INSTALLATION OF 1500L GRAVITY FED EMERGENCY TANK SHOWER WITH ZERO POWER COOLING SYSTEM

1. Background

Hughes Safety Showers UK (Hughes) installed and commissioned the world's first zero power cooling system (ZPC) for emergency tank showers at Saudi Aramco in Khurais, an oil field located 300km Southeast of Riyadh. This site produces 1.5 million barrels of oil per day[1]. Hughes, a UK based manufacturer of emergency safety showers for over 50 years, were excited to be given the opportunity to collaborate with Saudi Aramco in testing and showcasing the new zero power cooling system for their emergency tank showers.

Emergency tank showers are essential in areas where incoming water feeds are unreliable or suffer from solar radiation that can heat water to levels above the safe limits required to supply emergency safety showers. The internationally recognised ANSI Z358.1 standard stipulates the water supplied to emergency safety showers should be tepid, between 16 C and 38 C. Cooling water within tank showers requires chiller systems to maintain water at a set point no matter where or when they are used. They provide potable water at a safe temperature to ensure no further harm is inflicted upon the casualty on activation of the safety shower.

2. Products used in the Saudi Aramco project

- EXP-J-14KS/1500: 1500 litre emergency tank shower with a stainless-steel frame
- STD-25K: GRP covered eye/face wash unit - installed inside the tank shower
- ZPC: Integrated Zero Power Cooling system for Hughes tank showers

All products and parts used are suitable for use in hazardous areas.

3. Test data logging equipment used

- Tinytag - TGP-4017 (-40 C to +85 C) temperature logger to measure ambient air temperatures
- Tinytag - TG-4100 AQUATIC 2 (-40 C to +70 C) temperature logger
- Tinytag data logger reading cables and software to extract the data stored on the sensors

Internal water temperature data logger unit located in the centre of the water tank of the EXP-J-14KS/1500 safety shower.
External ambient temperature data logger unit located on the outer casing of the EXP-J-14KS/1500 safety shower.

4. Test overview

An emergency tank shower (EXP-J-14KS/1500) fitted with the zero-power cooling system was installed at the Aramco site in Khurais, KSA. The unit was exposed to ambient daytime temperatures exceeding 50 C.

The shower was situated in an area exposed to sunlight from all sides, all day, without any shade. No power was supplied to the unit and there was no water connection to the tank shower.

1500 litres of water was supplied to the tank shower via a hose. The supplied water temperature exceeded 41 C from the site's water main.

The insulation of the tank system combined with the cooling system maintains water at temperatures below the required limits of ANSI Z358.1 (less than 38 C).

The commissioning period for the tank shower unit (the time needed before the water is at a safe temperature) was expected to be 24-36 hours.

Saudi Aramco permits were obtained, and site personnel were present during the installation of the equipment and the visit to download readings from the test dataloggers.

The products used are all suitable for use in hazardous area or zones – the cooler has no moving or electrical parts.

[1] *1.5 mbpd production - https://www.arabianindustry.com/oil-gas/news/2018/sep/26/saudi-aramco-will-raise-production-at-khurais-field-to-15mn-bpd-5982678/*

1500L Emergency Tank Shower
with Hughes Zero Power Cooler®

Hughes Zero Power Cooler®

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6. Working Principle of the Tank Shower and Zero Power Cooling System

EXP-J-14KS/1500 - 1500 litre gravity fed emergency tank shower with a stainless-steel frame

The tank of the EXP-J-14KS/1500 delivers water to the shower using gravity. The tank is located above the shower unit and will exceed the minimum delivery volume and time needed to ensure a thorough decontamination and meet ANSI Z358.1 requirements. The stainless-steel frame is structurally tested to withstand earthquakes and the weight of the water. The tank has insulation as part of its design to help maintain water temperatures.
More information on the EXP-J-14KS/1500 can be found in the appendices.

ZPC - Integrated into the emergency tank shower (Patent Pending)

The ZPC cooling system uses internal and external exchangers to cool the water. It works by using lower night-time temperatures and a convection process to transfer heat out of the water tank into the air. The ZPC prevents the tank water from heating in the daytime sun by stratifying the hotter water to the top of the system allowing the cooler water to remain in the tank.

A video showing how the ZPC works can be viewed here: https://youtu.be/NGDQdXeZ4oM

More information on the ZPC can be found in the appendices.

TUV testing

A third party test report from TUV is available highlighting the testing and data of the zero power cooling system.

7. Standards and Tepid Water

ANSI Z358.1-2014

ANSI states that tepid, potable water should be used when supplying emergency safety shower and eye/face wash equipment. It defines tepid water as temperatures between 16-38 C (60-100 F).

Tepid water needs to be delivered to the user for 15 minutes to ensure there is adequate showering for the user.

A minimum of: 76 litres per minute are needed for the shower and 12 litres per minute for the eye/face wash unit.

Emergency safety showers should be located so that they can be reached within 10 seconds of the hazard.

8. Conclusion

Positive results were gained following the tests at Saudi Aramco's site in Khurais. The test unit demonstrates the effectiveness of the Zero Power Cooling system when installed on the gravity fed tank shower. After just 16 hours the water temperature inside the tank was at a safe enough level to be used for the emergency safety shower. The peak daytime temperatures of nearly 55 C showed that the test unit was able to withstand the high ambient temperatures of the region. The unit successfully maintained the water temperatures well within the required ANSI Z.358.1 tepid water range for emergency safety showers. This was achieved without the need of a power source making it ideal for any location where there is a requirement for a safety shower.

9. Appendices

a) EXP-J-14KS/1500 Datasheet
b) Hughes Zero Power Cooler® Datasheet
c) TUV Report

Hughes Zero Power Cooler®
Patent Approved
Pat. US 12,209,808 B2

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