

# Hyperbaric Conditioning Unit - External Regeneration (HCU-ER)



## Introduction

Within a Saturation Diving Complex it is necessary to condition the internal atmosphere to maintain a habitable environment. This is achieved by the use of a Habitat Conditioning Unit (HCU) which extracts the gaseous atmosphere, dehumidifies it, removes CO<sub>2</sub>, and reheats the gas on its return to the chamber complex. Conditioning units are commonly installed within the chamber, inconveniencing the divers with the continuous hum of the blower and the need to frequently change out chemical absorbent; External Regeneration (ER) systems provide increased diver comfort and effective use of support personnel.

## Description

The HCU-ER HCU100 Series scrubbers offer suitable capacity to condition both the entry lock (EL) and the main lock (ML); providing added benefit over other conditioning units which are typically capable of supporting only the EL or ML. Scrubbing capacity can be further increased in this Series of models by the incorporation of an optional water injection to the gas inlet. Models within the HCU100 Series provide local and remote control capability. Local control remains in the form of touch screen Human Machine Interface (HMI). The control system can be integrated with any other remote monitoring and/or control device (e.g. remote HMI, SCADA). The HCU100 Series is available in single and twin scrubber configurations. The single scrubber configuration requires shut down of the entire unit for scrubber change over to satisfy the double block and bleed safety principle while the twin configuration offers uninterrupted operation through its twin scrubber design, enabling the change out of chemical absorbent whilst maintaining habitat conditioning capability.

## System Overview

The HCU-ER HCU100 Series extracts gas from the chamber into the active scrubber, injecting additional moisture (optional) to improve scrubbing capacity. The gas passes through the chemical absorbent which retains any CO<sub>2</sub> present in the gas.

Gas is then transferred to the dehumidifier where it passes over a cold water coil. This coil has the effect of lowering the gas to a temperature below its dew point; reducing relative humidity and enabling the collection of condensation in the dehumidifier sump.

The 3-stage blower then accelerates the gas into the heater where a hot water coil increases the gas temperature. The fully reconditioned gas is then circulated back into the chamber.

Local control via HMI allows the operator to view at a glance chamber temperature, humidity, blower speed and alarms; as well as establish set points for these criteria and run system tests. Essential to the operation of the HCU-ER is the supply of 440VAC, 3PH, 60Hz, which is transformed and rectified to 24VDC by the integral HCU transformer.

## Water Injection Nozzle (Optional)

The ½mm water injection nozzle sprays a water mist into the gas inlet, saturating the incoming gas to improve the effect the chemical absorbent has at removing gas CO<sub>2</sub> content. Water supply is controlled by a solenoid valve. The water injection line requires supply from a potable water skid/system connected to the skid at the ½" FNPT water injection connection.

## CO<sub>2</sub> Scrubber(s)

Gas enters the HCU-ER via a 3" inlet connection and is diverted to the scrubber which contains a double basket assembly with a total capacity of 17.6 (8.8 kg in each basket) of Sodalime chemical absorbent, providing approximately 8 hours habitat conditioning for up to 6 divers in normal operations. To protect operators, a safety interlock is installed onto each scrubber lid which prevents opening whilst the scrubber is under the working pressure. Scrubber sumps are drained manually by operating the associated screw-lift valve.

## Dehumidifier

The coil pipe within the dehumidifier provides cooling and requires supply of cold water from a chiller unit connected at the ¾" FNPT cold water inlet and outlet. Condensation is collected in the sump and is drained manually by means of a screw-lift valve. An alarm signal sensor is installed to alert the user and shut the system down in the event of this not being carried out.

## Blower

The 3-stage blower is of hyperbaric design and incorporates a magnetic drive coupling, removing the need for conventional shaft seals which would wear and compromise pressure integrity. It is dynamically balanced to permit speeds of up to 6000 rpm.

## Heater

The coil pipe of the heat exchanger within the heater provides heating and requires supply of hot water from a heater unit connected to the HCU-ER at the ¾" FNPT hot water inlet and outlet. Gas is returned to the chamber via the 3" outlet connection.

## Controls

The HMI allows the operator to oversee automated functions with manual controls remaining for redundancy purposes. When control functions are delegated to a remote control point (e.g. remote HMI, SCADA), functions of the local HMI become locked from user input.

At installation the control parameters are setup by the operator to allow core functions to be controlled on an automated process; this results in automated temperature, humidity and water injection valve control. All of these functions have a manual control mode in case of fault, with all set points in this instance being set by the operator.



## Specification

Design Depth	450msw
PV Design Code	PD5500:2015
Construction	Duplex Stainless Steel
Number of Occupants Supported	6 Compressed Divers
Max Operating Depth	450msw
Working Pressure	45 Bar
Test Pressure	67.5 Bar
Design Temperature	-20°C to 80°C
Gas Inlet	3" ANSI B16.5 Class 600 RF Flange
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Gas Reclaim	½" FNPT
Hot Water Inlet	¾" FNPT
Hot Water Outlet	¾" FNPT
Cold Water Inlet	¾" FNPT
Cold Water Outlet	¾" FNPT
Water Injection	½" FNPT
Drain Line	½" FNPT

Dimensions	HCU100AC (Twin Scrubber)	HCU100BC (Single Scrubber)
Length	2000mm	2000mm
Width	1200mm	1200mm
Height	1850mm	1850mm
Weight	1400 kg	1100 kg

Hot Water Requirement	
Flow	≥ 45 lpm
Temp	≥ 60°C
Pressure	≥ 4 Bar

Cold Water Requirement	
Flow	≥ 45 lpm
Temp	≤ 2°C
Pressure	≥ 4 Bar

Fresh/Potable Water Requirement	
Min Flow	5 lpm with 10 µm filtration
Min Temp	Ambient
Min Pressure	55 Bar

Power Requirement	440VAC, 3-, 60Hz
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CO <sub>2</sub> Scrubber	
Capacity	17.6 kg (8.8 kg per basket)

3-Stage Variable Speed Blower	
Max Rpm	6000 rpm
Gas Flow	2.8 m <sup>3</sup> /min

Dehumidifier	
Cooling Capacity	12kw@180msw
Water Removal	600ml/min at 50% RH

Heater	
Heating Capacity	12kw@180msw

Controls	
Temperature Control	22°C to 32°C +/-1°C (+/-0.5°C tgt max var)
Humidity Control	40% to 65% RH +/- 5%



## Order Codes

Hyperbaric Conditioning Unit  
External Regeneration (HCU-ER) Twin Scrubber  
HCU100AC

Hyperbaric Conditioning Unit  
External Regeneration (HCU-ER) Single Scrubber  
HCU100BC

KI-MDS-567 R1