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**DYNAJET**  
HIGH-PRECISION SECONDARY  
COOLING SPRAY NOZZLES

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# ULTIMATE FLEXIBILITY MEETS HIGHEST PRECISION: EXPERIENCE THE NEXT STEP IN COOLING EFFICIENCY

## YOUR CHALLENGE

Steel companies need to optimize the continuous casting process faster than ever to meet the growing quality requirements of the market, and to offer customers an increasingly wide range of steel grades and sections sizes. This requires the highest standards of flexibility and precision for the continuous casting process. One vitally important component is the secondary cooling system.

That's why the secondary cooling system requires the best possible combination of cooling system hardware, control software and process and cooling expertise. The core element of the cooling system hardware is the spray nozzle, for which highest standards are demanded in terms of spray properties, flexibility and durability.

Which nozzle technology meets these high demands – and at the same time offers the advantages of a complete solution from a single source?

## OUR SOLUTION

The DynaJet nozzle family has been designed and precisely tailored to the exacting requirements of today's continuous casting process, based on the decades-long cooling-know-how of Primetals Technologies. The result is homogeneous spray distribution and heat dissipation, high control ratio, low sensitivity to clogging, precise positioning together with simple installation and a minimized number of spare parts.

In combination with the nozzle width adjustment system 3D Sprays and the ultimate process model Dynacs 3D, Primetals Technologies provides a powerful total cooling package that is available for every type of plant.

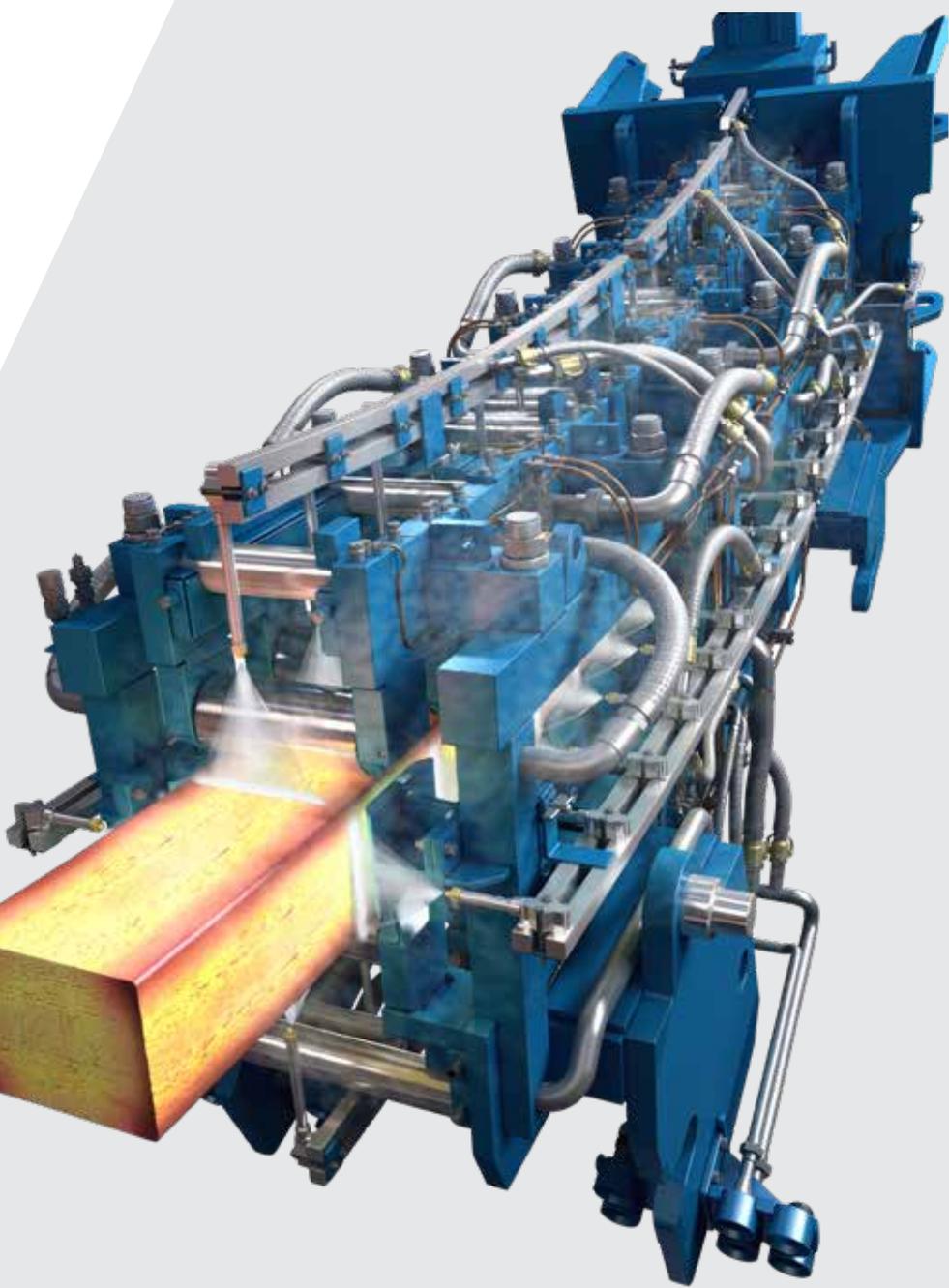
DynaJet nozzles are available in a wide range of variants which can be perfectly matched to the individual continuous casting machine requirements. This includes new plants and existing plants which can be revamped following cooling studies to give optimum cooling conditions. The performance of each nozzle design is verified by means of Primetals Technologies's in-house nozzle test facility.

The DynaJet nozzle family is already proven in hundreds of plants and is optimized for current and future requirements.

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An efficient secondary cooling system today is based on an intelligent overall solution. With decades of experience in metallurgical engineering, Primetals Technologies combines high performance components with intelligent control systems – for highest cooling efficiency. Benefit from complete solutions from a single source.

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### **ADVANTAGES OF COMPLETE IN-HOUSE COOLING EXPERTISE:**

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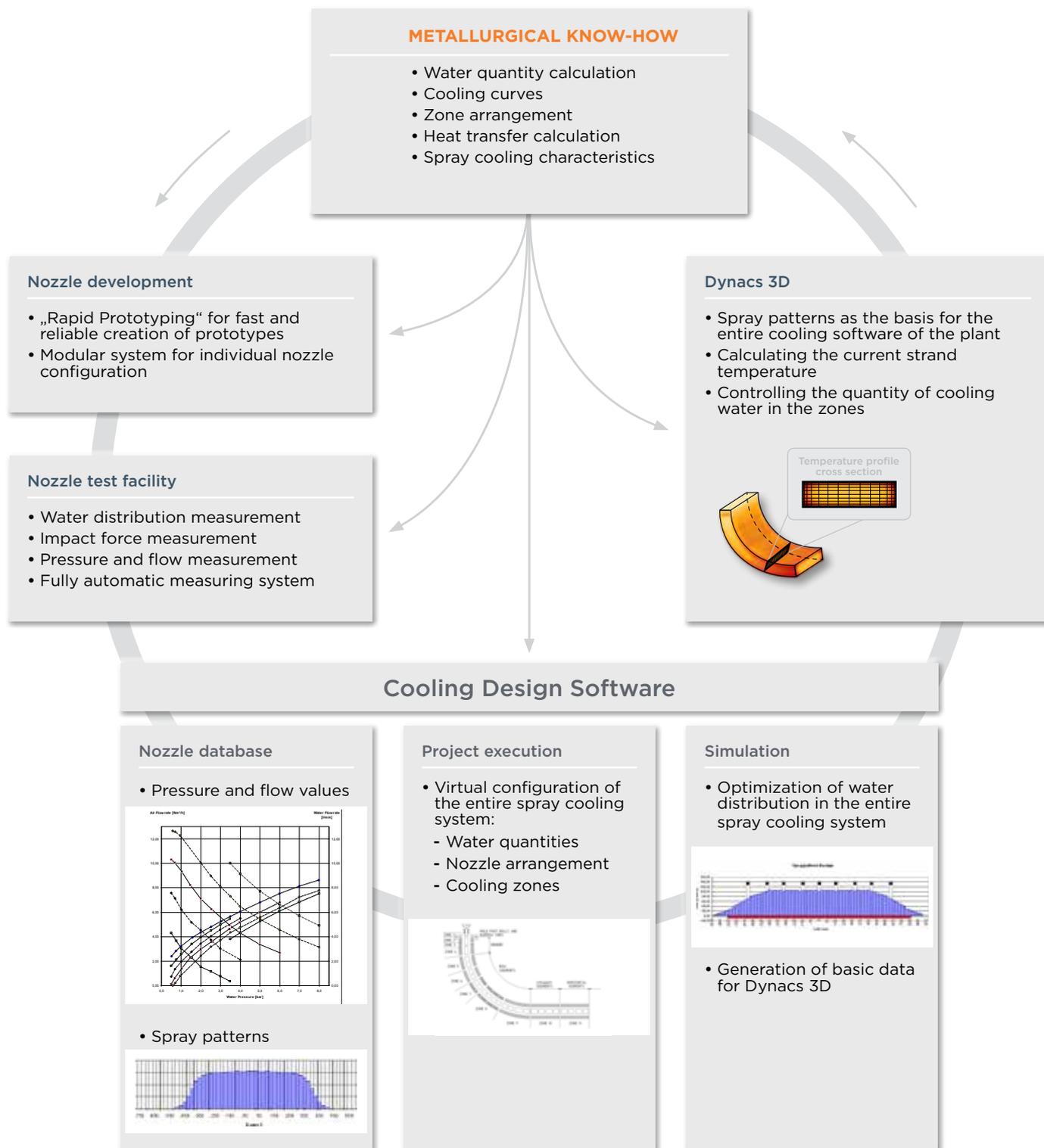
- **Short project execution time -**  
as a result of the optimized internal process and with the capabilities as a full line provider
  - **High flexibility in the implementation of customers' requirements -**  
through in-house development and manufacturing
  - **Highest quality of steel grades -**  
through customized and optimized overall solutions
  - **Intelligent design -**  
integration of know-how already during nozzle-development process
  - **Easy implementation also in existing plants -**  
based on cooling studies
-

# SPRAY COOLING DESIGN

## OVERALL CAPABILITY FOR A TOTALLY OPTIMIZED SOLUTION

Every cooling solution is based on decades of expertise in the construction of metallurgical plants. It is developed on a series of perfectly coordinated and harmonized steps and is supported by physical testing, mathematical simulations and rigorous quality controls.

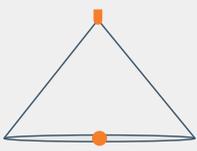
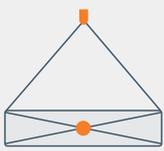
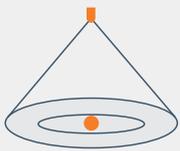
In this way, the nozzles and software are optimized. Your advantages: shorter project execution time, reliable components of the highest quality and a total solution perfectly matched to your plant.



# PRODUCT TYPES

## A LARGE VARIETY FOR NEW COOLING POSSIBILITIES

Due to the different designs and section sizes of continuous casting plants, the DynaJet nozzle family consists of a number of different nozzle types, in order to achieve an optimal cooling for each type of plant.

HEAD TYPES				
	Flat-spray	Rectangular-spray	Oval-spray	Full-cone-spray
Application criteria	 <ul style="list-style-type: none"> <li>• Short distances between rollers</li> <li>• Large spraying widths</li> <li>• Installation transversely to the casting direction</li> </ul>	 <ul style="list-style-type: none"> <li>• Medium distances between rollers</li> <li>• Large spraying widths</li> <li>• Installation transversely to the casting direction</li> </ul>	 <ul style="list-style-type: none"> <li>• Large distances between rollers</li> <li>• Narrow casting formats</li> <li>• Installation longitudinal to the casting direction</li> </ul>	 <ul style="list-style-type: none"> <li>• Medium distances between rollers</li> <li>• Medium casting formats</li> <li>• Medium spray angles</li> </ul>
Typical application	<ul style="list-style-type: none"> <li>• Slab caster</li> </ul>	<ul style="list-style-type: none"> <li>• Slab caster</li> <li>• Bloom caster</li> </ul>	<ul style="list-style-type: none"> <li>• Billet caster</li> <li>• Beam blank caster</li> </ul>	<ul style="list-style-type: none"> <li>• Bloom caster</li> <li>• Billet caster</li> </ul>

The shape of the nozzle tip dictates the spray shape of the particular nozzle regardless of the design of the nozzle body.

NOZZLE TYPES				
	Shaft	3D Spray Shaft	Block	Compact
Application criteria	 <ul style="list-style-type: none"> <li>• Large distances between spray header and strand surface</li> <li>• Fixed installation in the segment</li> </ul>	 <ul style="list-style-type: none"> <li>• Large distances between spray header and strand surface</li> <li>• Only in combination with nozzle width adjustment system 3D Sprays</li> </ul>	 <ul style="list-style-type: none"> <li>• Limited space</li> </ul>	 <ul style="list-style-type: none"> <li>• Installation without spray header</li> <li>• Cost-effective solution</li> </ul>
Typical application	<ul style="list-style-type: none"> <li>• Slab caster</li> <li>• Bloom caster</li> </ul>	<ul style="list-style-type: none"> <li>• Slab caster</li> </ul>	<ul style="list-style-type: none"> <li>• Bloom caster</li> <li>• Billet caster</li> </ul>	<ul style="list-style-type: none"> <li>• Slab caster (Bender/Segment 0)</li> </ul>

The design of the nozzle body is dictated by the type of caster in which the nozzle is employed.

# DYNAJET SHAFT NOZZLE

## THE PREFERRED SOLUTION FOR ADVANCED OPERATION



Optimum spray properties in any installation position and large range of variants

The DynaJet Shaft Nozzle is the most widely used nozzle in Primetals Technologies product line. On account of the patented tube-in-tube system, the cooling media (air and water) are led separately into the shaft and mixed only immediately before the nozzle tip; thanks to this, no un-mixing can take place up to the nozzle exit. On account of this system and its modular design, the most various lengths, shapes, bends and mounting positions of the shaft nozzle are possible without influencing the spray characteristics.

A special design of the DynaJet Shaft Nozzle is utilized in plants equipped with the nozzle width adjustment system 3D Sprays in order to ensure the required positioning accuracy in these kinds of plants through additional stability. The patented fixing system constitutes an essential feature of the DynaJet Shaft Nozzle, with which the nozzles are assembled on the spray header. The disassembly of the nozzle is done by simply loosening and swinging away of the fixing screws, so they can not be lost.

### MAIN BENEFITS

- Stable two-phase flow despite different geometrical properties of the shaft
- Large number of variants for all kinds of different possible applications
- Maintenance-friendly fixing system for simple installation and removal



Tube-in-tube system



Patented fixing system

# IN-HOUSE NOZZLE TEST FACILITIES

## HIGH-TECH MEASUREMENT SYSTEMS FOR FASTER AND MORE EXACT RESULTS



Quality assurance in every test pass



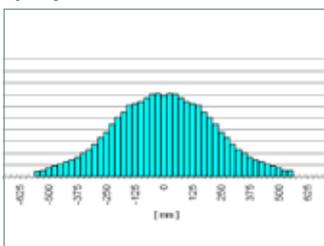
Fully automatic test facility with specific test programs

New nozzles developed internally are fully evaluated during the design phase by means of the in-house, highly automated, nozzle test facility. The rapid prototyping principle guarantees a fast and reliable manufacturing of the prototypes during the development phase. Other nozzle designs may also be checked, for example in the course of a cooling study, to allow optimization of the cooling of existing plants. Measurements of the water density and impact force can be carried out in a very short time with assured quality.

### WATER DISTRIBUTION MEASUREMENT

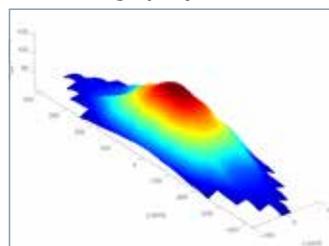
The cooling design is based on the water distribution of the nozzle for various duty points. The following two measuring methods are executed in the nozzle test facilities:

#### 2D-measurement for flat spray nozzles



Cumulative water distribution in casting direction

#### 3D-measurement for thickening spray nozzles



Water distribution in and cross casting direction

### IMPACT FORCE MEASUREMENT

For studies and research purposes the nozzle test facility is equipped with a measuring system for determining the impact force of the water drops affecting the surface of the cast product. The results obtained from this are included in the spray cooling model. With this measuring method, the impact force is examined one-dimensionally along the spray jet for flat spray nozzles and two-dimensionally over the entire wetted area for thickening spray nozzles.

### MAIN BENEFITS:

- Fully automatic nozzle measurement
- Fast results during the design process of the cooling system
- Optimized nozzle design to give required spray distribution
- Test results provide the basis for the design and simulation in the cooling design software

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