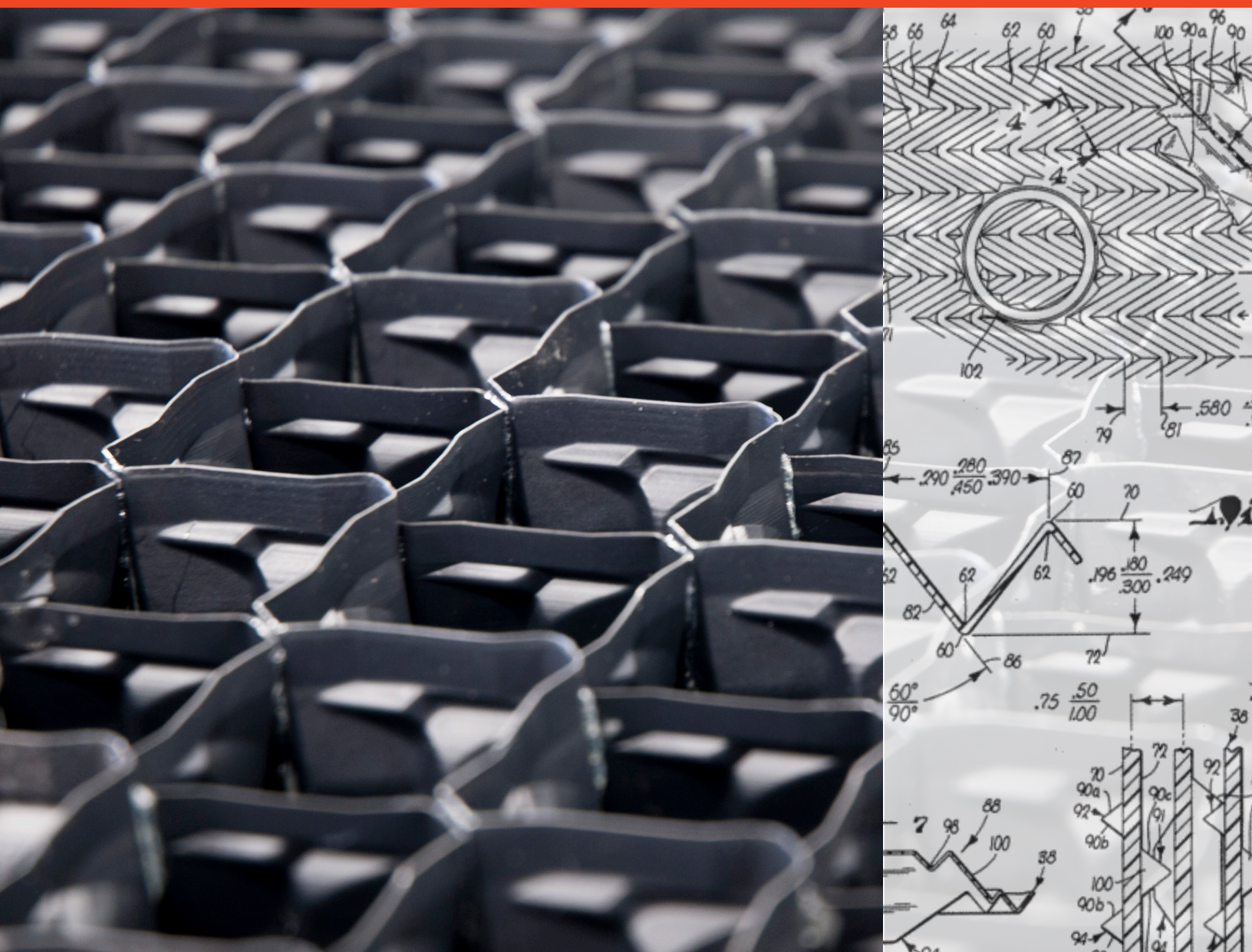
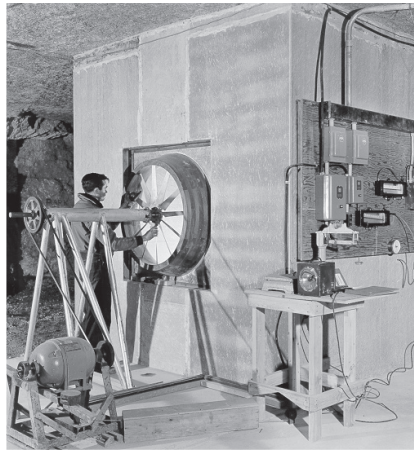


RELIABILITY - PERFORMANCE - OPERATING EFFICIENCY

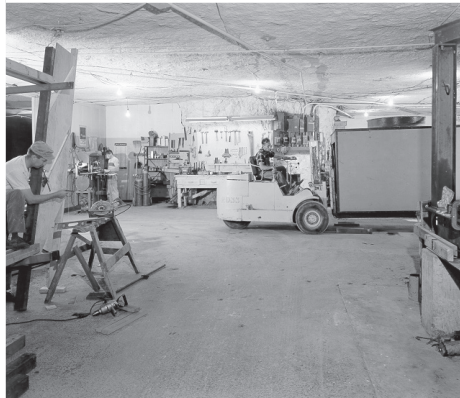


SPX®
COOLING TECHNOLOGIES

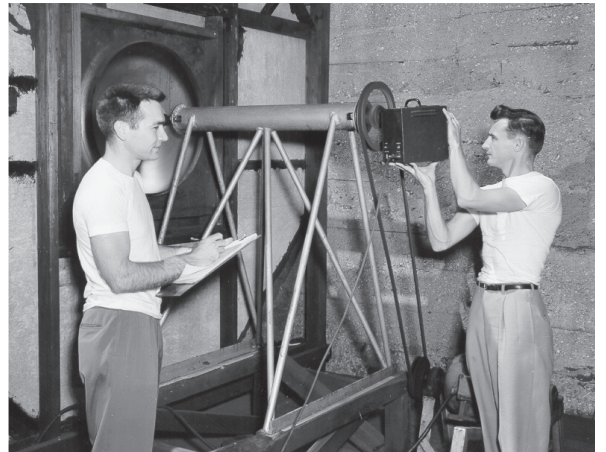




Research and Development Center



**Founded:
1957**





From its inception, The Marley Company, now SPX Cooling Technologies, Inc., has been committed to a strong research and development program that has, over the years, produced industry-leading technologies and innovations. The Research and Development Center, located in Kansas City has been the global technology hub for SPX product brands since its foundation in 1957.

The Research and Development Center, constructed on the site of a former limestone mine, provides an ideal year-round scientific environment. Inside the Research and Development Center's three underground acres, 70 feet below the surface, experiments are performed under controlled laboratory conditions. Above ground, seven acres provide ample space to conduct prototype testing under ambient conditions.

Through a perpetual program of expansion and improvement, the Research and Development Center has evolved into a world leading process cooling test facility – unique in the industry. The technological advances that continue to be developed help establish global standards for process cooling and individual components.

SPX Cooling Technologies and its subsidiaries have been granted 145 US patents along with numerous international patents and copyrights on cooling tower designs and components. The commitment to design excellence, technical superiority and product quality continues at the Research and Development Center where our engineers and scientists are working every day to develop the next break-through in evaporative cooling technology.

MARLEY® 

RECOLD® 

Performance

MODELING LAB

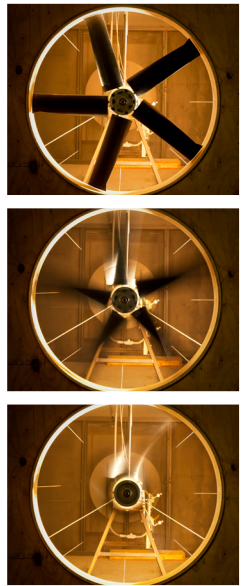
- Conceptual parts are designed and refined using sophisticated modeling software and are built in-house to ensure quick turn-around times and high quality.
- Once designed, programmable machining capabilities with CNC precision accurately manufacture the parts.
- All current fills, including **MX75** and **DF254**, were modeled, tested and verified by this process.

FAN DEVELOPMENT

- Fan performance has a direct influence on tower capacity and it is important to develop accurate fan performance models to properly size cooling towers and other heat exchangers.
- Fan development capabilities include a special purpose wind tunnel for fan performance testing, fan sound testing, structural load testing, competitive fan validation and leading edge erosion testing.
- To ensure the final design will produce the expected airflow, fan prototypes are tested in the actual model cooling tower configuration.
- All current fans, including both the **X7** and **Ultra Quiet** fans were modeled, tested and verified using this process.

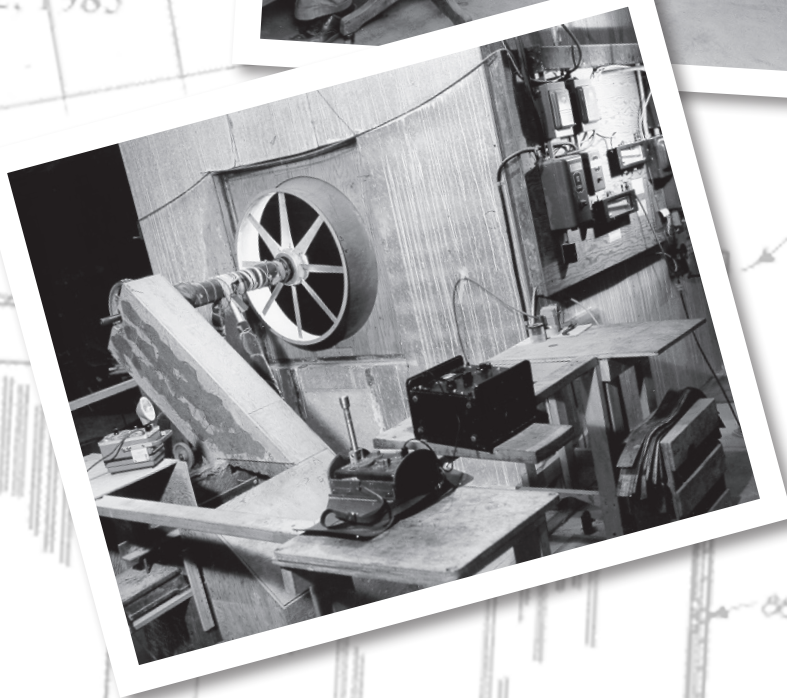
THERMAL PERFORMANCE TESTING

- To ensure accurate and reliable thermal performance ratings of developed fill configurations, prototype testing is conducted in large crossflow and counterflow test cells.
- The ability to measure the heat and mass transfer capabilities of all types of heat exchange surfaces (fluid cooler coils, dry finned bundles, splash fill, film fills), allows for a variety of heat exchange surfaces to be designed to address various customer needs.
- Information measured from these test cells is used to size and select cooling towers and other heat exchangers around the world.
- The top three fills in use today, **MX75**, **DF254** and **Mesa** were all tested in these thermal test cells.



U.S. Patent Oct. 22, 1985 Sheet 4 of 4

Over 50 Years



of Innovation



Operating Efficiency

SOUND ATTENUATION

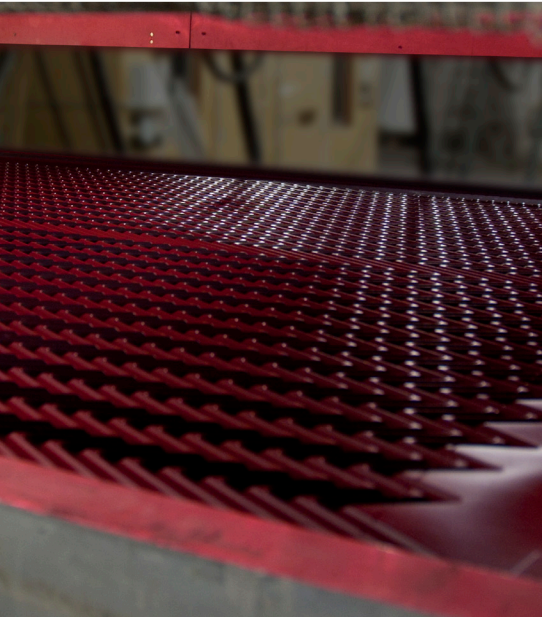
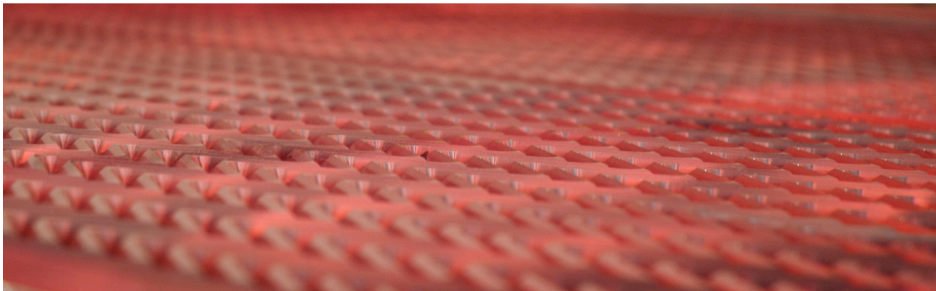
- Various testing procedures are available to identify the optimal solution for customer specific sound requirements.
- Examples of solutions to sound sensitive projects include low noise fans, ultra quiet fans, air inlet and splash and air outlet attenuation.
- The **Ultra Quiet** fan was recently tested onsite at the Research and Development Center.

WATER DISTRIBUTION

- Cooling tower water distribution systems are evaluated using both scaled and full size models.
- Attributes of a good spray system design include uniform water distribution over the fill surface to provide the best heat transfer capacity, low nozzle head pressure to lower operating costs and large orifice sizes to reduce clogging.
- The **NS5A**, **Balcke SK** and **SF**, **NS7** and **ST** nozzles have all been tested at the Research and Development Center.

FILL MODELING

- Capabilities allow for optimized heat exchange surface geometries for counterflow and crossflow towers with designs that address customer requirements, including efficient energy usage, poor water quality, small footprints, sound requirements and low operating costs.
- Complex and innovative designs for film fill and splash fill produced in the modeling lab become reality through versatile machining and mold-making capabilities.
- Complete fabrication capabilities are currently supporting new prototype development of **counterflow film fill**, **crossflow film fill** and **crossflow splash fill**.



Reliability

CHEMISTRY LAB

- Microscope metallurgical examinations, UV exposure testing, resin burnout, small burn tests and density tests are part of the dedicated analysis performed to check material specifications and perform failure analysis.
- The lab has sophisticated drift-testing capabilities and an area dedicated to analyze the effects of biological fouling on various types of fill media to ensure proper material and product application.
- **Fiberglass pultrusion** component designs are verified at the Research and Development Center.

DESTRUCTIVE TESTING

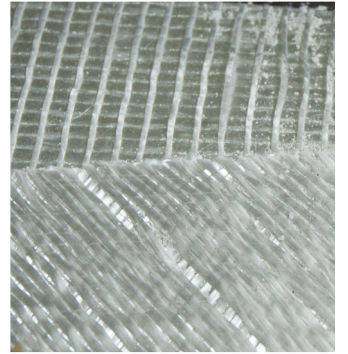
- Testing is done on fiberglass, plastic, metal and wood to identify the characteristics of materials, verify material properties and understand how materials fail. Tests include tensile, compression, bending, impact, heat deflection and corrosion.
- Structural engineers set engineering design standards and make sure proper material strengths are used during the design process. This ensures the tower structure can withstand wind loads, heat, moisture and seismic loads while meeting customer expectations for product life.
- **Seismic testing** for OSHPD and CBO, as well as **strength** and **longevity** testing of fiberglass and PVC components are supported and evaluated.

MATERIAL TESTING

- Proper material selection and application requires the knowledge of how materials react when subjected to the cooling tower environment. Information is gathered to support proper tower operation covering daily operating requirements and extreme environmental conditions.
- Located within the Research and Development Center are environmental chambers that allow determination of the effects of temperature, moisture, salt fog and other aggressive environments on materials chosen for cooling tower components.
- **Fiberglass pultrusion** component designs are tested in exposure chambers and verified to meet structured requirements.

PROTOTYPES AND OPERATING MODELS

- The area outside of the Research and Development Center is set up for prototype testing that allows validation of designs and the ability to adjust product capabilities for a reliable, durable and highly efficient product.
- Prototype towers are tested for thermal capacity, sound, vibration and other design improvements.
- Third-party tests of field-erected towers and yearly CTI certification tests of factory-assembled products are conducted to ensure standards are met.
- Production components, including the **MX75**, **DF254** and **Mesa** fills, were verified in large operating models and through field tests.



Research and Development Center

SPX COOLING TECHNOLOGIES, INC.

7401 WEST 129 STREET
OVERLAND PARK, KS 66213 USA
913 664 7400 | spxcooling@spx.com
spxcooling.com

DC-12 | ISSUED 05/2017

COPYRIGHT © 2017 SPX CORPORATION

In the interest of technological progress, all products are subject to design and/or material change without notice.

