- If the condensing pressure approaches the HLPS setpoint, the VSD will slow the compressor to keep it within the compressor operating envelope.

Current Protection

- The VSD will limit the compressor speed to within the compressor maximum operating current (MOC).

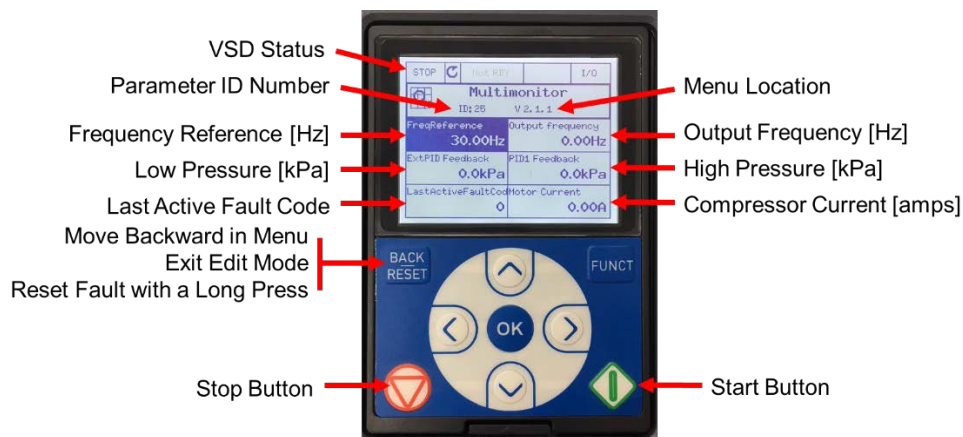
Start Up Current Protection

- The VSD will allow 200% over current for 5 seconds after starting the compressor from standstill.
- If the VSD senses a motor stall fault it will stop the compressor and a manual reset will be required. This will occur if the compressor speed is less than 20Hz and the MOC is reached for 5 seconds.

Speed Boost

- If the compressor operates below 31Hz for more than 30 minutes the speed boost function will speed the compressor to 45Hz for 90 seconds to return oil to the compressor.

When power is supplied to the VSD the Multimonitor screen will display after a 5 minute delay.



- VSD Status will show either Stop, Ready or Run.
- Parameter ID Number is the displayed parameter.
- Menu Location identifies the displayed menu index.
- Frequency Reference is the frequency the VSD is targeting.
- Output Frequency is the actual frequency output of the VSD.
- Low Pressure is the suction pressure as read by the LP transducer.
- High Pressure is the condensing pressure as read by the HP transducer.
- Last Active Fault Code is the most recent fault.
 - Refer to the Fault Codes and Descriptions in the Vacon Application manual.
- Compressor Current is the actual compressor amperage draw.

Variable speed drive (VSD) set up

In most applications the VSD requires only three parameters to be adjusted,

1. Suction pressure setpoint which is Keypad setpoint 1 relating to suction pressure.
2. High pressure limit setpoint which is Keypad setpoint 1 relating to condensing pressure.
3. Condenser EC fan speed control which is Min and Max Frequency Reference.

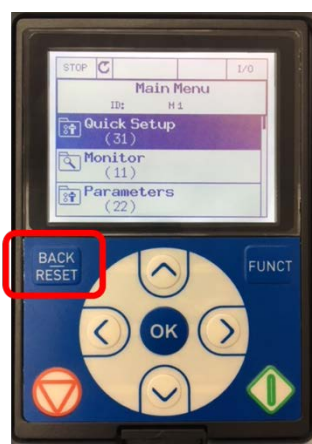
1. Suction pressure setpoint

The target saturated suction pressure must be set to suit the application.

The default set point is 400kPa which is -6 SST with R404A.

The following table shows pressures of R134a and R404A at various saturated suction temperatures.

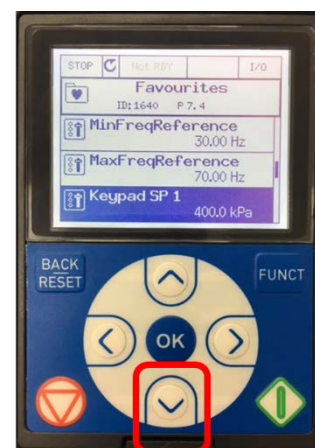
	Pressure Settings [kPa]									
Target SST	-35	-30	-25	-20	-15	-10	-5	0	5	10
R404A	67	106	152	205	266	337	417	508	611	
R134a					63	99	142	191	248	313



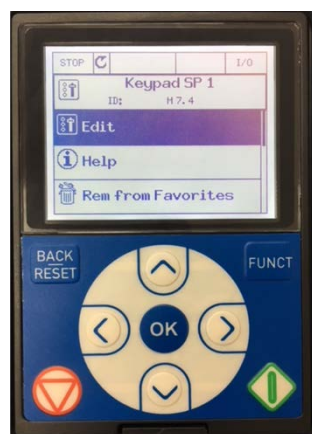
Press BACK RESET button multiple times to get to main menu



Press down button multiple times to get to favourites menu press OK



Press down button multiple times to get to Keypad SP 1 parameter relating to suction pressure and press OK



Press OK button to enable the Edit menu



Press arrow buttons to set target pressure and OK button to confirm selection

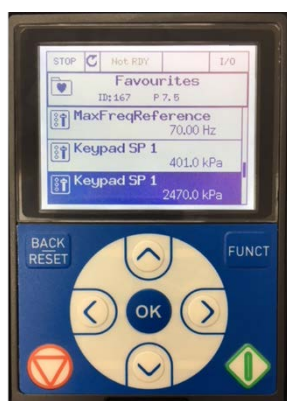
Variable speed drive (VSD) set up - continued

2. High pressure limit setpoint

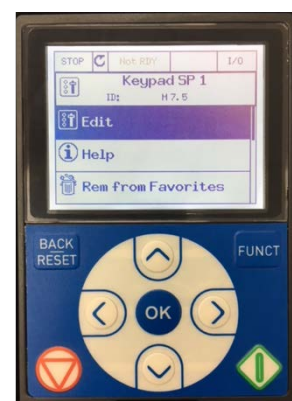
The high-pressure limit setpoint must be set to suit the refrigerant.
The default set point is 2470 kPa which is 55°C SCT with R404A.
The R134a suggested set point is 1772 kPa which is 65°C SCT.



Press BACK RESET button to return to Favourites menu



Press down arrow button to highlight Keypad SP 1 relating to condensing pressure



Press OK buttons to enable the Edit menu



Press arrow buttons to set target pressure and OK button to confirm selection



After 5 minutes the Multimonitor screen will be displayed

Variable speed drive (VSD) set up - continued

3. Min and Max Frequency Reference

The VSD supplies a 0-10 Volt output to the EC condenser fans to control the fan speed to maintain the condensing pressure within the minimum and maximum set points.

The MinScale and MaxScale reference is a percentage of the pressure probe span.

The pressure probe span is 0 to 30bar so is 30.

The following table shows the percentage set points for common saturated condensing temperatures (SCT's).

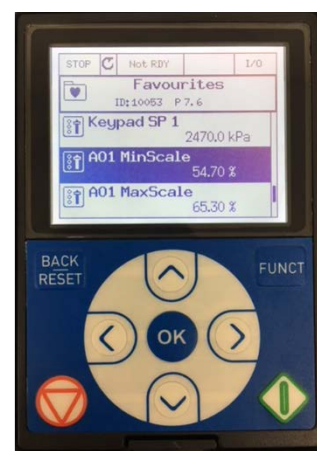
VSD Percentages for Condenser Fan Speed Control											
Target SCT [°C]	30	32	34	36	38	40	42	44	46	48	50
R404A [%]	43.8	46.3	48.9	51.5	54.3	57.1	60.1	63.1	66.3	69.5	72.9
R134a [%]	22.3	23.8	25.4	27	28.7	30.5	32.3	34.2	36.2	38.3	40.4



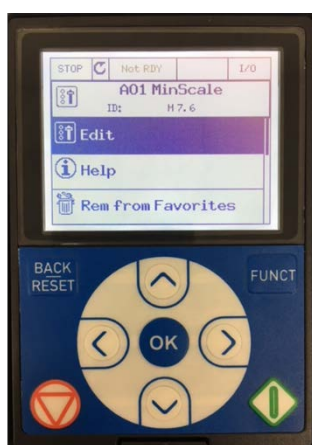
Press BACK RESET button multiple times to get to main menu



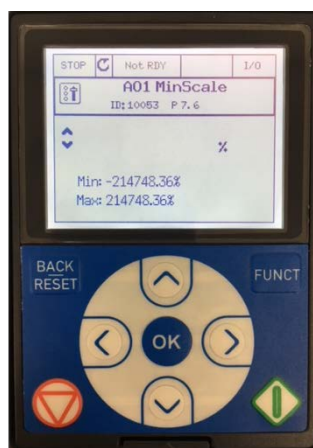
Press down button multiple times to get to favourites menu press OK



A01 MinScale



Press OK to enable the Edit menu



Press arrow buttons to set target percentage and OK button to confirm selection

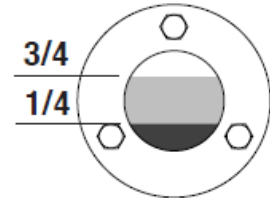
Repeat this procedure for the A01 MaxScale.

After five minutes the Multimonitor display will be displayed.

Operational checks

Operation checks include but are not limited to the following,

- Voltages of all phases
- Amperages of compressor and fans
- Suction and discharge pressures
- Compressor suction superheat *
- Evaporator suction superheat *
- Liquid sub-cooling
- Liquid line moisture indicator colour and sight glass clearness
- Compressor discharge temperature
- Compressor oil sight glass level
- Confirm oil is returning to compressor
- Refrigerant charge
- Vibration and noise
- Observe on/off cycle after reaching design temperature and ensure;
 - No liquid slugging at start up
 - Pump down pressure is within published operating envelope (if pump down is used)
 - Cycle times (no more than 8 compressor starts per hour)



Correct compressor oil level

* When refrigerated space is at or near design temperature

Oil level regulator

An INT280B oil level regulator is fitted to monitor and control the oil level in the compressor. When the optical monitoring unit detects the oil level is low the integrated oil supply solenoid valve is activated. Oil is cyclically injected into the compressor crankcase. The INT280B generates an alarm signal and activates the relay output if the oil is still too low after a defined period. During the alarm period the INT280B operates the solenoid to inject oil into the compressor. The alarm status is automatically reset if the oil level is at half the height of the sight glass.

LED Status

- | | |
|---------------------|-------------------|
| • Level OK | Green illuminates |
| • Filling | Green flashes |
| • Oil level too low | Red illuminates |
| • Internal error | Red flashes |

Handover to end user

When the commissioning is complete the contractor should provide a full explanation of system usage to the end user.

Section 5 of this instruction should be completed, and this instruction left with the end user to keep on site so, the unit base data is known.

4. MAINTENANCE AND DECOMMISSIONING GUIDELINES

Maintenance guidelines

It is good practice to have regular preventative maintenance performed to ensure this condensing unit continues to perform efficiently.

- 3 to 6 monthly – Air cooled condenser check, clean as required
- 3 to 6 monthly – Operational check including but not limited to electrical connections, voltages, amperages, pressures, temperatures including compressor superheat, unit sub-cooling and discharge temperature, refrigerant leak check, moisture indicator check and correct compressor oil level.

Use of genuine spare parts from Actrol is recommended.

De-commissioning guidelines

- This condensing unit contains refrigerant and oil that is harmful to the environment; these must be recovered and returned to an approved recycling or destruction facility.
- Only fully qualified licensed personnel should carry out decommissioning of this unit.
- It is illegal to vent some types of refrigerant to the atmosphere.
- Disconnection of electricity supply wiring must be carried out by fully qualified and licensed personnel.
- This unit should be disposed of in a responsible manner.

CAUTION - This unit contains high pressure refrigerant and oil.

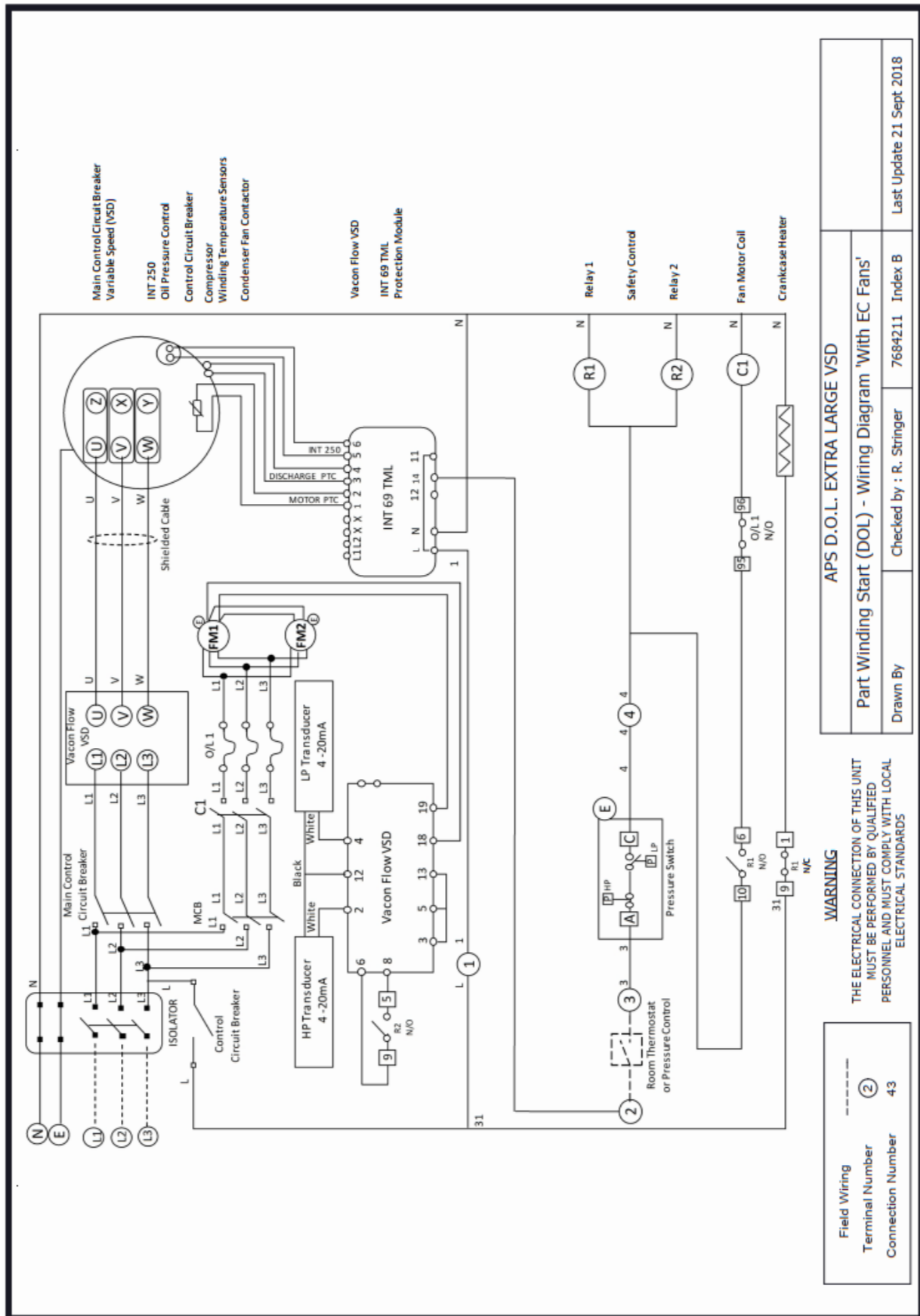
Glossary of terms

- Condensing unit - unit comprising compressor, condenser and associated components to recirculate refrigerant via external components and back through the condensing unit.
- HFC refrigerant – hydro-fluoro-carbon fluid circulated around a refrigeration system used to transfer heat energy by changing phase from vapour to liquid and back to vapour.
- Ambient temperature – the air temperature surrounding the equipment.
- VSD – Variable speed drive adjusts the compressor speed

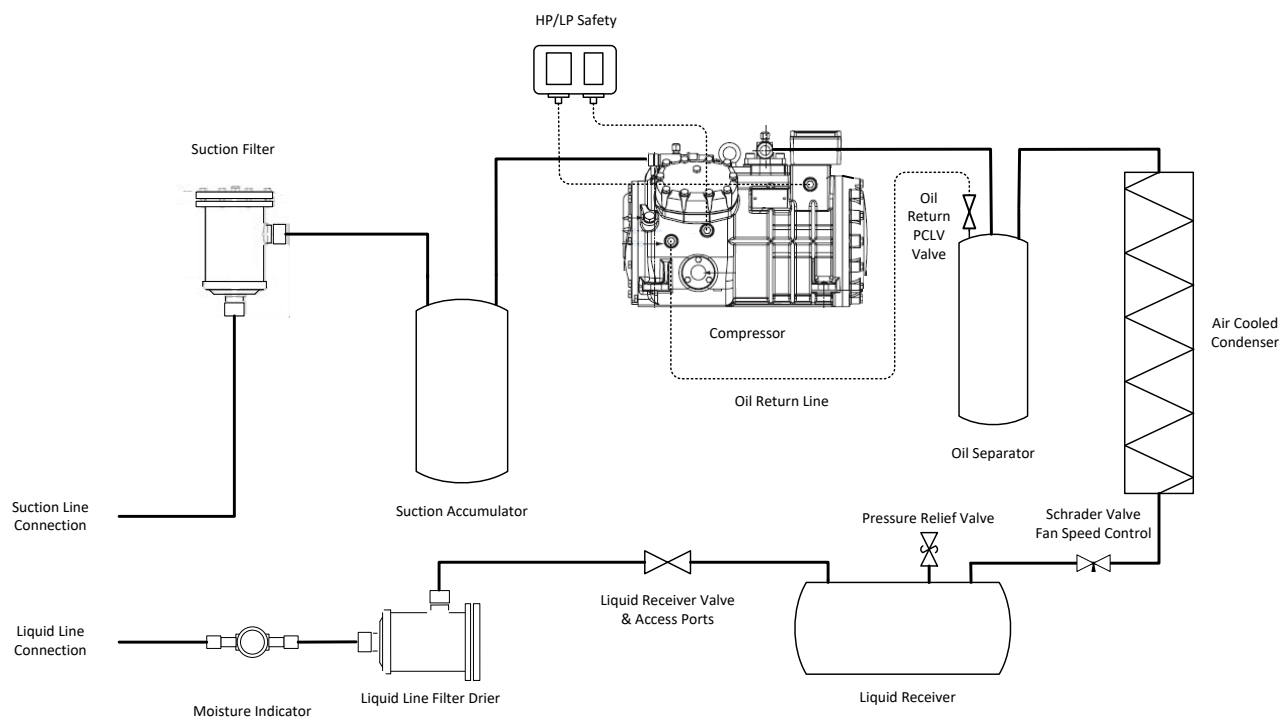
Ongoing product improvement

Due to ongoing product improvement Actrol reserves the right to change equipment specification without notice.

Wiring diagram for model APS56.4ML2-1VSD



Unit piping schematic diagram



Models with demountable liquid line drier

5. EQUIPMENT, INSTALLER AND COMMISSIONING DETAILS

Model Number			
Serial Number			
Date of Purchase			
Date of Installation			
Installer Information			
Installer Phone No's			
Address of Installation			
Application Description			
Application Design Temperature		Refrigerant Type	
Ambient Temperature at Commissioning			
Refrigerated Space Temperature at Commissioning			
Suction and Discharge Pressures			
Operating Amps	Compressor		
	Condenser Fan/s		
Operating Voltage	Phases 1 / 2 / 3		
High Pressure Safety Switch Setting			
Low Pressure Safety / Pump-down Setting			
Compressor Suction Superheat			
Liquid Sub-Cooling			
Refrigerant Charge [kg]			
Compressor Oil Level			
Name and Signature of Technician			
Date of Commissioning			