Operation and Maintenance Manual

for the

Habitat Conditioning Unit - External Regeneration (HCU-ER) Single Scrubber Pot, 350 MSW

(HCU100BA Series)

A part of

James Fisher and Sons plc

Marine Services Worldwide

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Approval Sheet

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Original Document By:	Mark Summers- Senior Package Engineer				
Checked By:	Vladimir Garzon- Mechanical Engineer				
Approved By:	Alastair Naylor- Senior Mechanical Engineer				

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List of Abbreviations

Abbreviation	Definition
HCU-ER	Habitat Conditioning Unit – External Regeneration
MSW	Meters Sea Water
HMI	Human Machine Interface
SCADA	Supervisory Control And Data Acquisition
PLC	Programmable Logic Controller
RH	Relative Humidity
RPM	Revolutions Per Minute
LP	Low Pressure
LPM/ lpm	Litres Per Minute
He	Helium
O2	Oxygen
HeO_2	Helium/Oxygen Gas Mix (Heliox)
CO_2	Carbon Dioxide
SP	Set Point
PV	Pressure Vessel
SV	Soleniod Valve
Nm	Newton Metres

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Table of Contents

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Chapter 1 - Introduction

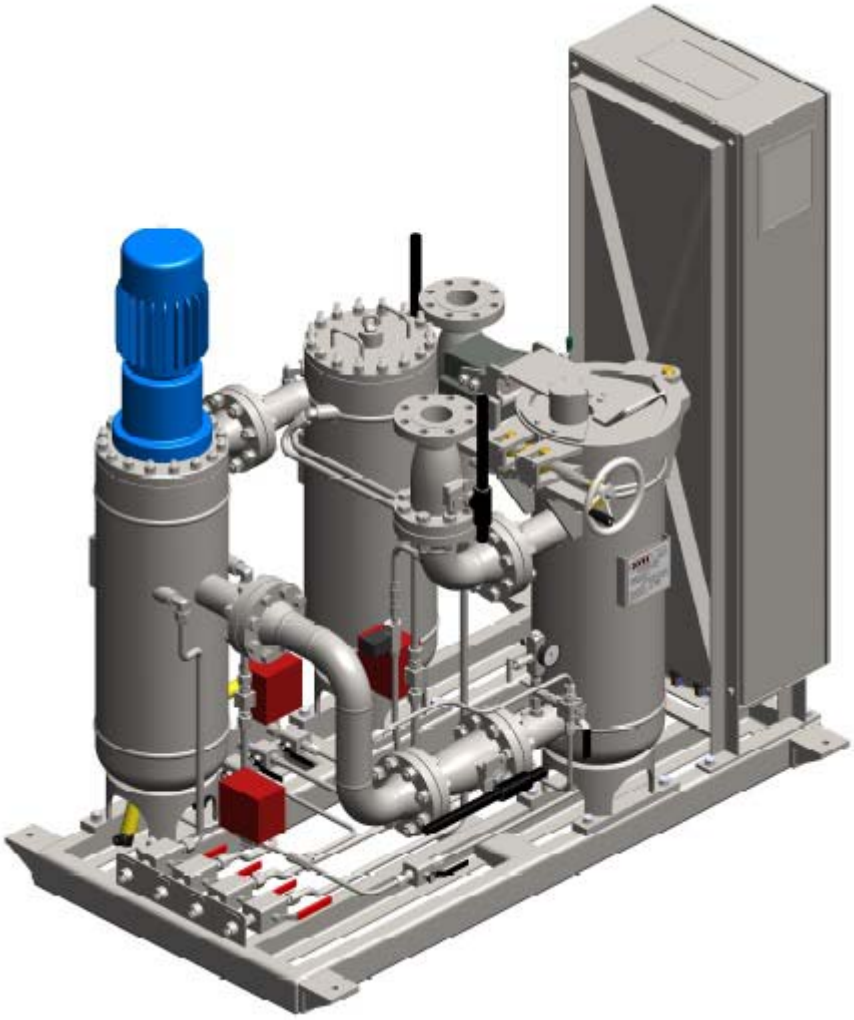

Fig 1.1 Single Scrubber, Isometric View

- Interlocked Scrubber
- Local and remote control compatibility
- 3 Stage variable speed blower

The HCU100BA type HCU-ER is suitable for habitat conditioning of Saturation Diving System chambers/living compartments to a maximum working depth of 350 MSW and supports single or multiple chambers with a maximum total of 6 occupants per HCU-ER.

The external regeneration configuration of the HCU-ER series habitat conditioning units provide increased comfort to the chamber/living compartment occupants by reducing internal noise levels and increased internal living space whilst enhancing online serviceability and radically reduces service lock operations to exchange sodalime for internal scrubbers.

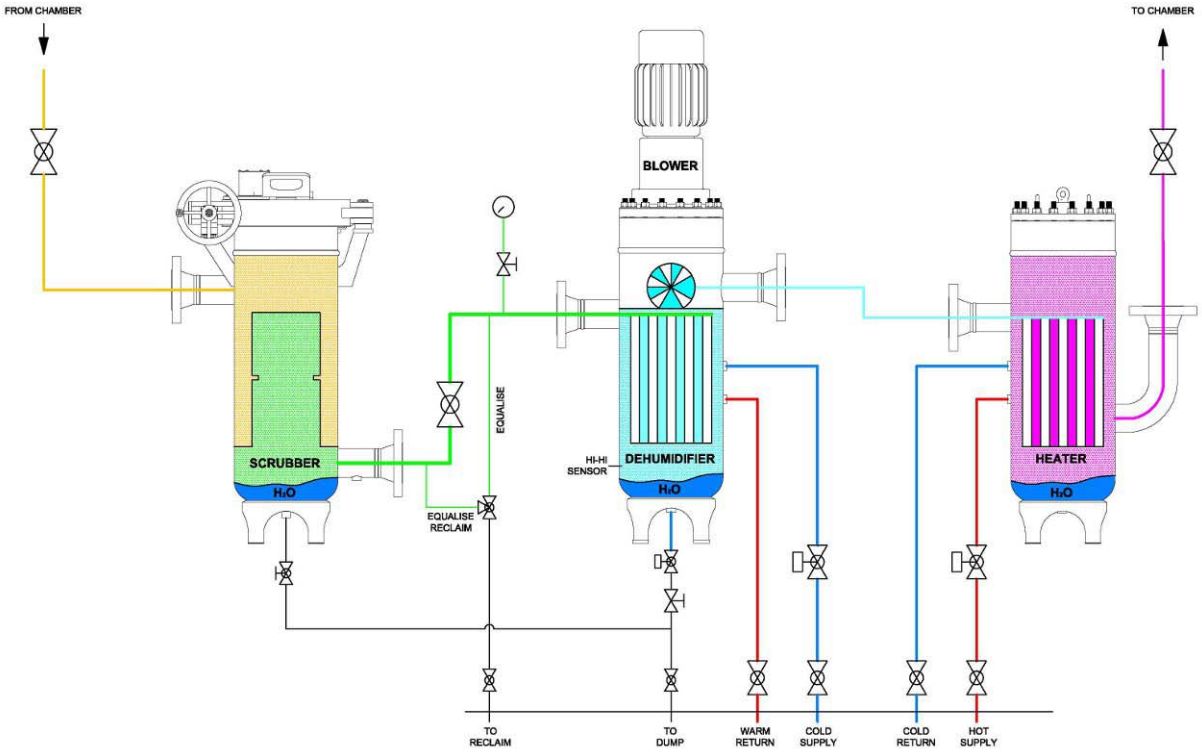

Fig 1.2 Single Scrubber, flow process

Chapter 2 - System Description

Contents

Habitat environmental conditioning is achieved through the closed loop re-circulation of the chamber/living compartment atmosphere via a large bore external circuit, through the HCU-ER, and returned re-conditioned to the chamber/living compartment.

The HCU-ER processes the gas in three independent sequential stages;

- Scrubber stage – removes carbon dioxide,
- Dehumidifier stage – removes moisture form gas,
- Heater stage – reheats gas before returning to chamber/living compartment

See detail description of each stage below.

Each HCU-ER unit is equipped with a dedicated touch screen Human Machine Interface (HMI) providing local control capability, with the capability to transfer control to a remote control device/system, e.g. remote HMI, SCADA etc.

2.1 Scrubber Stage

The scrubber pot utilises two, stacked scrubber baskets filled with sodalime, each with a sodalime capacity of 8.8 kg, for a total sodalime capacity of 17.6 kg providing approximately 8 hours of habitat conditioning for up to 6 occupants during normal operation.
The scrubber access hatch is equipped with a pressure actuated safety interlock to prevent opening whilst the scrubber is pressurised.
In addition the scrubber is equipped with a manual drain valve which is piped to the HCU-ER skid interface panel for connection to the diving system drain circuit.

Fig 2.1 Scrubber Stage

2.2 Dehumidifier Stage

Equipped with a high efficiency heat exchanger rated to 10kW chilling capacity, supplied with cold water from a refrigeration plant, the heat exchanger lowers the gas temperature flowing over the heat exchanger to below the gas dew point, resulting in condensate formation drawing moisture out of the gas stream which accumulates in the sump of the dehumidifier pot.

Water is drained automatically by means of an actuated valve. If excessive water accumulates in the dehumidifier sump and reaches the vibration type level sensor an alarm is triggered on the HMI alerting the operator to manually drain the dehumidifier pot.

If the pot is not drained within a preset time, adjustable on the HMI, the active alarm will trigger a shutdown of the blower to prevent potential damage.

The alarm remains active until the sump is drained.

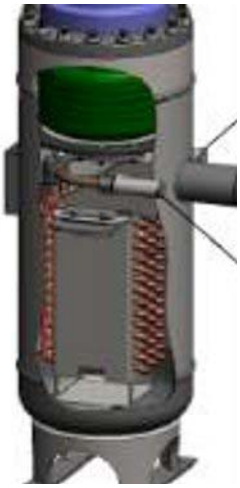

Fig 2.2 Dehumidifier

2.2.1 Blower

A variable speed, dynamically balanced 3-stage centrifugal blower is fitted to the dehumidifier stage to circulate gas from the chamber/living compartment, through the HCU-ER, and return the reconditioned gas to the chamber/living compartment.

The blower speed is controlled from the HMI with an adjustable speed range from 0 to 6,000 rpm.

The electric motor is magnetically coupled to the blower impeller with no pressure boundary seal, ensuring a gas tight interface.

Fig 2.3 Blower

2.3 Heater Stage

Equipped with a high efficiency heat exchanger rated to 10kW heating capacity, supplied with hot water from the heating plant, the heat input from the exchanger re-heats the gas to a preset temperature, adjustable on the HMI, to ensure a comfortable chamber/living compartment environment.

Fig 2.4 Heater

2.4 Controls

The HCU-ER is equipped with direct and indirect controls as well as operational monitoring and display of pressure, temperature, humidity, and blower speed.

Direct controls are valves etc fitted to the HCU-ER whereas indirect control is provided via the HMI (Human Machine Interface) control panel. The HMI (Local) allows the operator to oversee automated functions with the ability to override to manual mode for redundancy. When control is delegated to a remote control point (e.g. remote HMI, SCADA), some functions are unavailable at the local HMI although monitored information is still displayed locally.

Chapter 3 - Technical Specification

Pressure Vessels		Services
PV Design Code	PD5500:2012	
Construction	Stainless Steel	
Max Occupants	6 Compressed Divers	
Operating Depth Range	0 to 350 MSW	
Working Pressure	35 Bar	
Test Pressure	46 Bar	
Design Temperature	-20 to +80°C	

Gas Regeneration Circuit		Services
Gas Inlet	3” ANSI B16.5 Class 300 RF Flange	
Gas Outlet	3” ANSI B16.5 Class 300 RF Flange	
Gas Return to Reclaim	1/2” NPT(FEM)	◄

Scrubber Stage		Services
Capacity, Total	17.6 kg	
Number of baskets	Two	
Capacity per basket	8.8 kg	

Blower		Services
Speed Range	0 to 6,000 RPM	
Number of Stages	3	
Gas Flow Rate	2.96 m^3/min [2,960 LPM] @ STP(20°C, 1.013 Bara)	

Dehumidifier Stage		Services
Cooling Capacity	10 kW Max	
Water Removal	780 ml/hr at 50% RH	
Cold Water Inlet	3/4” NPT(FEM)	◄
Cold Water Outlet	3/4” NPT(FEM)	◄
Cold Water Flow	20 LPM Min.	◄
Cold Water Temperature	+1 to +3°C	◄
Cold Water Pressure	4 to 5 Bar [4.078 to 5.099 kg/cm^2]	◄

Heater Stage		Services
Heating Capacity	10 kW Max	
Hot Water Inlet	3/4” NPT(FEM)	◄
Hot Water Outlet	3/4” NPT(FEM)	◄
Hot Water Flow	20 LPM Min.	◄
Hot Water Temperature	+60 to +70°C	◄
Hot Water Pressure	4 to 5 Bar [4.078 to 5.099 kg/cm^2]	◄

Controls		Services
Temperature Control	+22 to +32^oC [±1^oC](±0.5o tgt max var)	
Humidity Control	40 to 65% RH [±5%]	

Power		Services
Power Requirement	440 VAC, 3 PH, 60 Hz	◄

Other		Services
Water Injection	1/2” NPT(FEM)(5 ltr/min potable water)	◄
Drain	1/2” NPT(FEM)	◄

Chapter 4 - General Arrangements

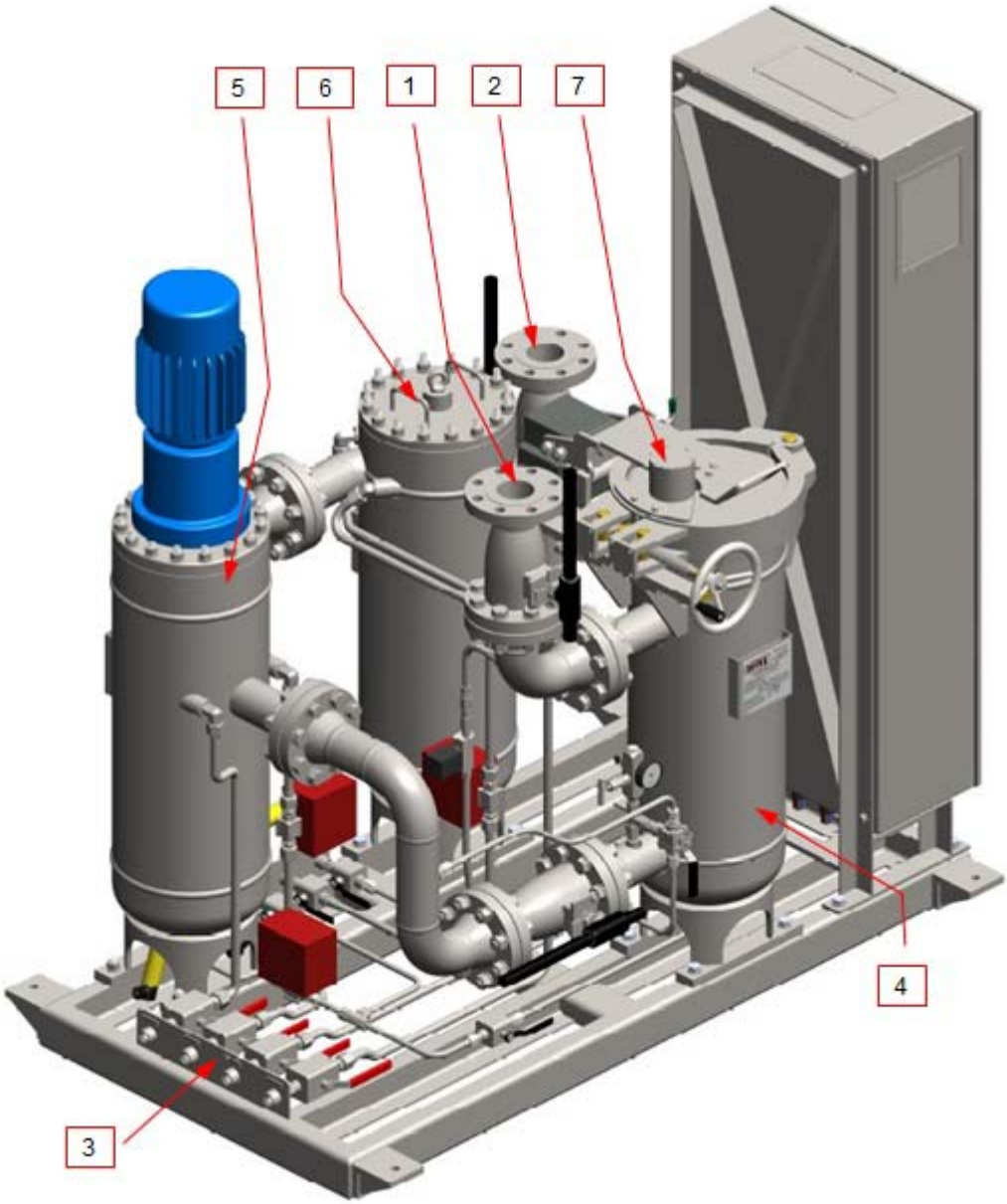

Fig 4.1 Single Scrubber, Isometric View

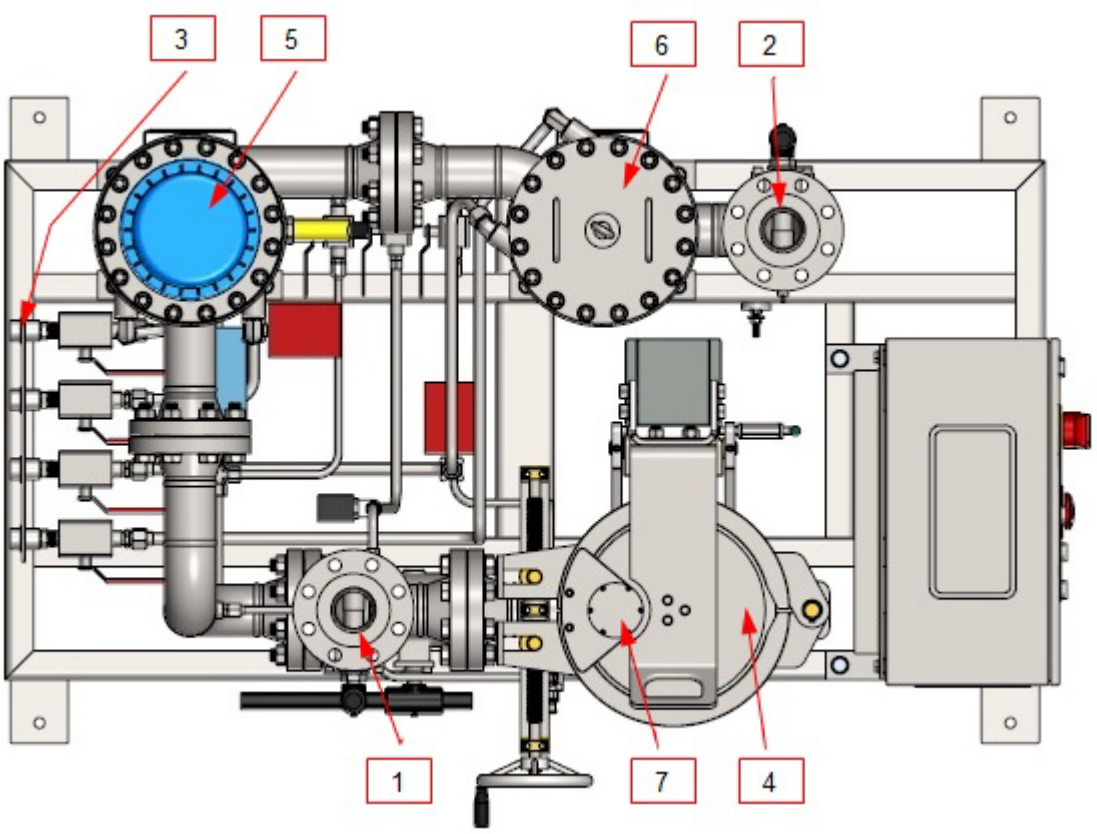

Fig 4.2 Single Scrubber, Plan view

Balloon	Description
1	Flange connection, from Chamber to HCU-ER
2	Flange connection, from HCU-ER to Chamber
3	Services Connection Panel
4	Scrubber Pot
5	Dehumidifier Pot with Blower
6	Heater Pot
7	Interlock, Pressure Actuated

Chapter 5 - Local HMI Interface & Controls

Contents

The touch screen interface comprises the following screens & menus:

5.1 Standard Navigation Bar

The Standard Navigation Bar appears on every HMI screen and provide shortcuts to system screens. The Setup menu is password protected.

Fig 5.1 Standard Navigation Bar

5.2 Home Screen

The Home Screen presents and overall flow diagram with monitored parameters and system status at a glance.

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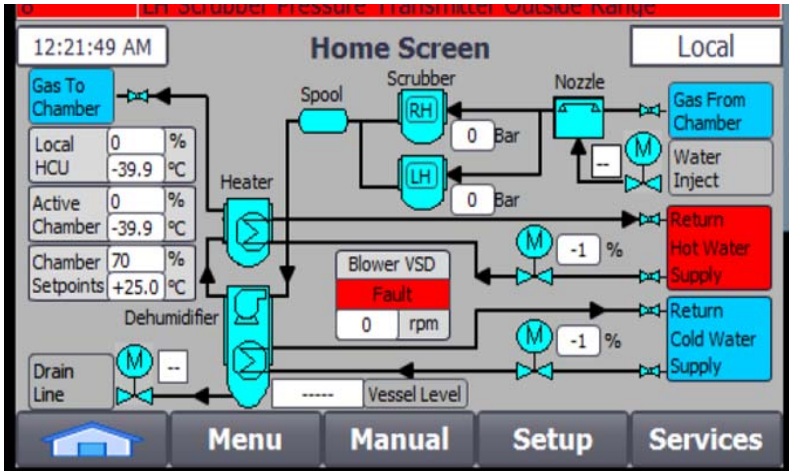

Fig 5.2 Home Screen

5.3 Main Menu Screen

The Main Menu Screen provides shortcuts to essential system control functions.

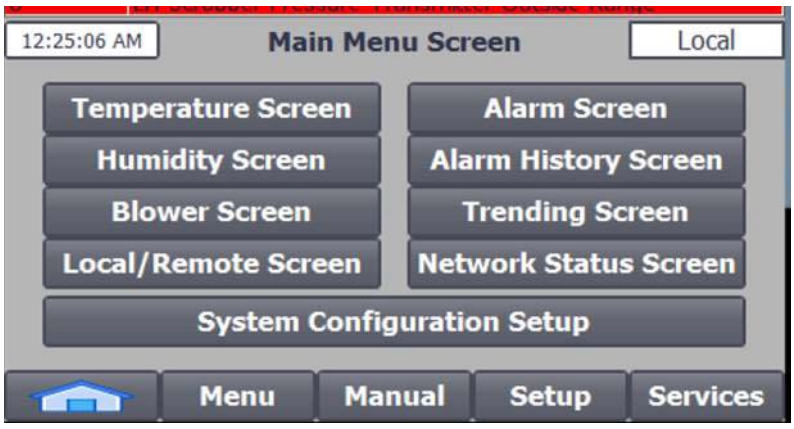

Fig 5.3 Main Menu Screen

5.4 Manual Menu Screen

The Manual Menu Screen allows the operator to override automated system functions.

Fig 5.4 Manual Menu Screen

5.5 Services Screen

The Services Screen provides shortcuts to local functions and controls. It is also the only menu through which the System Setup menu can be accessed.

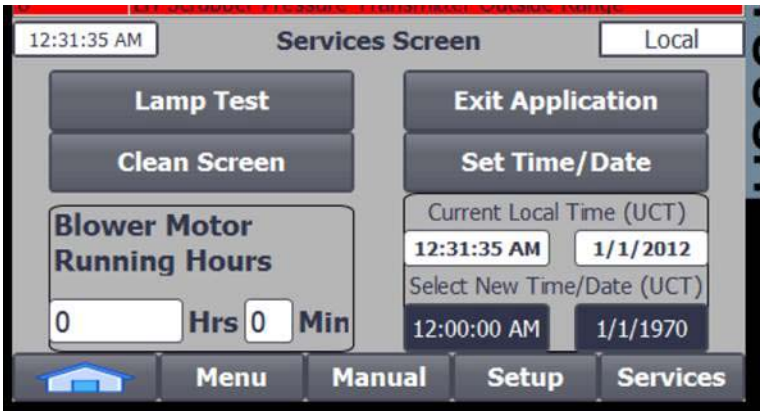

Fig 5.5 Services Screen

5.6 System Settings Screen

The System Settings Screen requires operator login and enables the operator to define the parameters of automated processes.
When the System Setup Menu is idle for more than 5 minutes the operator will be required to login again.

	WARNING
	Adjustment of automated processes will alter system behaviour. Always check and confirm system functions as intended.

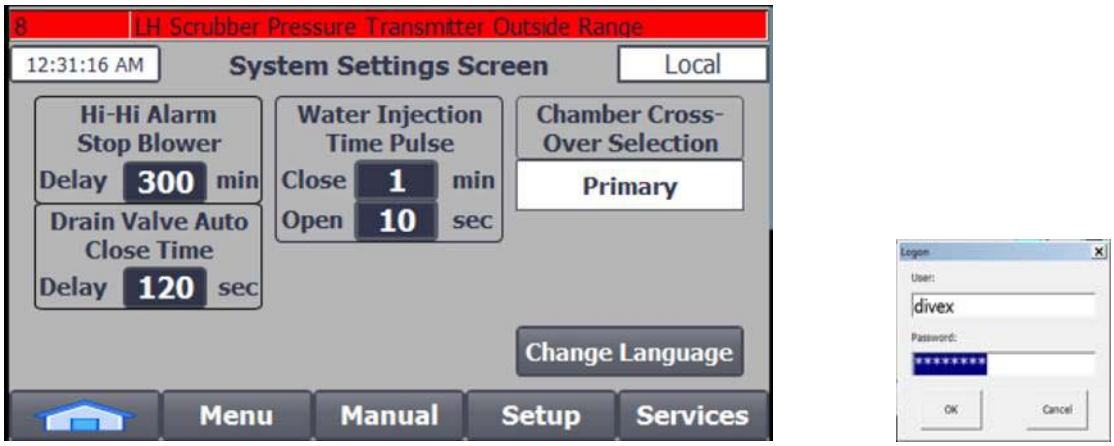

Fig 5.6 System Settings Screen

IMPORTANT
Default Login Details: User name: divex Password: divex

5.7 Local/ Remote Screen

The Local/Remote Screen enables selection of Local or remote control authority, which is indicated at the upper right of all control screens.

Control authority may be changed at any time during operation. Remote control can only be activated from the Local HMI control Screen.

Fig 5.7 Local/Remote Screen

5.8 Network Status Screen

The Network Status Screen provides an overview of connectivity between local, intermediate, and remote stations. Red lines indicates failure in communication whereas green lines indicates communication is taking place between devices.

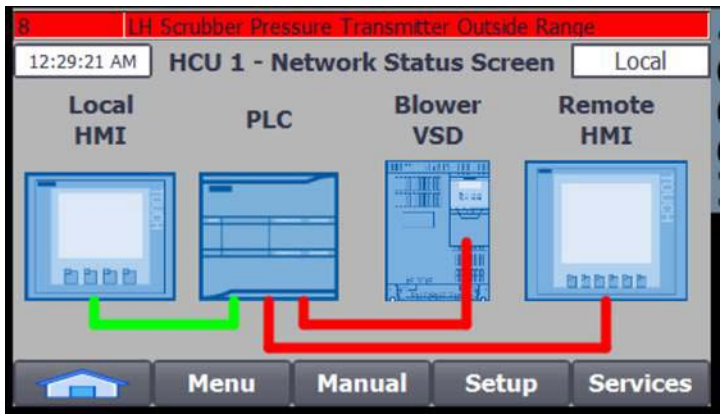

Fig 5.8 Network Status Screen

5.9 Blower Screen

The Blower Screen enables adjustment of the blower speed. The adjustment range is between 0 and 6,000 rpm with the recommended normal blower speed 3,000 rpm.

Prolonged operation of blower at speeds exceeding 3,000 rpm reduces bearing life, increases noise levels and may reduce dehumidification efficiency.

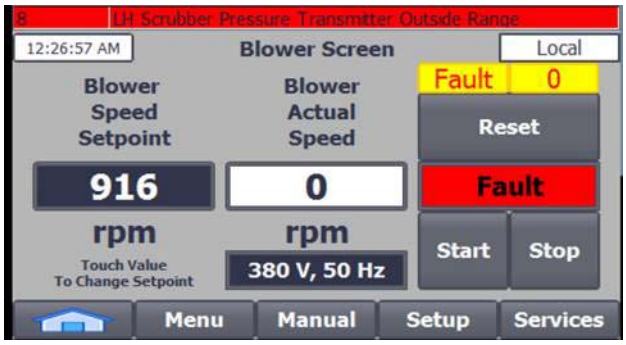

Fig 5.9 Blower Screen

5.10 Temperature Screen & Humidity Screen

The Temperature and Humidity Screens enable adjustment of the temperature and humidity set points and monitors Chamber Actual Temperature as well as HCU Local Actual Temperature.

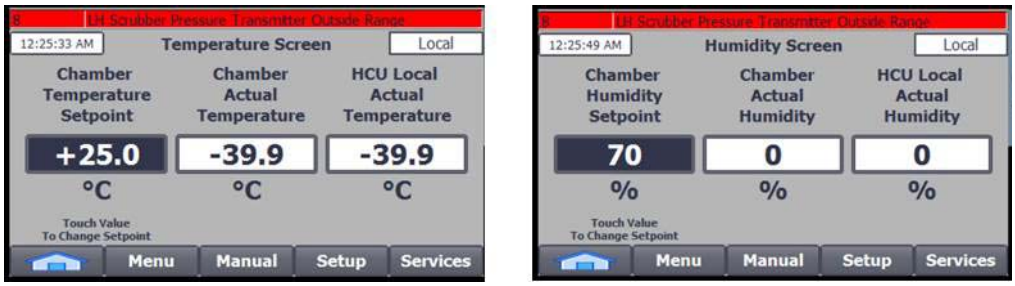

Fig 5.10 Temperature & Humidity Screens

5.11 Temperature Trend & Humidity Trend Screens

Temperature and Humidity trends over a specified time range is displayed in graph format in the Trend Local Temp/Humidity Screen and Trend Chamber Temp/Humidity Screen.

Fig 5.11 Temperature & Humidity Trend Screens

5.12 Trend Select Screen

The Trend Local HCU Temperature and Humidity Trend, and Chamber Temperature and Humidity Trend Screens are accessible from the Trend Select Screen.

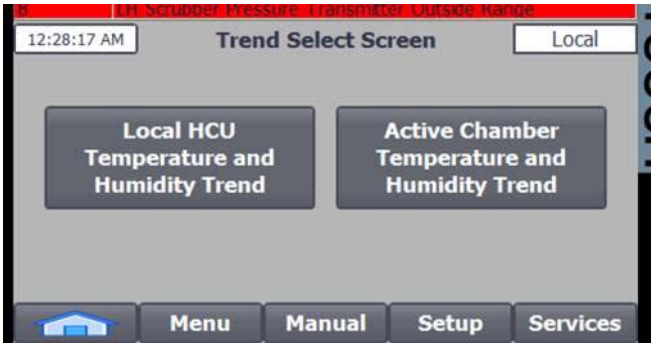

Fig 5.12 Trend Select Screen

5.13 Drain Valve Control

The Drain Valve Control screen allows adjustment of the drain valve timer settings and manual Open & Close buttons. The Drain Valve only works in manual mode and while pressing the open button.

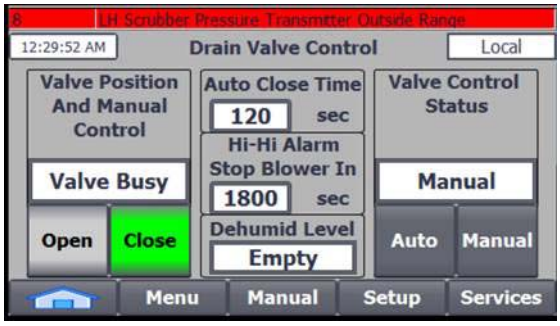

Fig 5.13 Drain Valve Control

	CAUTION
⚠	DRAIN LINE GAS VENTING To minimise gas loss, adjust drain valve open time interval to minimum.

	CAUTION
⚠	SYSTEM BACK PRESSURE The drain circuit is at atmospheric pressure and may be common to other drain systems.To prevent back pressure drain only one system at a time

5.14 Water Injection Control (optional)

When water injection is fitted, the Water Injection SV Control Screen allows adjustment of the injection solenoid valve opening and closing interval, as well as selecting between manual and automatic operation.

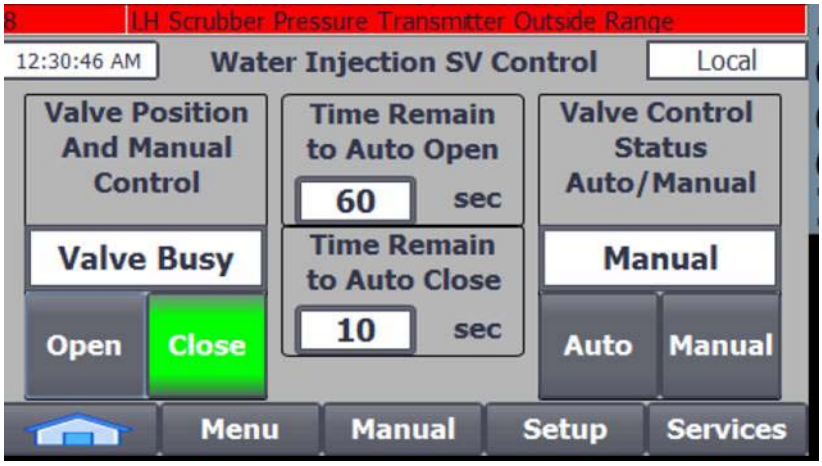

Fig 5.14 Water Injection Control

5.15 Alarm & Alarm History Screens

The Alarm Screen displays the current alarms/faults, and the Alarm History Screen displays the alarm/fault log since the alarm log was last cleared.

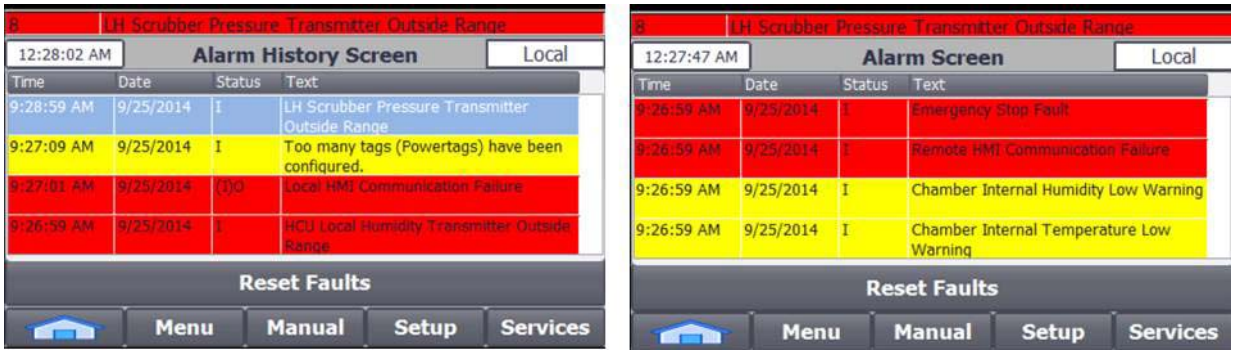

Fig 5.15 Alarm & Alarm History Screens

5.16 Emergency Stop

The ‘Emergency Stop’ (press and release) only stops the blower, it does not deactivate PLC’s, and does not isolate or depressurise the system. Press ’Reset’ to recover to normal operation.

Chapter 6 - Installation

HCU-ER units must be installed adjacent to, or as close as is possible to, the related chambers/locks to minimise pressure losses in the regen circuit.

Where system configuration does not allow installation of the HCU-ER's adjacent to the chamber, installation on the adjoining deck is acceptable. Line restrictions, bends, valves, change in pipe bores etc, should be kept to a minimum.

The recommended minimum regen circuit pipe size is 3" NB with all joints butt-weld type, and with 3" full bore ball valves and flanged connections.

6.1 System Cleanliness

Ensure the internals of the entire regeneration loop is flushed and cleaned for breathing gas service to a recognised standard, or as dictated by the certification authority prior to connecting the HCU-ER.

HCU-ER's are shipped cleaned and sealed ready for service. If the ports/internals of the unit may have been exposed to contaminants the HCU-ER must be cleaned as stated above. Please consult Divex for advice if necessary.

6.2 Services

Connect services flagged with ◄ (small black triangle) under Chapter 3 Technical Specification ensuring it meets or exceeds the specified criteria.

The heating, cooling, and gas regen circuit to/from the HCU-ER must be insulated with a minimum of 25mm Armaflex or equivalent.

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Chapter 7 - System Start - Up

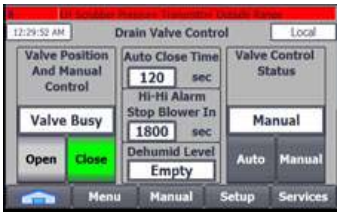
IMPORTANT
System settings must be updated after every software update.

1. Move the HCU-ER Power Selector to the ‘On’ position.
2. Navigate to the Local/Remote Control screen and select Local or Remote to set control authority.
3. Navigate to the System Setup Menu via the Menu and Log on using the default user name & password (as below) or user defined account details.

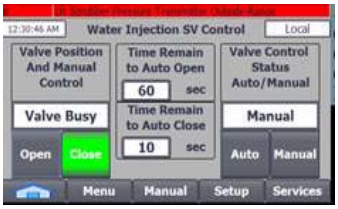
IMPORTANT
Default Login Details: User name: divex Password: divex

4. Navigate to the System Configuration Screen Menu, select Single/Dual Pot operation, Drain Solenoid valve manual/automatic. Note. This menu only appear at the very first start for initial configuration.

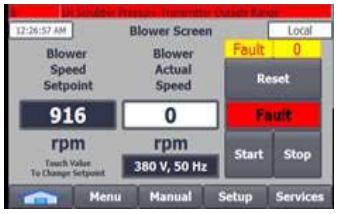
5. Navigate to Drain Valve Control. For HCU-ER’s fitted with two or more water level sensors, adjust the set point for the Drain Valve Open Timer screen as desired
6. If only one level sensor is fitted this functionality is not active. Water must be drained manually.



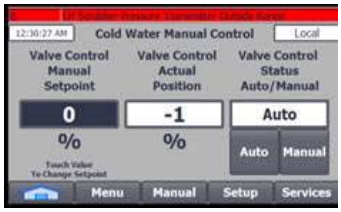
7. If HCU-ER is equipped with water injection (optional), navigate to Water Injection Control Screen. Change control to Auto Mode and adjust Auto Close Time and Auto Open Time Set Points as desired



8. Confirm Blower direction is set as required (typically FORWARD), change if required. Navigate to the Blower Screen and adjust the set point for the blower speed.



9. Navigate to the Hot and Cold Water Control Screens, set control to Auto Mode.



10. Select Home button to return to the Home screen.

Chapter 8 - Commissioning

Ensure installation is complete, sub-systems are functional, scrubber baskets filled with new sodalime, and all personnel in and near equipment/system is aware and familiar with planned activities prior to commencing commissioning activities.

No.	Activity	Confirm/Record	
1.	On the HMI navigate to the Network screen via the Services menu and confirm all key components are highlighted with green		
2.	Ensure chamber/living compartment/system is at atmospheric pressure		
3.	Confirm water injection operation		
4.	Pressurise compartment/system to 10 barg (10 MSW)		
5.	Confirm interlock actuated and engaged		
6.	Test blower speed range from 0 to 6,000 rpm		
7.	Function test Temperature Control System		
7.1	Record current temperature		
7.2	Temperature Change (blower speed @ 3,000 rpm)	Time	Temp.
7.2.1	Adjust temperature set point to _____°C, record settling time and final temperature	h m	°C
7.2.2	Adjust temperature set point to _____°C, record settling time and final temperature	h m	°C
7.2.3	Adjust temperature set point to _____°C, record settling time and final temperature	h m	°C
8.	Function test Humidity Control System		
8.1	Record current percentage humidity		
8.2	Humidity Change (blower speed @ 3,000 rpm)	Time	Humidity
8.2.1	Adjust humidity set point to _____%RH, record settling time and final humidity	h m	%RH
8.2.2	Adjust humidity set point to _____%RH, record settling time and final humidity	h m	%RH
8.2.3	Adjust humidity set point to _____%RH, record settling time and final humidity	h m	%RH

No.	Activity	Confirm/Record	
9.	Function test Carbon Dioxide Scrubbing System		
9.1	Inject carbon dioxide into chamber/system at desired rate ensuring adequate circulation. No personnel should be allowed access to the chamber/system until certified safe		
9.1.1	Record current carbon dioxide percentage/ppm level		
9.2	Scrubbing (blower speed @ 3,000 rpm)	Time	CO_2
9.2.1	Inject carbon dioxide at _____lpm[1], record settling time and final % or ppm(indicate unit of measure)	h m	
9.2.2	Inject carbon dioxide at _____lpm[1], record settling time and final % or ppm(indicate unit of measure)	h m	
9.2.3	Inject carbon dioxide at _____lpm[1] , record settling time and final % or ppm (indicate unit of measure)	h m	

Note
CO_2 production rates per person may vary depending environmental conditions, stress etc. For certification of new systems CO_2 production rates per person are dictated by certification authority Rules.
CO_2 percentage in the atmosphere must be maintained below the Hyperbaric Exposure Limit of 0.5% [500ppm / 0.005 bar ppCO_2].

Chapter 9 - Carbon Dioxide Scrubber - Chemical Absorbent Change

	CAUTION
	Wear Personal Protective Equipment (PPE) when changing chemical absorbent, and when opening/closing scrubber pot.

1. Turn off blower.
2. Isolate 3” ball valves on both sides of scrubber pot.
3. Isolate drain valve.
4. Switch 3-way ball valve to vent gas from scrubber pot to reclaim.
5. Lift and rotate interlock to release locking pins
6. When scrubber pot is depressurised the interlock will be free to move with minimum effort.
7. Turn hand-wheel anti-clockwise to release door clamp.
8. Open door and lock in open position.
9. Lift and remove scrubber baskets.
10. Refill scrubber/s baskets with new chemical absorbent, ±9 kg per scrubber basket.
11. Re-install scrubber baskets into scrubber pot. Ensure bottom scrubber is correctly seated and sealed against bottom plate.
12. Wipe sealing faces on door and pot, and wipe o-ring seal to remove any dirt/debris. Inspect seal for damage and fit. Replace seal if it shows any signs of damage. Lightly lubricate seal with oxygen compatible grease.
13. Close door and inspect for good seating.
14. Turning hand-wheel clockwise close clamp.
15. Position interlock, and ensure pins are fully engaged by interlock plate.
16. Switch 3-way ball valve to vent gas from dehumidifier circuit into scrubber pot to equalise scrubber pot to system pressure.
17. Check for leaks while scrubber pot is being pressurised.
18. Slowly open 3” ball valves on both sides of the scrubber pot.
19. Start blower.

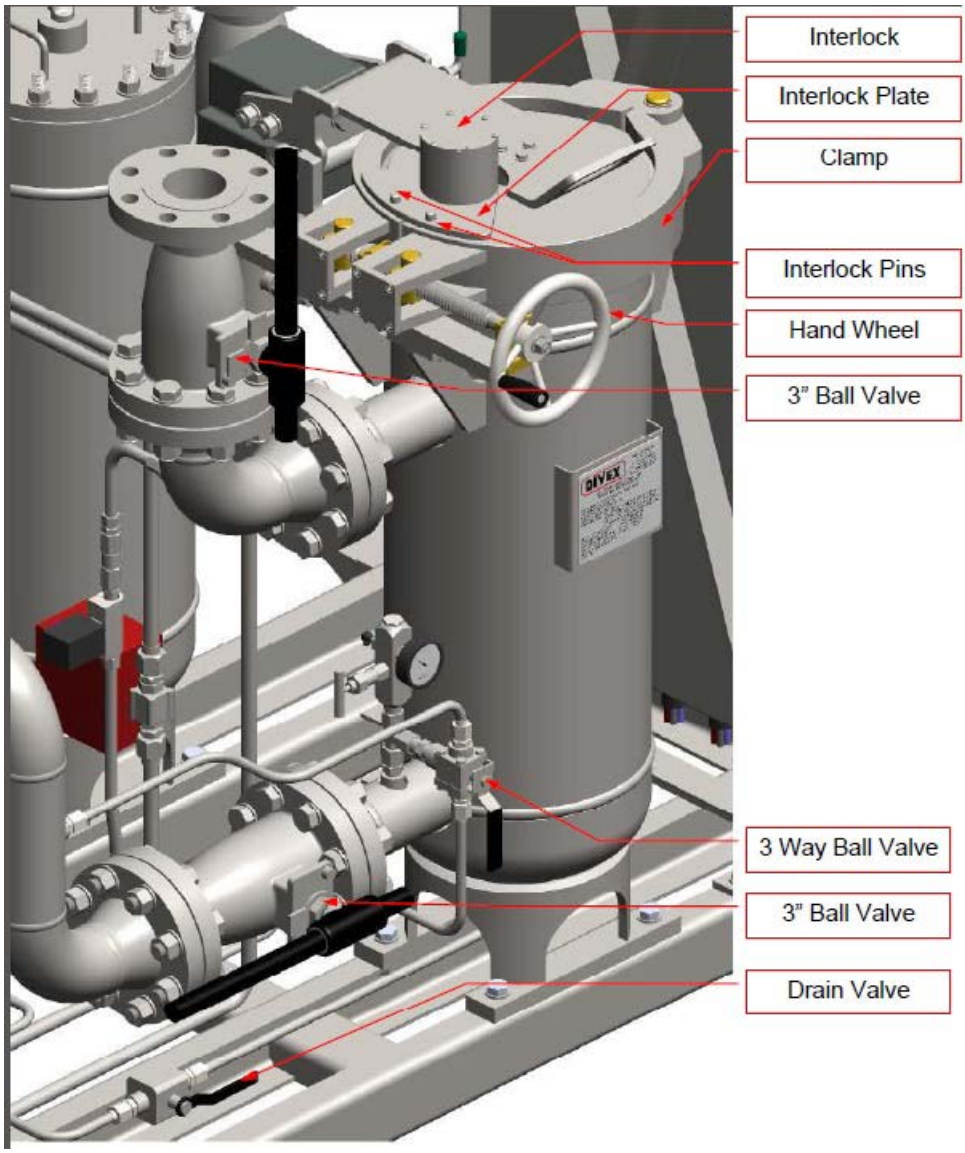


Fig 9.1 Carbon Dioxide Scrubber

Chapter 10 - Inspection and Maintenance

Task	Procedure
Weekly	
Lamp Test via HMI Setup Menu	N/A
Inspect and lubricate the upper and lower Scrubber seals as required	N/A
Visually examine the HCU-ER pressure vessels for any defects or wear on load bearing surfaces	N/A
Visually examine both Scrubber counterbalances for tightness	N/A
Visually examine HCU-ER Gas, Hot water and Cold Water Supply and Return lines for any defects	N/A
Clean any chemical absorbent from Scrubber/s	N/A
Monthly	
Check all manual valves for correct operation	N/A
Check the solenoid and motorised valves for correct operation	N/A
Check CO2 Scrubber/s clamp mechanisms for correct operation and lubricate as required	N/A
Annually	
Isolate, Depressurise and Deactivate the HCU-ER	⚠
Check all Blower housing mounting bolts are securely fastened between 33 – 44Nm.	N/A
Blower Function test: Test to maximum speed (6000 RPM), checking blower housing for excessive vibration.	N/A

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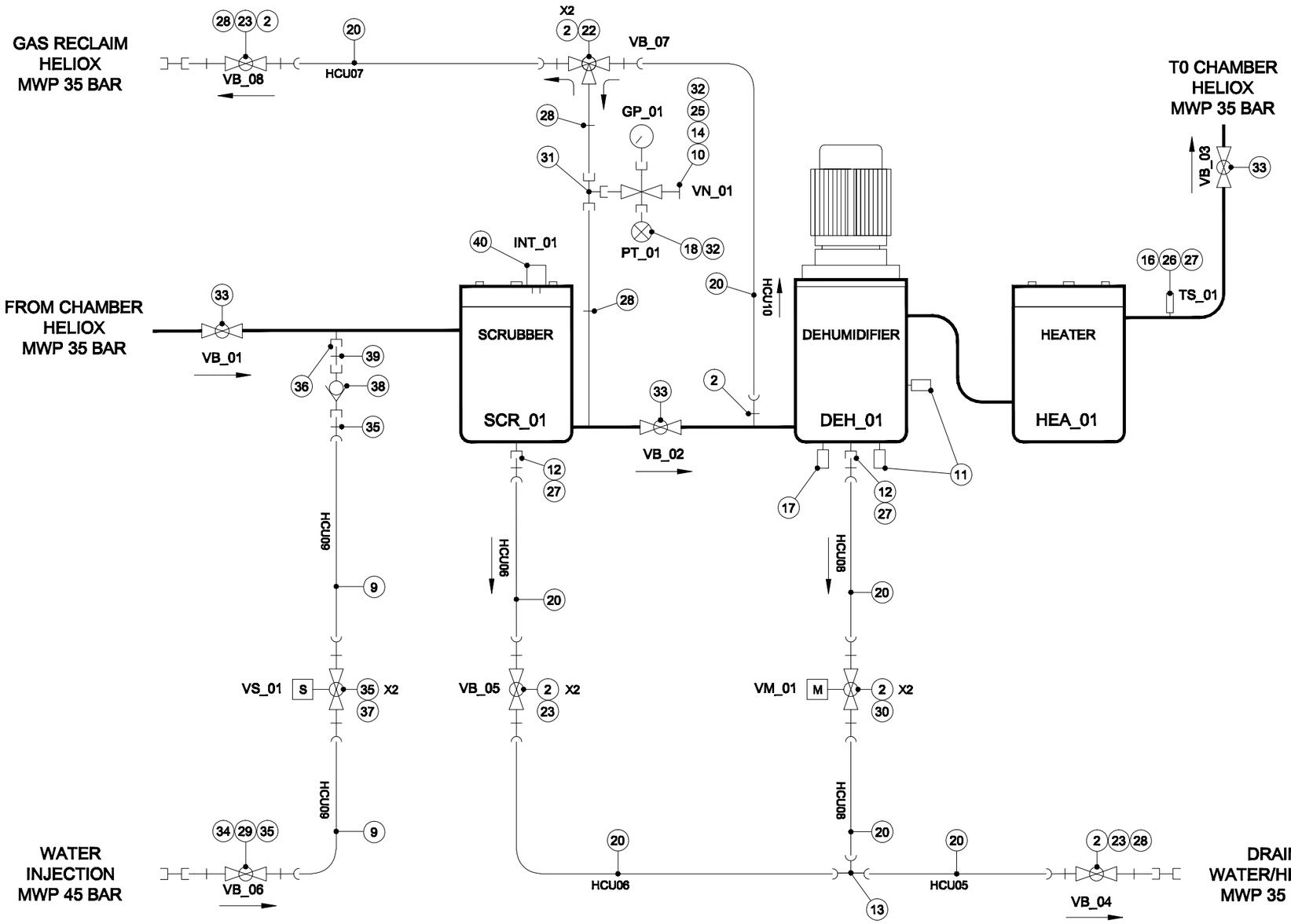
Chapter 11 - Recommended Spare Parts

Divex P/N	Description	Qty
DX2338	O RING RADIAL GROOVE	3
EM20363	24V RELAY, 6 AMP, WEIDMULLER	1
EM25282	ACTUATOR, ROTARY, MOTORIZED, BURKERT, FOR VE302	1
EM25283	ACTUATOR, ROTARY, MOTORIZED, BURKERT, FOR VE304	1
FC179	CIRCLIP, EXTERNAL, 30 NOM x 2 THK	2
FP3470	O-RING, FOR 3/4" O-LOK FITTINGS, NBR	12
FP348	NUT, 3/4" O-LOK, C/W SLEEVE & O-RING	8
FW024	WASHER, DOWTY, 1/2" BSP	2
FW060	WASHER, DOWTY, 3/8" BSP	1
GP101	PRESSURE GAUGE, BACK MOUNT, 63mm, 40 BAR, 1/4" M NPT	1
HCU1003015	DUCT, INLET, HEAT EXCHANGER	2
HCU1003022	BLOWER, 3 STAGE	1
HCU1003073	ADAPTOR 3/8" BSP - 1/2" NPT	1
HCU10043100	SEAL ASSEMBLY, BLOWER VESSEL	1
KI14691	NYLOK NUT 1/2-20 UNF	1
KI17488	SPECIAL WASHER	1
KI17497	IMPELLER ASSEMBLY	3
KI17503	WOODRUFF KEY	3
KI17504	WOODRUFF KEY	1
KI17510	HEX SCKT HD CAP SCREW 3/8-16 UNC x 1.50"	8
KI17514	HEX BOLT 1/4-20 UNC x 4.00"	1
KI17516	BACKUP RING 8-228	1
KI17544	BEARING ISOLATOR	1
KI17555	BEARING SHIELD, NOVA 212 BLOWER	1
KI17557	BALL BEARING, DEEP GROOVE, OPEN SINGLE ROW	2
KI17558	DISC SPRING, AK SERIES, NOVA 212 BLOWER	1
KI17559	SETSCREW 3/8-24 UNF x 1	8
KI17560	SPRING LOCK WASHER, 1/4"	1
KI17561	RETAINING RING, NTM, NOVA 212 BLOWER	1
KI17562	MACHINE SCREW, FHSD 4-40 UNC x 0.188	16

Divex P/N	Description	Qty
KI9285	ROTOR ASSEMBLY, B223-0022-01	1
MC786	SENSOR, LIQUID LEVEL, VIBRATE FORK, 3/4" MNPT,LONG	1
MC787	SENSOR, TEMP/HUMID, 50BAR, G3/8", HCU-ER	1
MC788	SENSOR, LIQUID LEVEL, VIBRATING FORK, 3/4” MNPT	2
RN0274-7	O-RING, 253.60 ID X 3.53 CS, 70 SHORE NITRILE	2
RN0343-7	O-RING, 94.62 ID X 5.34 CS, 70 SHORE NITRILE	5
RN888	O-RING, BS REF NO.4518-319357	1
RP789	TRANSDUCER, PRESSURE, 1/4" MNPT, 69 BAR, 4-20 MA	1
VK330	SEAL KIT, FOR VB3330, SWAGELOK SS-9K-44	1
VK302	SEAL KIT, FOR VE302 BALL VALVE, BURKERT	2
VK304	SEAL KIT, FOR VE304 BALL VALVE, BURKERT	1
VK31251	KIT, REPAIR, NEEDLE VALVE, TO SUIT VS402	1
VK704	SEAL KIT, FOR VB704, FLOWSERVE 07A446666TTSENSEN	4
VK780	SEAL KIT, FOR VB780, SWAGELOK SS-63XTF8	1
VK781	SEAL KIT, FOR VB781, SWAGELOK SS-63TDVF8-JL	2
VB561	VALVE, BALL, 2 WAY, 3" BW, FLOWSERVE, R459, SCH 80	1
VM150	VALVE, NEEDLE, GAUGE, 1/2"MNPT-1/2"FNPT, HCU-ER	1

Chapter 12 - Parts List and Line Schematic

Fig 12.1 Gas & Fluid Schematic HCU-ER Single Scrubber 350MSW
(Drawing HCU1001021 S1/S2/S3)



ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE SHEET 3

FINISH: N/A

THIRD ANGLE PROJECTION

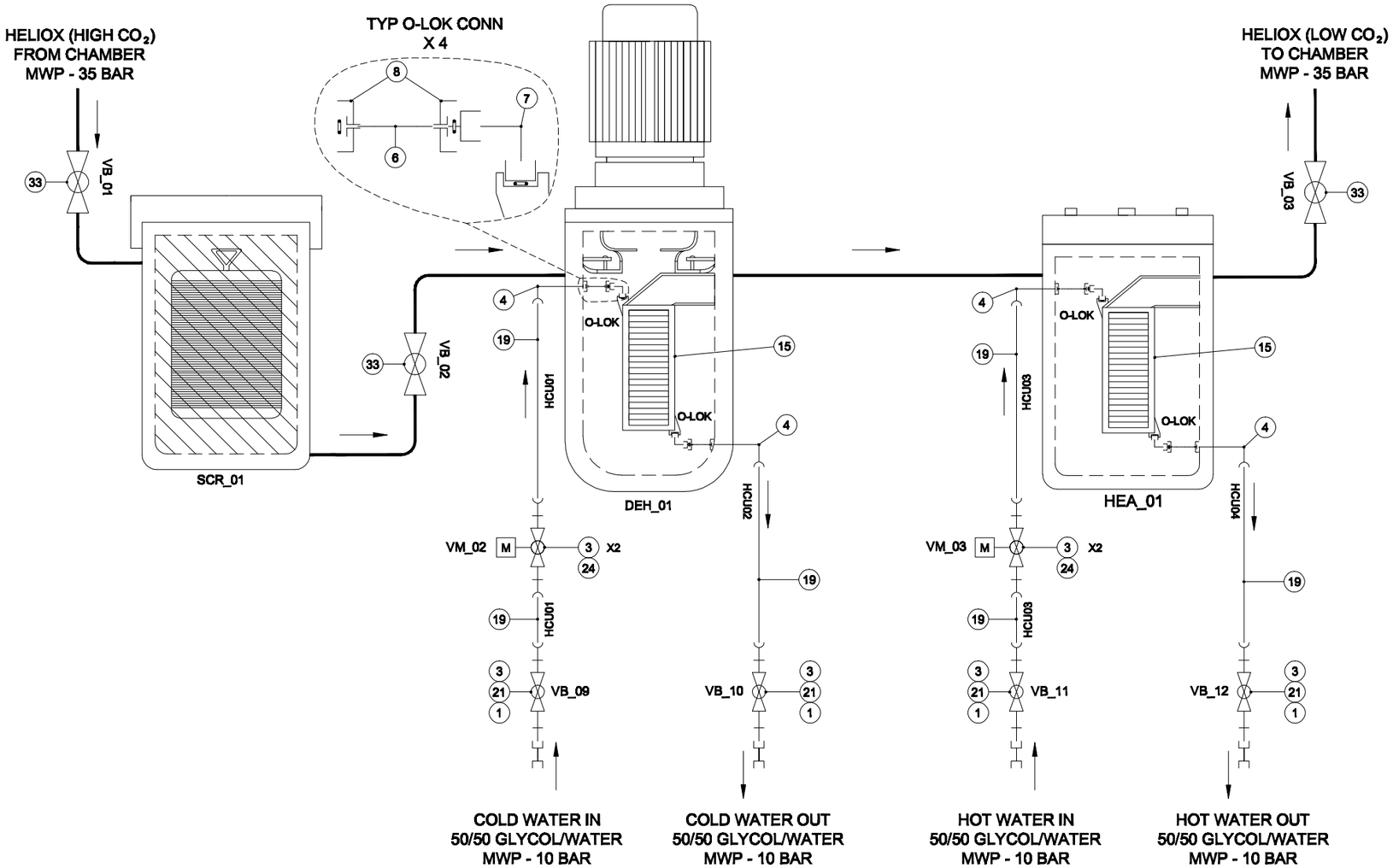
REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R00	ISSUED FOR MANUFACTURE		JJM	05/05/15	SC

DO NOT SCALE DRAWING

TITLE: GAS & FLUID SCHEMATIC
HCU-ER, SINGLE SCRUBBER
350 MSW

DRAWING No.: HCU1001021S1
REV: R00
PART No.: HCU100BA
PRODUCT / PROJECT No.: HCU100
SIZE: A3
SCALE: NTS
SHT 1 OF 3

DIVEX LIMITED
ENTERPRISE DRIVE
WESTHILL
ABERDEEN
AB32 6TQ
UNITED KINGDOM
Tel : +44(0)1224 740145
Fax : +44(0)1224 740172
email : info@divexglobal.com
www.divexglobal.com



NOTES

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE SHEET 3

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R00	ISSUED FOR MANUFACTURE		JJM	05/05/15	SC

DO NOT SCALE DRAWING

TITLE: GAS & FLUID SCHEMATIC
HCU-ER SINGLE SCRUBBER
350 MSW

DRAWING No.: HCU1001021S2
REV: R00
PART No.: HCU100BA
PRODUCT / PROJECT No.: HCU100
SIZE: A3
SCALE: NTS
SHT 2 OF 3

DIVEX LIMITED
ENTERPRISE DRIVE
WESTHILL
ABERDEEN
AB32 6TQ
UNITED KINGDOM

Tel : +44(0)1224 740145
Fax : +44(0)1224 740172
email : info@divexglobal.com
www.divexglobal.com

EQUIP. TAG	PART NO	DESCRIPTION	SIZE	MATERIAL	MWP/ LEAK TEST PRESS (BAR)	DESIGN PRESS. (BAR)	HYDRO TEST PRESS. (BAR)	MEDIUM	PROCESS ID
HCU07	TM497	TUBE, SEAMLESS	1/2" OD X 0.049	ASTMA269/213 316	35	38.5	52.5	HELIOX	GAS RECLAIM/CIRCUIT
HCU10	TM497	TUBE, SEAMLESS	1/2" OD X 0.049	ASTMA269/213 316	35	38.5	52.5	HELIOX	GAS RECLAIM/CIRCUIT
HCU05	TM497	TUBE, SEAMLESS	1/2" OD X 0.049	ASTMA269/213 316	35	38.5	52.5	HELIOX/WATER	DRAIN CIRCUIT, COMMON
HCU08	TM497	TUBE, SEAMLESS	1/2" OD X 0.049	ASTMA269/213 316	35	38.5	52.5	HELIOX/WATER	DRAIN CIRCUIT, DEHUMIDIFIER
HCU08	TM497	TUBE, SEAMLESS	1/2" OD X 0.049	ASTMA269/213 316	35	38.5	52.5	HELIOX/WATER	DRAIN CIRCUIT, DEHUMIDIFIER
HCU06	TM497	TUBE, SEAMLESS	1/2" OD X 0.049	ASTMA269/213 316	35	38.5	52.5	HELIOX/WATER	DRAIN CIRCUIT, SCRUBBER
HCU06	TM497	TUBE, SEAMLESS	1/2" OD X 0.049	ASTMA269/213 316	35	38.5	52.5	HELIOX/WATER	DRAIN CIRCUIT, SCRUBBER
HCU09	TM899	TUBE, SEAMLESS	3/8"OD X 0.064	ASTMA269/213 316	45	49.5	67.5	POTABLE WATER	WATER INJECTION CIRCUIT
HCU09	TM899	TUBE, SEAMLESS	3/8"OD X 0.064	ASTMA269/213 316	45	49.5	67.5	POTABLE WATER	WATER INJECTION CIRCUIT
HCU01	TM497	TUBE, SEAMLESS	1/2" OD X 0.049	ASTMA269/213 316	10	11	15	50/50 WATER/GLYCOL MIX	COLD WATER IN CIRCUIT
HCU01	TM497	TUBE, SEAMLESS	1/2" OD X 0.049	ASTMA269/213 316	10	11	15	50/50 WATER/GLYCOL MIX	COLD WATER IN CIRCUIT
HCU02	TM497	TUBE, SEAMLESS	1/2" OD X 0.049	ASTMA269/213 316	10	11	15	50/50 WATER/GLYCOL MIX	COLD WATER OUT CIRCUIT
HCU03	TM898	TUBE, SEAMLESS	3/4" OD X 0.064	ASTMA269/213 316	10	11	15	50/50 WATER/GLYCOL MIX	HOT WATER IN CIRCUIT
HCU03	TM898	TUBE, SEAMLESS	3/4" OD X 0.064	ASTMA269/213 316	10	11	15	50/50 WATER/GLYCOL MIX	HOT WATER IN CIRCUIT
HCU04	TM898	TUBE, SEAMLESS	3/4" OD X 0.064	ASTMA269/213 316	10	11	15	50/50 WATER/GLYCOL MIX	HOT WATER OUT CIRCUIT
DEH_01	N/A	DEHUMIDIFIER UNIT	-------	ASME SA 790 S31803	35	38.5	52.5	HELIOX/WATER	DEHUMIDIFIER UNIT
GP_01	GF101	GAUGE, PRESS., 0-40 BAR, Ø63MM, 1/4" NPT(M) R/E	1/4" / Ø63MM	316 SS	35	38.5	N/A	HELIOX	INTERLOCK/GAS RECLAIM/CIRCUIT
HEA_01	N/A	HEATER UNIT	-------	ASME SA 790 S31803	35	38.5	52.5	HELIOX	HEATING UNIT
INT_01	DC0302AB	INTERLOCK PRESSURE ACTUATED	1/2"	REF. BOM	35	38.5	52.5	HELIOX	SCRUBBER UNIT
PT_01	RP789	TRANSDUCER, PRESS, 1/4"NPT(M), 69BAR, 4-20MA	1/4"	REF. DATA SHEET	35	38.5	N/A	HELIOX	REGEN CIRCUIT
TS_01	MC787	SENSOR, TEMP/HUMID, 50BAR, G3/8"	3/8"	REF. DATA SHEET	35	38.5	N/A	HELIOX	REGEN CIRCUIT
SCR_01	N/A	CO2 SCRUBBER UNIT, R/H	-------	ASME SA 790 S31803	35	38.5	52.5	HELIOX/WATER	SCRUBBER UNIT
VB_01	VB556	2 WAY VALVE, 3", REDUCED BORE, SS	3"	316 SS	35	38.5	N/A	HELIOX	REGEN CIRCUIT
VB_02	VB556	2 WAY VALVE, 3", REDUCED BORE, SS	3"	316 SS	35	38.5	N/A	HELIOX	REGEN CIRCUIT
VB_03	VB556	2 WAY VALVE, 3", REDUCED BORE, SS	3"	316 SS	35	38.5	N/A	HELIOX	REGEN CIRCUIT
VB_04	VB781	VALVE, BALL, 1/2"NPT(F), SS	1/2"	ASTMA276/ A479 EN10272	35	38.5	N/A	HELIOX/WATER	DRAIN CIRCUIT, COMMON
VB_05	VB781	VALVE, BALL, 1/2"NPT(F), SS	1/2"	ASTMA276/ A479 EN10272	35	38.5	N/A	HELIOX/WATER	DRAIN CIRCUIT, SCRUBBER
VB_06	VB330	VALVE, BALL, 3/8"NPT(F), SS	3/8"	ASTMA276/ A479 EN10272	45	49.5	N/A	POTABLE WATER	WATER INJECTION CIRCUIT
VB_07	VB780	VALVE, BALL, 1/2"NPT, 3 WAY	1/2"	ASTMA276/ A479 EN10272	35	38.5	N/A	HELIOX	GAS RECLAIM/CIRCUIT
VB_08	VB781	VALVE, BALL, 1/2"NPT(F), SS	1/2"	ASTMA276/ A479 EN10272	35	38.5	N/A	HELIOX	GAS RECLAIM/CIRCUIT
VB_09	VB704	VALVE, BALL, 3/4"NPT(F), SS	3/4"	ASTMA276/ A479 EN10272	10	11	N/A	50/50 WATER/GLYCOL MIX	COLD WATER IN CIRCUIT
VB_10	VB704	VALVE, BALL, 3/4"NPT(F), SS	3/4"	ASTMA276/ A479 EN10272	10	11	N/A	50/50 WATER/GLYCOL MIX	COLD WATER OUT CIRCUIT
VB_11	VB704	VALVE, BALL, 3/4"NPT(F), SS	3/4"	ASTMA276/ A479 EN10272	10	11	N/A	50/50 WATER/GLYCOL MIX	HOT WATER IN CIRCUIT
VB_12	VB704	VALVE, BALL, 3/4"NPT(F), SS	3/4"	ASTMA276/ A479 EN10272	10	11	N/A	50/50 WATER/GLYCOL MIX	HOT WATER OUT CIRCUIT
VM_01	VE304	VALVE, BALL, MOTORISED, 1/2"NPT(F), SS	1/2"	ASTMA276/ A479 EN10272	35	38.5	N/A	HELIOX/WATER	DRAIN CIRCUIT, DEHUMIDIFIER
VM_02	VE302	VALVE, BALL, 3/4"NPT(F), SS, C/W MOTOR	3/4"	ASTMA276/ A479 EN10272	10	11	N/A	50/50 WATER/GLYCOL MIX	INTERLOCK/GAS RECLAIM/CIRCUIT
VM_03	VE302	VALVE, BALL, 3/4"NPT(F), SS, C/W MOTOR	3/4"	ASTMA276/ A479 EN10272	10	11	N/A	50/50 WATER/GLYCOL MIX	DRAIN CIRCUIT, SCRUBBER
VN_01	VM150	VALVE, NEEDLE, GAUGE, 1/2"NPT(M) - 1/2"NPT(F), SS	1/2"	ASTMA276/ A479 EN10272	35	38.5	N/A	HELIOX	GAS RECLAIM/CIRCUIT
VS_01	VE303	VALVE, SOLENOID, 3/8"NPT(F), 45 BAR	1/2"	ASTMA276/ A479 EN10272	45	49.5	N/A	POTABLE WATER	WATER INJECTION CIRCUIT

ITEM	PART NO	DESCRIPTION	QTY	MATERIAL	MWP/ LEAK TEST PRESS. (BAR)	DESIGN PRESS. (BAR)
1	FP698	NIPPLE, HEX, 3/4"NPT(M), SS	4	ASTM, A182, 316 SS	10	11
2	FJ493	CONNECTOR, MALE, 8 JIC - 1/2"NPT(M), SS	9	ASTM, A182, 316 SS	35	38.5
3	FJ600	CONNECTOR, MALE, 12 JIC - 3/4"NPT(M), SS	8	ASTM, A182, 316 SS	10	11
4	FJ6054	ELBOW, MALE, 12 JIC - 3/4"NPT(M), SS	3	ASTM, A182, 316 SS	10	11
5	FJ663	ELBOW, 45DEG, 12 JIC - 3/4"NPT(M), SS	1	ASTM, A182, 316 SS	10	11
6	TM215	TUBE, TUNGUM, 3/4" X 18SWG, WP118BAR, TC L100/A	AS REQD	TUNGUM	35	38.5
7	FP347	ELBOW, 3/4" O-LOK	4	ASTM, A182, 316 SS	35	38.5
8	FP348	NUT, 3/4" O-LOK	4	ASTM, A182, 316 SS	35	38.5
9	TM899	TUBE, SEAMLESS, 3/8" OD X 0.064" WT, 316SS	1	ASTM A269/213 316	45	49.5
10	FP450	PLUG, HEX, 1/2"NPT(M), SS	1	ASTM, A182, 316 SS	35	38.5
11	MC788	SENSOR, LIQUID LEVEL, VIBRATING FORK, 3/4" MNPT	2	REF. DATA SHEET	35	38.5
12	FJ842	ELBOW, EXTENDED, 8 JIC - 1/2"NPT(M), SS	2	ASTM, A182, 316 SS	35	38.5
13	FP789	TEE, UNION, 8 JIC, SS	1	ASTM, A182, 316 SS	35	38.5
14	GF101	PRESSURE GAUGE, BACK MOUNT, 63MM, 40BAR, 1/4"NPT(M)	1	316 SS	35	38.5
15	HC U1003309	HEAT EXCHANGER, HEATER/DEHUMIDIFIER	2	REF. DATA SHEET	35	38.5
16	MC787	SENSOR, TEMP/HUMID, 50BAR, G3/8", HC-ER	1	REF. DATA SHEET	35	38.5
17	MC786	SENSOR, LIQUID LEVEL, VIBRATING FORK, 3/4" MNPT, LONG	1	REF. DATA SHEET	35	38.5
18	RP789	TRANSDUCER, PRESSURE, 1/4" MNPT, 69BAR, 4-20MA	1	REF. DATA SHEET	35	38.5
19	TM698	TUBE,SEAMLESS, 3/4"OD X .064 WT, SS316	AS REQD	ASTM, A269, TP 316 SS	10	11
20	TM497	TUBE,STAINLESS STEEL, SEAMLESS, 1/2" OD X 0.049	AS REQD	ASTM A269/213 316	35	38.5
21	VB704	VALVE, BALL, 3/4"NPT(F), SS	4	ASTM A276/A479 EN10272	10	11
22	VB780	VALVE, BALL, 1/2"NPT(F), 3 WAY, SS	1	ASTM A276/A479 EN10272	35	38.5
23	VB781	VALVE, BALL, 1/2"NPT(F), SS	3	ASTM A276/A479 EN10272	35	38.5
24	VE302	VALVE, BALL, 3/4"NPT(F), SS, C/W MOTOR	2	ASTM A276/A479 EN10272	10	11
25	VM150	VALVE, NEEDLE, GAUGE, 1/2"NPT(M) - 1/2"NPT(F), SS	1	ASTM A276/A479 EN10272	35	38.5
26	HC U1003073	ADAPTOR, SENSOR, 1/2"NPT(M) - 3/8"BSPP, SS	1	ASTM, A182, 316 SS	35	38.5
27	FW060	WASHER, DOWTY, 3/8"BSP	1	ASTM, A182, 316 SS	35	38.5
28	FP442	NIPPLE, HEX, 1/2"NPT(M), SS	4	ASTM, A182, 316 SS	35	38.5
29	VB330	VALVE, BALL, 3/8"NPT(F), SS	1	ASTM A276/A479 EN10272	45	49.5
30	VE304	VALVE, BALL, MOTORISED, 1/2"NPT(F), SS	1	ASTM A276/A479 EN10272	35	38.5
31	FP784	TEE, 1/2"NPT(F), SS	1	ASTM, A182, 316 SS	35	38.5
32	FP431	ADAPTOR, REDUCING, 1/2"NPT(M) - 1/4"NPT(F)	2	ASTM, A182, 316 SS	35	38.5
33	VB556	2 WAY VALVE, 3", REDUCED BORE, SS	3	316SS	35	38.5
34	FP499	NIPPLE, HEX, 1/2"NPT(M) - 3/8"NPT(M), SS	1	ASTM, A182, 316 SS	45	49.5
35	FP943	CONNECTOR, 6 JIC - 3/8"NPT(M), SS	4	ASTM, A182, 316 SS	45	49.5
36	HC U1003068	NOZZLE, 1/2"NPT(M) - 3/8"NPT(F), SS	1	ASTM, A182, 316 SS	45	49.5
37	VE303	VALVE, SOLENOID, 3/8"NPT(F), 45 BAR	1	ASTM A276/A479 EN10272	45	49.5
38	VC307	VALVE, CHECK, 3/8"NPT(F), SS	1	ASTM, A182, 316 SS	45	49.5
39	FP364	NIPPLE, 3/8"NPT(M), SS	1	ASTM, A182, 316 SS	45	49.5
40	DC0302AB	INTERLOCK, PRESSURE ACTUATED	1	REF. BOM	35	38.5

NOTES

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R00	ISSUED FOR MANUFACTURE		JJM	05/05/15	SC

DO NOT SCALE DRAWING

TITLE: GAS & FLUID SCHEMATIC HCU-ER, SINGLE SCRUBBER 350 MSW

DRAWING No.: HCU1001021S3 | REV: R00

PART No.: HCU100BA | PRODUCT / PROJECT No.: HCU100

SIZE: A3 | SCALE: NTS | SHT 3 OF 3

DIVEX
DIVEX LIMITED
ENTERPRISE DRIVE
WESTHILL
ABERDEEN
AB32 6TQ
UNITED KINGDOM
Tel : +44(0)1224 740145
Fax : +44(0)1224 740172
email : info@divexglobal.com
www.divexglobal.com

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Chapter 13 - Alarm Handling/Troubleshooting

The Alarm Screen displays all current alarms while the Alarm History Screen displays all historic alarms from the last time the alarm cache has been cleared.

- Faults can only be reset once the cause thereof has been cleared.
- Warnings automatically reset.

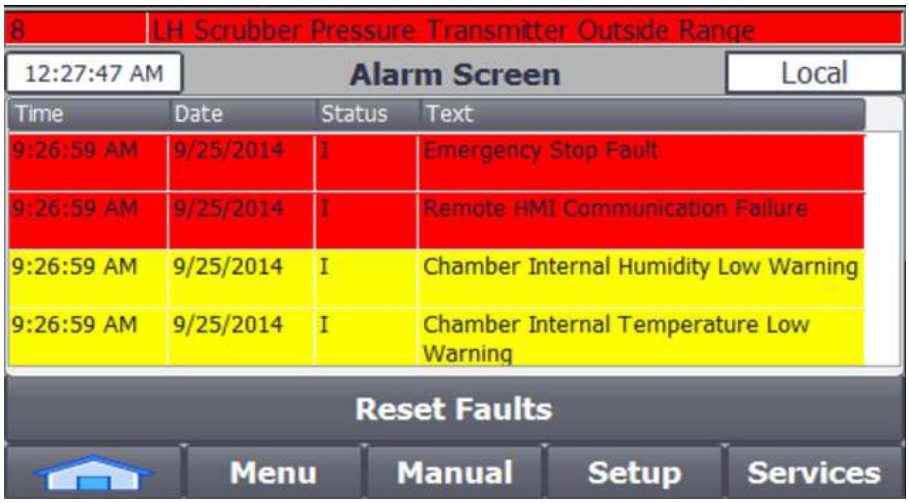


Fig 13.1 Alarm Screen

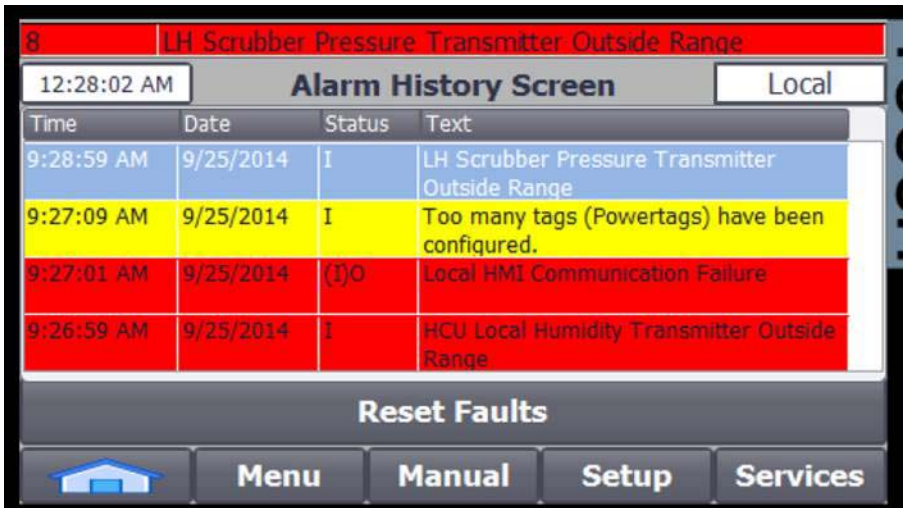


Fig 13.2 Alarm History Screen

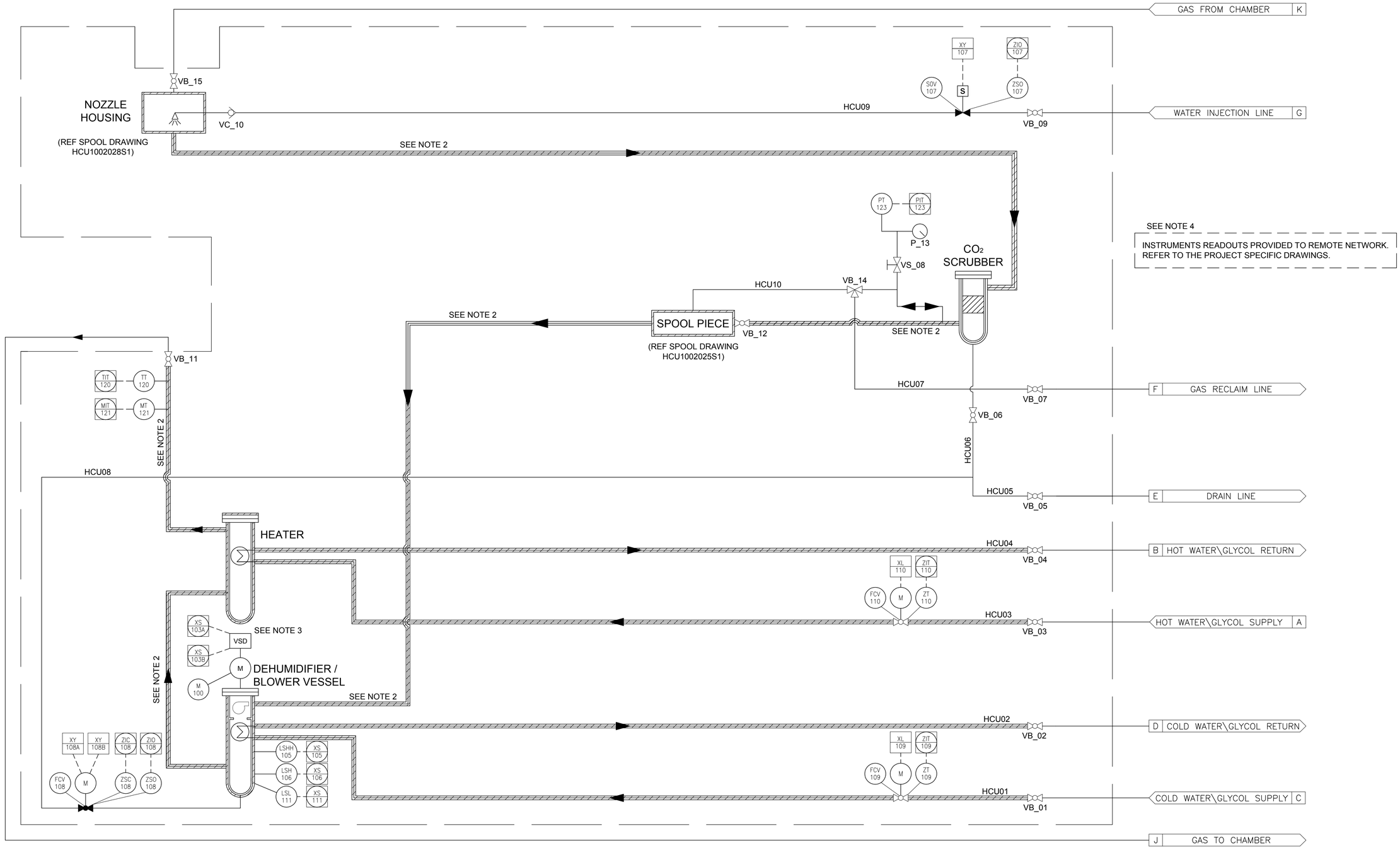
The following tables are to be used as a troubleshooting guide to aid in the identification of faults and outline possible corrective action.

Warning	Solution
Chamber Internal Temperature High Warning	Check SP in relation to actual
Chamber Internal Temperature Low Warning	Check SP in relation to actual
Chamber Internal Humidity High Warning	Check SP in relation to actual
Chamber Internal Humidity Low Warning	Check SP in relation to actual
Hot Water Valve in Manual Control	Switch mode back into Auto
Cold Water Valve in Manual Control	Switch mode back into Auto
Drive Warning	Investigate Fault # number and reset

Alarm	Solution
Dehumidifier High Level Fault	Drain Humidity Pot
Scrubber Pressure Transmitter Outside Range	Check cable connection and sensor supply
Primary Chamber Temperature Transmitter Outside Range	Check cable connection and sensor supply
Primary Chamber Humidity Transmitter Outside Range	Check cable connection and sensor supply
HCU Local Temperature Transmitter Outside Range	Check cable connection and sensor supply
HCU Local Humidity Transmitter Outside Range	Check cable connection and sensor supply
Dehumidifier High Level Delay Expired	Drain humidity pot and restart blower
Emergency Stop Fault	Reset tripped E stop
Blower Drive Fault	Investigate Fault # number and reset
Drain Valve Position Fault	Ensure valve movement is not obstructed
Hot Water Valve Position Out of Range	Ensure valve is in Auto function
Cold Water Valve Position Out of Range	Ensure valve is in Auto function
Blower Drive Circuit Breaker Tripped	Investigate fault and reset breaker
Blower Drive Communication Fault	Check wiring connections
Local HMI Communication Failure	Check wiring connections
Secondary Chamber Temperature Transmitter Outside Range	Check wiring connection and verify sensor validity
Secondary Chamber Humidity Transmitter Outside Range	Check wiring connection and verify sensor validity

Chapter 14 - Appendix

Fig 14.1 Single Scrubber, HCU-ER, P & ID
(Drawing HCU1001012S1/S2)



NOTES

1. ALL COMPONENTS INCLUDING VALVES, ELECTRICAL FITTINGS, AND PIPE ROUTING SHALL BE POSITIONED AS PER GENERAL ARRANGEMENT DRAWING NO. HCU1001110S1 & S2
2. BOLTED FLANGE CONNECTION - OR PV STUBS (FLANGES) NOT PART OF LINE NO TABLE SCOPE ON SHEET 2.
3. ALL CONTROL COMMANDS FROM THE PLC TO THE VSD GO VIA PROFIBUS.
4. OPTIONAL - CHAMBER AREA SCOPE OF SUPPLY.

SKID SCOPE OF SUPPLY

1/2" THK INSULATION ARMAFLEX CLASS O TYPE

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: N/A

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R04	SEE SHEET 2	17361	ZD	19/01/2015	MS
R03	CHAMBER GAS LINES DEFINED	16951	ZD	03/09/2014	MS
R02	HCU10 LINE ADDED, TAG ADDED & CORRECTED	13832	DJR	28/01/2011	MS
R01	VALVES VB_10 & VB_12 ADDED	13755	SR	15/09/2010	SW
R00	ISSUED FOR MANUFACTURE		DJR	03/09/2010	SW

DO NOT SCALE DRAWING

TITLE

SINGLE SCRUBBER, HCU-ER, P & ID

28/01/2011 MS

DRAWING No. **HCU1001012S1** REV **R04**

PART No. HCU100BA

PRODUCT / PROJECT No. HCU-ER

SIZE A1 | SCALE N/A | SHT 1 OF 2

DIVEX LIMITED
ENTERPRISE DRIVE
WESTHILL
ABERDEEN
AB32 6TQ
UNITED KINGDOM

Tel : +44(0)1224 740145
Fax : +44(0)1224 740172
email : info@divexglobal.com
www.divexglobal.com

4

EQUIPMENT TAG	DIVEX PART No	DESCRIPTION	SIZE (INCH)	MATERIAL	WORKING PRESSURE (BAR)	TEST PRESSURE (BAR)
VB-01	VB780	COLD WATER / GLYCOL SUPPLY ISOLATION	3/4"	SS	10	15
VB-02	VB780	COLD WATER / GLYCOL RETURN ISOLATION	3/4"	SS	10	15
VB-03	VB780	HOT WATER / GLYCOL SUPPLY ISOLATION	3/4"	SS	10	15
VB-04	VB780	HOT WATER / GLYCOL RETURN ISOLATION	3/4"	SS	10	15
VB-05	VB781	DRAIN ISOLATION	1/2"	SS	35	52.5
VB-06	VB781	CO2 SCRUBBER DRAIN	1/2"	SS	35	52.5
VB-07	VB781	GAS SCRUBBER DRAIN	1/2"	SS	35	52.5
VS-08	VM150	CO2 SCRUBBER GAUGE ISOLATION	1/2"	SS	35	52.5
VB-09	VB330	WATER INJECTION ISOLATION	3/8"	SS	45	67.5
VB-10	VC307	WATER INJECTION NON RETURN VALVE	3/8"	SS	45	67.5
VB-11	VB556	GAS OUT VALVE	3"	SS	35	52.5
VB-12	VB556	SCRUBBER OUTLET VALVE	3"	SS	35	52.5
P_13	GF101	PRESSURE GAUGE - CO2 SCRUBBER	1/4"	SS	-	-
VB-14	VB780	CO2 SCRUBBER GAS RECLAIM / PRESSURISATION VALVE	1/2"	SS	35	52.5
VB-15	VB556	GAS INLET VALVE	3"	SS	35	52.5
SOV107	VE303	WATER INJECTION SOLENOID ON/OFF	3/8"	SS	45	67.5
FCV108	VE304	DEHUMIDIFIER / BLOWER DRAIN MOTORISED ON / OFF	1/2"	SS	35	52.5
FCB109	VE302	COLD WATER / GLYCOL SUPPLY PROPORTIONAL	3/4"	SS	10	15
FCV110	VE302	HOT WATER / GLYCOL SUPPLY PROPORTIONAL	3/4"	SS	10	15
PT123	RP789	PRESSURE TRANSDUCER - CO2 SCRUBBER	1/4"	SS	-	-

LINE NO.	DESCRIPTION	SIZE (INCH)	THICKNESS (INCH)	MATERIAL	WORKING PRESSURE (BAR)	HYDRO TEST PRESSURE (BAR)	LEAK TEST PRESSURE (BAR)
HCU01	COLD WATER / GLYCOL SUPPLY	3/4"	0.064	316SS	10	15	10
HCU02	COLD WATER / GLYCOL RETURN	3/4"	0.064	316SS	10	15	10
HCU03	HOT WATER / GLYCOL SUPPLY	3/4"	0.064	316SS	10	15	10
HCU04	HOT WATER / GLYCOL RETURN	3/4"	0.064	316SS	10	15	10
HCU05	DRAIN	1/2"	0.049	316SS	35	52.5	35
HCU06	CO_2 SCRUBBER DRAIN	1/2"	0.049	316SS	35	52.5	35
HCU07	GAS RECLAIM CO_2 SCRUBBER	1/2"	0.049	316SS	35	52.5	35
HCU08	DEHUMIDIFIER DRAIN	1/2"	0.049	316SS	35	52.5	35
HCU09	WATER INJECTION	3/8"	0.064	316SS	45	67.5	45
HCU10	PRESSURISATION CO_2 SCRUBBER	1/2"	0.049	316SS	35	52.5	35

NOTES

4 - DENOTES CHANGES MADE AT THIS REVISION.

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: N/A

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R04	'DIVEX' PART No. COLUMN ADDED TO TABLE	17361	ZD	19/01/2015	MS
R03	SEE SHEET 1	16951	ZD	03/09/2014	MS
R02	VB_14, VB_15, HCU10 ADDED, TAG ADDED & CORRECTED	13832	DJR	28/01/2011	MS
R01	SEE SHEET 1	13755	SR	16/09/2010	SW
R00	ISSUED FOR MANUFACTURE		DJR	01/09/2010	SW

DO NOT SCALE DRAWING

TITLE: SINGLE SCRUBBER, HCU-ER, P & ID

DRAWING No.: HCU1001012S2

REV: R04

PART No.: HCU100BA

PRODUCT / PROJECT No.: HCU-ER

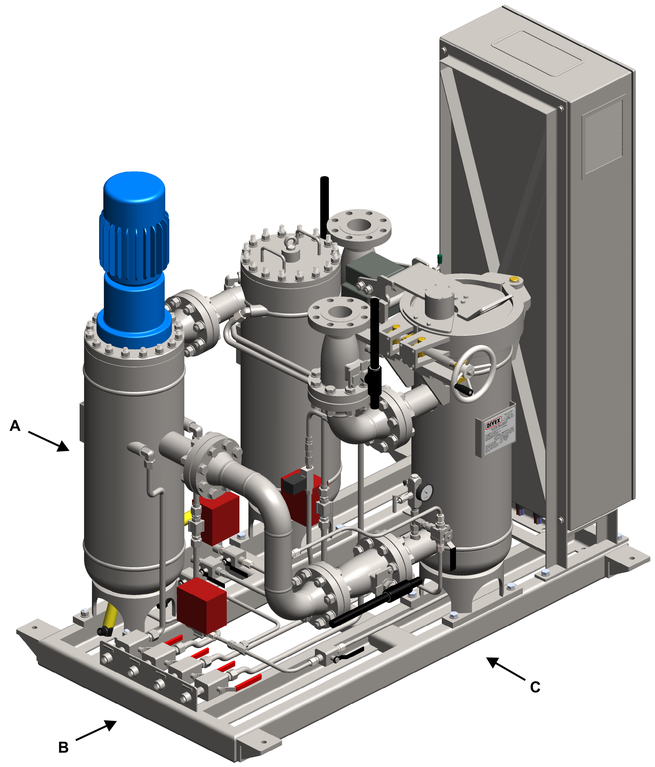
SIZE: A1 | SCALE: N/A | SHT 2 OF 2

DIVEX LIMITED
ENTERPRISE DRIVE
WESTHILL
ABERDEEN
AB32 6TQ
UNITED KINGDOM

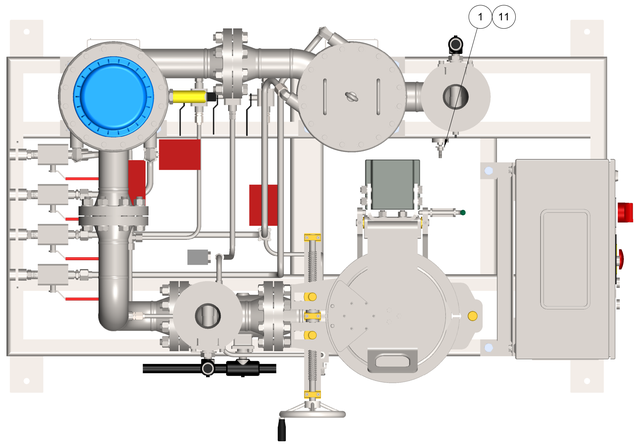
Tel : +44(0)1224 740145
Fax : +44(0)1224 740172
email : info@divexglobal.com
www.divexglobal.com

Fig 14.2 Single Scrubber HCU-ER, General Arrangement
(Drawing HCU1001110S1/S2)

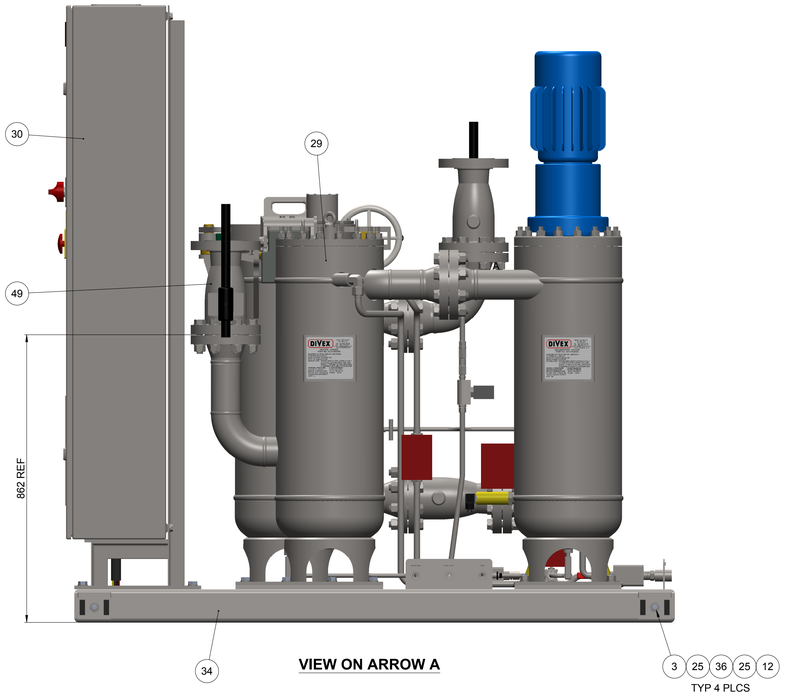
ITEM NO.	PART NO.	DESCRIPTION	QTY
1	E15384	WASHER, PLAIN, M10	1
2	FB384	BOLT, HEX HD, M12 x 1.75 x 40 LG, BS4882 GRADE B8	8
3	FB557	BOLT, HEX HD, M16 X 2.0P X 55LG, A4-70 SS	20
4	FB399	BOLT, HEX, M20 x 2.5 x 90LG, SS, A193 GRADE B8M	56
5	FJ493	CONNECTOR, MALE, 8-JIC-1/2"NPT(M), SS, MWP413BAR	9
6	FJ600	CONNECTOR, MALE, 12-JIC x 3/4"NPT(M), SS, MWP344BAR	8
7	FJ6054	ELBOW, MALE, 12-JIC, SS, MWP275BAR	3
8	FJ663	ELBOW, 45DEG, 3/4"(M)NPT - 12JIC, ST/ST, C/W N&F	1
9	FJ842	ELBOW, EXTENDED, 1/2"MNPT-8JIC, C/W N&S, S/S	2
10	FN050	NUT, HEX, M12 x 1.75, 316SS	8
11	FN062	NUT, HEX, M10, SS 316	1
12	FN063	NUT, HEX, M16, 316 STAINLESS STEEL, A4-80 GRADE	20
13	FN099	NUT, HEX, M20 x 2.5, SS, A194 GRADE 8M	56
14	FP364	NIPPLE, 3/8"NPT(M) - 3/8"NPT(M), ST/ST	1
15	FP431	ADAPTOR, REDUCING, 1/2IN MNPT X 1/4IN FNPT, SS	2
16	FP442	NIPPLE, HEX, 1/2"(M)NPT	4
17	FP450	PLUG, HEX, 1/2"NPT(M), SS, MWP482BAR	1
18	FP499	NIPPLE, HEX, 1/2"(M)NPT-3/8"(M)NPT, ST.ST.	1
19	FP698	NIPPLE, HEX, 3/4" NPT(M), SS, MWP441BAR	4
20	FP784	TEE, 1/2"FNPT	1
21	FP789	TEE, UNION, COMPLETE, 1/2"JIC	1
22	FP943	NIPPLE, 3/8" MNPT-6 JIC, C/W NUT/SLEEVE, S/S	4
23	FW060	WASHER, DOWTY, 3/8" BSP	1
24	FW071	WASHER, PLAIN, FORM A, M12, 316SS	16
25	FW079	WASHER, PLAIN, M16, A4-70 (316) SS	40
26	FW130	WASHER, FORM A, M20	112
27	GF101	PRESSURE GAUGE, BACK MOUNT, 63mm, 40BAR, 1/4"MNPT	1
28	HCU1002002	DEHUMIDIFIER/BLOWER, FINNED COIL, HCU-ER	1
29	HCU1002003	HEATER, FINNED COIL, HCU-ER	1
30	HCU1002004	PANEL, PLC, HCU-ER CONTROL	1
31	HCU1002012	CO2 SCRUBBER ASSEMBLY, R/H, HCU-ER	1
32	HCU1002025	SPOOLPIECE, 3", SCH 80, SINGLE SCRUBBER HCU-ER	1
33	HCU1002028	NOZZLE HOUSING, SINGLE SCRUBBER HCU-ER	1
34	HCU1002040	FRAME ASSEMBLY, SINGLE SCRUBBER HCU-ER	1
35	HCU1003035	SUPPORT, CONTROL PANEL, ELECTRIC BOX, HCU-ER	1
36	HCU1003036	PLATE, SKID LIFTING, HCU-ER	4
37	HCU1003068	NOZZLE, 1/2" MNPT - 3/8" FNPT, MACHINED, S/S	1
38	HCU1003073	ADAPTOR, SENSOR, 1/2" MNPT-3/8"BSPP, MACHINED, S/S	1
39	HCU1003074	PLATE, SHIM, 320mm x 50mm x 12mm THK, S/S	6
40	MC786	SENSOR, LIQUID LEVEL, VIBRATE FORK, 3/4" MNPT, LONG	1
41	MC787	SENSOR, TEMP/HUMID, 50BAR, G3/8", HCU-ER	1
42	MC788	SENSOR, LIQUID LEVEL, VIBRATING FORK, 3/4" MNPT, SHORT	2
43	RN0343-7	O-RING, 94.62 ID x 5.34 CS, 70 SHORE NITRILE	7
44	RP789	TRANSDUCER, PRESSURE, 1/4" MNPT, 69BAR, 4-20MA	1
45	TM399	TUBE, SEAMLESS, 3/8" OD x 0.064, SS 316	AS REQD
46	TM497	TUBE, STAINLESS STEEL, SEAMLESS, 1/2" OD x 0.049	AS REQD
47	TM698	TUBE, SEAMLESS, 3/4"OD x 0.064 WT, SS316	AS REQD
48	VB330	VALVE, BALL, 3/8" FNPT, SS, SWAGELOK	1
49	VB556	2 WAY VALVE, 3", REDUCED BORE, S/S, FLOWSERVE	3
50	VB704	VALVE, BALL, 3/4"NPT(F), ST/ST, WORCESTER	4
51	VB780	VALVE, BALL, 1/2"NPT, 3 WAY, PRESSURISING, HCU-ER	1
52	VB781	VALVE, BALL, 1/2"FNPT	3
53	VC307	VALVE, CHECK, 3/8" FNPT, SS, SWAGELOK	1
54	VE302	VALVE, BALL, 3/4"FNPT, C/W MOTOR, 24VDC, 4-20MA	2
55	VE303	VALVE, SOLENOID, 3/8"FNPT, 45 BAR, 24VDC (ON/OFF)	1
56	VE304	VALVE, BALL, MOTORIZED, 1/2"FNPT, 35BAR WP, S/S	1
57	VM150	VALVE, NEEDLE, GAUGE, 1/2"MNPT-1/2"FNPT, HCU-ER	1



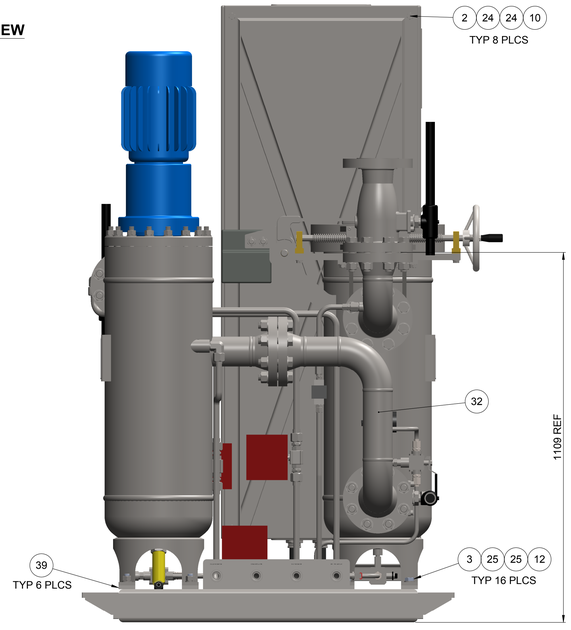
ISOMETRIC VIEW



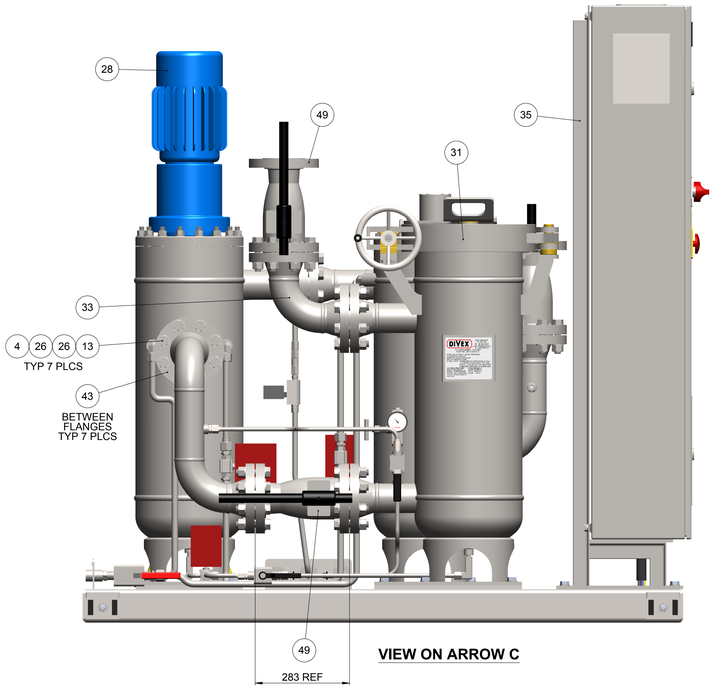
PLAN VIEW



VIEW ON ARROW A



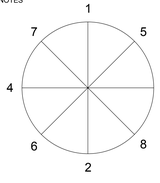
VIEW ON ARROW B



VIEW ON ARROW C

3 - DENOTES CHANGES MADE AT REV 3.

NOTES



1. ALL BOLTS SHOULD BE TIGHTENED BY HAND USING A SUITABLE HANDSPANNER UNTIL BOLTS CANNOT BE TIGHTENED ANY FURTHER BY HAND WHILST FOLLOWING TIGHTENING SEQUENCE.
2. AT THIS POINT BOLTS TO BE TORQUED TO 50% OF THE MAXIMUM TORQUE VALUE ENSURING SUITABLE NUMBER OF RUNS AS PER THE TIGHTENING SEQUENCE TO ENSURE TIGHTENING IS UNIFORM.
3. APPLY FINAL TORQUE VALUE TO THE BOLTS, AND REPEAT THE TIGHTENING SEQUENCE UNTIL ALL THE BOLTS HAVE BEEN TORQUED TO THE FINAL SETTING.
4. IT IS RECOMMENDED THAT SUFFICIENT COMPLETE TIGHTENING CIRCUITS ARE CARRIED OUT IN SEQUENECE TO ENSURE THAT ALL BOLTS HAVE OBTAINED THE SPECIFIED TORQUE.
5. CHECK AND IF NECESSARY, RE-TIGHTEN THE BOLTS IMMEDIATELY BEFORE AND AFTER PRESSURE TESTING.
6. TORQUE VALUES FOR ITEM 13 : 20Nm

1. DESIGN CODE TO PD5500 : 2006 CONSTRUCTION CATEGORY NO. 1
2. DESIGN APPROVAL ; LLOYDS RULES FOR SHIPS, DEC 1989, PARTS 1-7 AND DNV-OS-E402, JAN 2004.
3. MAX WORKING PRESSURE : 35bar g
   DESIGN PRESSURE : 35bar g
   HYDRO TEST PRESSURE : 46bar g
   DESIGN TEMP : -20°C TO +80°C
   DEPTH RATING : 350msw
4. APPROX MASS : 1200kg
5. ALL THE PIPEWORK TO BE HYDROTESTED AS PER HCU-ER P & ID DRAWING HCU1001012S1 & S2
6. ALL THE PIPEWORK AND COMPONENTS TO BE INSULATED AS PER HCU-ER P & ID DRAWING HCU1001012S1 & S2.

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: REFER TO PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH.BY
R06					
R05					
R04					
R03	FB397 REPLACED WITH FB557	16268	MJ	02/12/13	MS
R02	REFERENCE DIMENSIONS ADDED, BALLOONS ADDED, PART NUMBERS & QUANTITIES UPDATED	13832	DR	01/12/2010	MS
R01	RECLAIM LINE AMENDED & SHEET 2 ADDED	13667	DR	23/09/2010	SW
R00	ISSUED FOR MANUFACTURE	X	DR	09/09/2010	SW

DO NOT SCALE DRAWING

TITLE: SINGLE SCRUBBER HCU-ER, GENERAL ARRANGEMENT

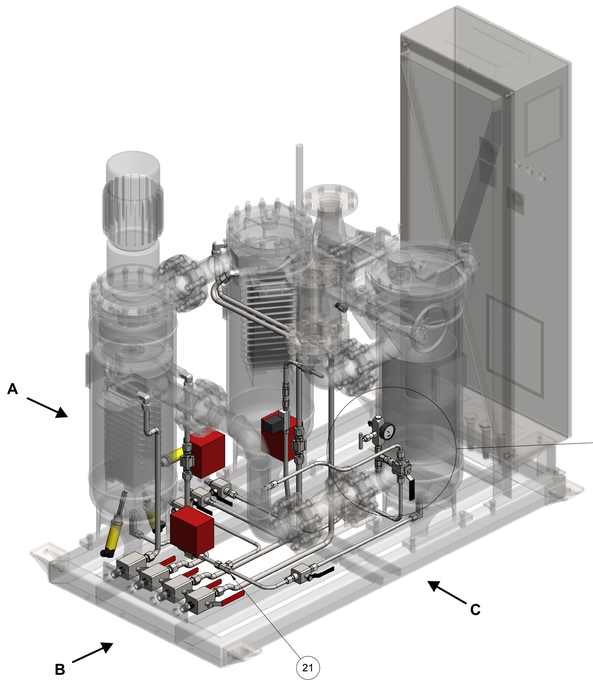
DRAWING No.: HCU1001110S1 | REV: R03

PART No.: HCU100BA | PRODUCT / PROJECT No.: HCU-ER

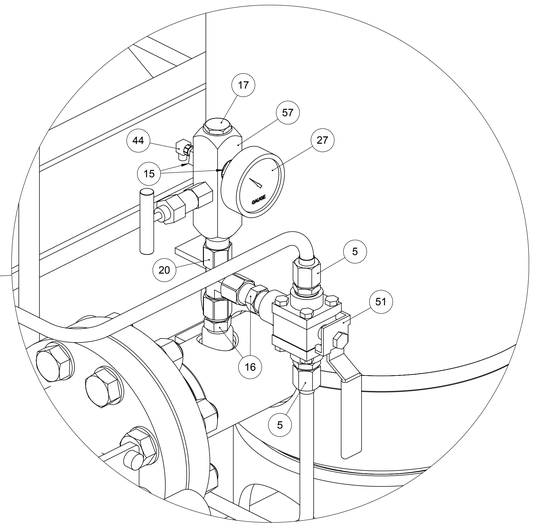
SIZE: A0 | SCALE: NTS | SHT 1 OF 2

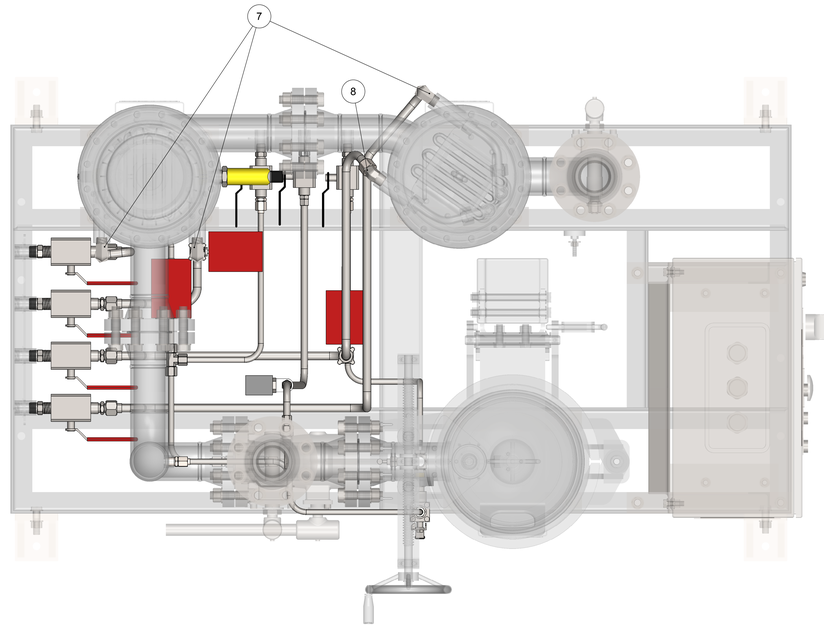
DIVEX LIMITED
ENTERPRISE DRIVE
WESTHILL
ABERDEEN
AB32 6TQ
UNITED KINGDOM

Tel : +44(0)1224 740145
Fax : +44(0)1224 740172
email : info@divexglobal.com
www.divexglobal.com

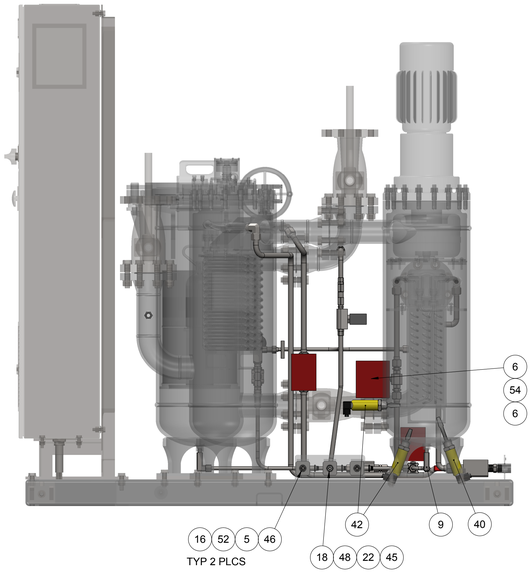


ISOMETRIC VIEW

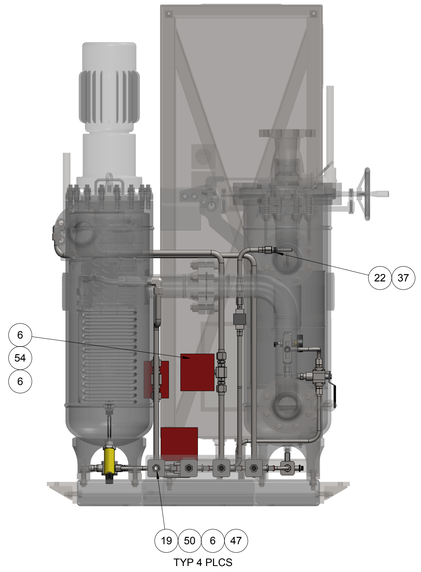




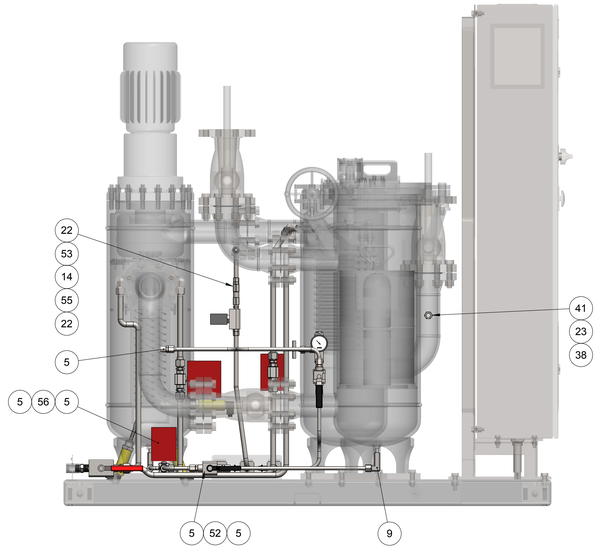
PLAN VIEW



VIEW ON ARROW A



VIEW ON ARROW B



VIEW ON ARROW C

3 - DENOTES CHANGES MADE AT REV 3.

NOTES

1. ALL PARTS REQUIRING ACCESS INCLUDING VALVES AND ELECTRICAL FITTINGS SHALL BE POSITIONED AS SUCH AND AS SHOWN UNLESS OTHERWISE AGREED.
2. ALL THE PIPEWORK TO BE HYDROTESTED AS PER HCU-ER P & ID DRAWING HCU1001012S1 & S2
3. ALL THE PIPEWORK AND COMPONENTS TO BE INSULATED AS PER HCU-ER P & ID DRAWING HCU1001012S1 & S2.

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: REFER TO PARTS LIST (SHEET 1 OF 2)

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH.BY
R06					
R05					
R04					
R03	SEE SHEET 1	16268	MJ	03/12/13	MS
R02	DETAIL VIEW UPDATED	13832	DR	01/12/2010	MS
R01	RECLAIM LINE AMENDED & SHEET 2 ADDED	13755	DR	23/09/2010	SW
R00	ISSUED FOR MANUFACTURE				

DO NOT SCALE DRAWING

TITLE: SINGLE SCRUBBER HCU-ER, GENERAL ARRANGEMENT

DRAWING No.: HCU1001110S2 | REV: R03

PART No.: HCU100BA | PRODUCT / PROJECT No.: HCU-ER

SIZE: A0 | SCALE: NTS | SHT 2 OF 2

DIVEX LIMITED
ENTERPRISE DRIVE
WESTHILL
ABERDEEN
AB32 6TQ
UNITED KINGDOM

Tel : +44(0)1224 740145
Fax : +44(0)1224 740172
email : info@divexglobal.com
www.divexglobal.com