RSS US Services Inc.	Client: N/A Project: N/A Project No: N/A Prep. By: PAC Rev. No.: 0 Date:

TITLE: **DM-76 Aviation Control Tower Escape Chute System – Basis of Design**

RSS US Services Inc.

DM-76
Aviation Control Tower
Escape Chute System

BASIS
OF
DESIGN

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1.0 INTRODUCTION

RSS are based in Houston and we offer an extensive range of safety & survival products worldwide. RSS design, fabricate and, install & comprehensive range of Marine Evacuation Systems (MES) for the offshore oil & gas industry and escape chute systems for, Military & Commercial Aviation, Industrial and Mining sectors.

RSS has a proven track record of supplying Control Tower Escape Chute systems to many clients worldwide including US Government & US Air Force.

2.0 SYSTEM OVERVIEW

RSS DM-76 Industrial Vertical Escape Chute System is a floor mounted evacuation system designed to be installed in a cut-out. The escape chute system enables personnel trapped at height within a control tower to evacuate safely to ground level via the vertical three layered chute system that protects the evacuees from direct flame impingement, heat flux and combustion products while descending to ground level.

The DM-76 is a simple - mechanical free fall system reducing risk of failure to the lowest possible level. To deploy the system the individuals wishing to escape to ground level open the chute container lid, turn the control handle clockwise 90º, this releases the escape chute container lower trap door. The escape chute, free falls to deck level and the first individual transits down to deck level in less than 60 seconds.

For severe weather environments the system can be fitted with electrical heat tracing to ensure availability on demand even in the harshest of conditions. Example RSS has installed a DM-76 with electrical heat tracing system at US Air Force base in Greenland inside the Arctic Circle.

3.0 DESCRIPTION OF SYSTEM

The system is comprised the following main components:

- Qty 1 x Chute container with lower trap door, hinged lid and hydraulic dampened arms. The chute container depth (excluding the lid) can vary dependent upon the length of chute required to be packed inside, however the standard dimensions are:

  890mm x 890mm x 1219mmH (35'' x 35'' x 48''H). Height can vary dependent on control tower chute height.

- Three Layered Vertical Escape Chute designed to support a dead weight of 2 tonnes. Heat resistant to 600^{o} C, melting point 800^{o} C. The chute length varies dependent upon the height of the control tower above the deck exit location. Note: 1-meter air gap is required at the bottom for evacuees to exit

3.1 Chute Container

The system is comprised a deck mounted chute container into which the chute, is packed. The container is fabricated from powder coated mild steel.

The main chute container is painted red with the lower trap door safety yellow and red chevrons and the words '***Escape Chute'***. In all cases an epoxy three coat preparation and painting system is provided with supporting fabrication and painting certificates, metal mill test reports, welding certs, UV and UT reports provided. All paint applications are suitable for offshore marine environments.

The deck mountable chute container requires a cut out of approx. 900m x 900m (35.4" X 35.4") or fits into a deck mounted support frame (supplied as an option by RSS and has a hydraulically dampened lid and lower trap door. The lid assembly is safety yellow and decaled with red chevrons and the wording '***Escape Chute'***. A serial number identification plate is provided and lists the system serial/model number with the date of manufacturer and RSS emergency contact telephone numbers.

3.2 Vertical Three Layer Chute

Layered Vertical Escape Chute designed to support a dead weight of 2 tones and heat resistant to 650 degrees with a melting point of 800 degrees. The Chute length varies dependent on operating height; however in all cases a one meter air gap is required at deck level for evacuees to exit the chute.

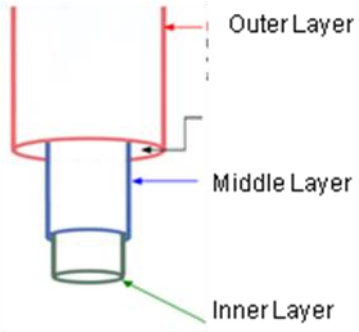
Layer 1
The outer 'Flame-resistant' layer Is there to protect the individual from the flames and radiated heat. This layer can withstand a constant temperature of 650°C and starts to melt at 800°C.

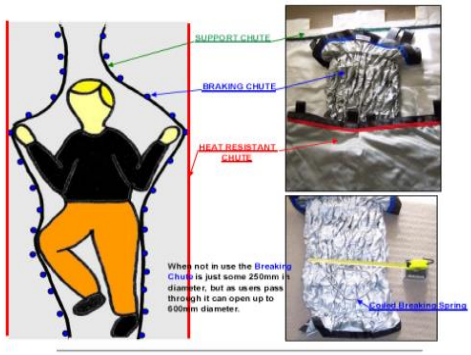
There is a space between the outer and middle layer designed to reduce the radiated heat transferred to the middle & inner chute layers.

Layer 2
The middle 'Braking' layer, this is fitted with a series of stainless-steel coiled springs sewn into the material. These springs have a small diameter designed arrest descent as the individual descends. Descent speed through the chute is adjusted by the individual extending or withdrawing arms & legs.

The evacuee only needs to apply pressure on the chute's interior wall with legs and arms, the more pressure, the more you slow down, less pressure and you will speed up.
In all cases descent speed is controlled and safe.

Layer 3:
The Inner Layer - Support layer this is the layer that is connected to the storage/deployment device, and holds the chute in place; it can withstand the dead
weight load of 2 tones.





3.3 Material Specification

INNER CHUTE LAYER:

MATERIAL : Polyester
WARP : Polyester
Breaking Tenacity : 185.2 Tensile Strength (Kgf) (C.R.E. Grab Method)
Breaking Tenacity : 82.7 Tearing Strength (Kgf) (C.R.W. Tongue Method)
Flame Resistant : None
Decomposing Temperature : 260 Degrees "C"
WEFT : Polyester
Breaking Tenacity : 184.9 Tensile Strength (Kgf) (C.R.E. Grab Method)
Breaking Tenacity : 80.4 Tearing Strength (Kgf) (C.R.W. Tongue Method)
Flame Resistant : None
Decomposing Temperature : 260 Degrees "C“

MIDDLE CHUTE LAYER:

MATERIAL : Nylon 1901
WARP : Nylon 1901
Breaking Tenacity : 52.0 Tensile Strength (Kgf) (C.R.E. Grab Method)
Breaking Tenacity : 3.0 Tearing Strength (Kgf) (C.R.W. Tongue Method)
Flame Resistant : None
Decomposing Temperature : 215 Degrees "C"
WEFT : Nylon 1901
Breaking Tenacity : 51.9 Tensile Strength (Kgf) (C.R.E. Grab Method)
Breaking Tenacity : 2.8 Tearing Strength (Kgf) (C.R.W. Tongue Method)
Flame Resistant : None
Decomposing Temperature : 215 Degrees "C"
MATERIAL : Stainless Steel Springs AIS 1304
Breaking Tenacity : 150 Kgf/mm2 (1471N/mm2)

OUTER CHUTE LAYER:

MATERIAL : Electro Glass, Fiber Glass (Gray / Silver)
Weight : 440g/m2
Softening Point : 800 Degrees "C"
Temperature Limit for Continuous use : 550 to 600 Degrees "C"
Tensile Strength - WARP : Over 174.0Kgf/2.5cm (1705N)
Tensile Strength -WEFT : Over 128.0Kgf/2.5cm (1254N)

4.0 DRAWINGS, MANUALS, CERTIFICATION, AND SERVICING

4.1 Drawings Manuals & Calculations

A complete set of technical drawings/calculations are developed for each build and submitted for customer approval prior to the commencement of work scope. Full operational and maintenance manuals are supplied in electronic and paper format with the installed system.

4.2 Certification

All components are supplied with appropriate certification, covering: Escape Chute, Chute Container and Mechanical Deployment Lever as applicable.

4.3 Servicing

Annual servicing of the DM-76 system is required; this can be carried out by RSS designated service engineer. The DM-76 system has been designed to be low maintenance providing reliability and ease of use. Bi-annual inspections are carried out.

The bi-annual inspection includes testing and recertification of the escape chute system which is removed and inspected for re-certification purposes.

5.0 OPTIONAL EQUIPMENT & SERVICES

RSS offer a range of optional equipment for the DM-76 as follows

5.1 Electrical Heat Tracing Winterization System

The chute system can be fitted with an electrically operated heat tracing blanket over the stored escape chute whilst in its container. This provides winterization during sub-zero conditions and ensures the chute remains fully functional and ready for use at all times.

The chute material is designed to tolerate - 48ºC temperatures, however water retention within the chute whilst it is stored could create a situation where the chute would not deploy as the water would freeze around the outer material make the chute material rigid.

To prevent this situation a heat tracing system is used and incorporated within a thermal blanket that protects the chute from sub-zero temperatures. The system can be supplied at 110 volts 60 Hz and only requires an external power supply to be available. A thermostat with audible alarm is provided so that when the temperature drops below the set-point value the alarm will activate. The heat tracing system requires very little maintenance and is inspected on a monthly basis to ensure the chute is freeze free.

Main Components Heat Tracing System

- 12”W x 12”L x 6”D Powder coated Steel F.E.A.M Enclosure
- Main front Mounted Power Isolation Switch
- Heater Control Switch – OFF –ON
- Emergency Stop Button – Mushroom Type RED
- Digital Temperature Gauge Escape Chute & Control Rod Circuit
- Digital Temperature Gauge External Air
- Internal Audible Alarm Siren
- Top Mounted Red Beacon
- Cable Glands and Thermally Insulated Cable
- Terminal Junction Box Chute Container
- Adjustable thermostat x 2 Chute and Control Rod
- Plug Play quick release connectors Chute/Control Rod

In addition to the heat tracing an additional circuit is provided to operate a pressure switch fitted to the lower chute container door. It is designed such that when the chute is deployed a signal is sent to the main control panel which in turn can be configured to transmit an alarm to the emergency services / Fire-Department.

5.2 Training Chutes

RSS offer training for on-site training of personnel. Length can be specified by the customer. In all cases a full documentation pack is provided in paper/electronically and web based secure download option and includes:

- Technical drawings and calculations.
- Certificates covering all certified components.
- Environmental criteria.
- Compliance and performance specifications.
- Individual component and total weights analysis.
- Operational & maintenance manual including preventative maintenance schedule.
- Training manual.
- Evacuation statistics based on chute length.

5.3 Training

RSS can provide 'Train the Trainer' courses where key personnel are trained to become certified trainers. The Train the Trainer course can be carried out at the customer's facility or at a certified RSS training facility.

Each candidate is certified for a period of 2 years with certificates issued. The trainers then provide on-site training to all on board personnel.

6.0 IMAGES

6.1 **DM-76 Chute Container Shown Under Installation**

6.2 **Control Tower Staff Evacuating Through the Chute**

6.3 **Chute System Pre- packing Inspection Showing Optional Heat Tracing**

6.4 **Chute Container Installed in Control Tower Viewed from Ground Level**

6.5 **Chute Container Internals Showing Heat Tracing Thermocouple**

6.6 **DM-76 Mounted into Control Tower Outside Control Room**

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