English edition

Dasher boards

PRODUCT GUIDE

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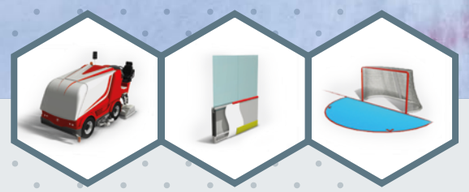
engo
ice arena equipment



ICE RESURFACER
DASHER BOARDS
ACCESSORIES

40 years of experience

Strong for the ice age

Engo is the reliable partner and supplier of high-quality ice arena equipment with 40 years of experience.

We develop and produce various models of electric ice resurfacers, and innovative, flexible dasher boards. The product range also covers a comprehensive range of arena accessories.
Engo's products set standards in terms of user-safety, innovative technology, and particularly in user-friendly operating systems.
Ice arenas worldwide, and international ice sports championships, right up to the Olympic Games put their trust in the quality of Engo products.

MADE IN
SOUTH TYROL
ITALY

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ice arena equipment

Dasher boards by Engo

Innovation and user-safety is our priority

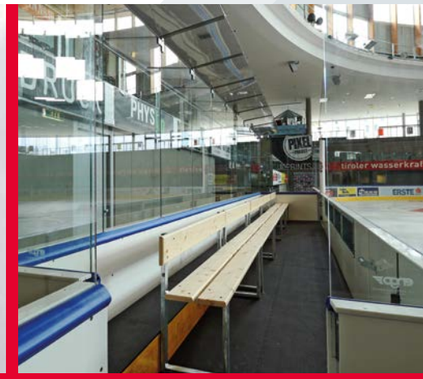
Engo develops and produces different types of dasher boards for various applications and individual customers' requests.

We offer light systems for community rinks up to IIHF-conform, flexible dasher boards for large-scale indoor stadium facilities.

Certifications

The Flexboard PPS conforms to the **CE marking**. CE (= Conformité Européenne) is a special certification that indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic Area.

The Engo company is also **ISO certified.** To meet the **ISO 9001:2015 standards**, we evaluated all of our processes using detailed metrics, and we implemented a quality management system according to international standards.



FlexBoard PPS

Flexible. Safe. Multifunctional. The new generation of load-reducing boards.

So-called flexible board systems are safer and more flexible than traditional boards, and they cushion the effect of robust body checks.

Engo was one of the first manufacturers to recognize the potential of flexible dasher boards to reduce the risk of injury. In collaboration with the technical university of Dresden, we developed the high-quality model Engo FlexBoard PPS. Because of its special material and structure, it absorbs the major part of the impact when players collide into it.

What makes the FlexBoard PPS special:

- Unique, flexible uprights made fiberglass-reinforced plastic
- Strong base made of aluminum
- Reduces the force of a check for best possible player protection
- Used at top-level Championships
- Soft handrail as additional injury prevention
- Long-lasting, thanks to durable materials
- Developed in collaboration with technical university
- Special fixing systems for a quick assembly and disassembly
- It can be delivered with the CE certificate and conforms to IIHF and KHL standards

ESG tempered glass shield

Acrylic glass shield

Optional equipment:

- Ice dam
- Quick assembly system
- Advertising protection system
- Soundproofing protection system
- Soft polymer handrail in red
- Outside covering system
- ESG tempered glass shield
- Acrylic glass shield
- Net protection system on the board
- Net protection system above the shield
- Players benches
- Penalty benches
- Jury box
- Goal judge box
- Hockey goal light for goal judge

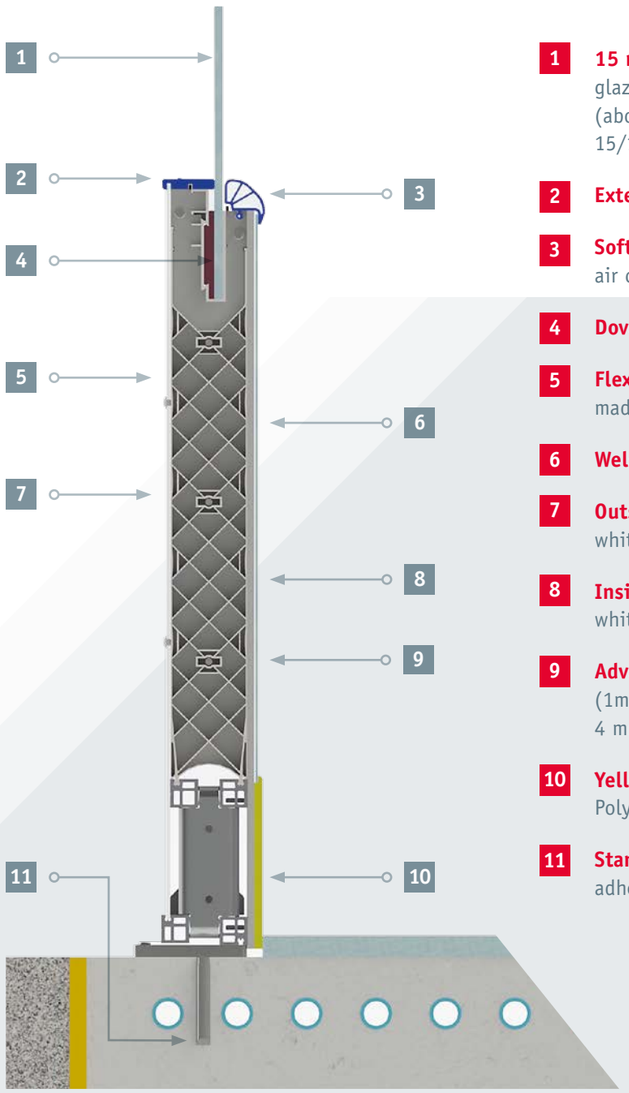
Technical data	Engo FlexBoard PPS
Height of one single element	**1.100 mm**
Length of one single element	**2.400 mm**
Weight of one single element (without protective shield)	**76 kg**
Frame construction	**Aluminum with flexible fiberglass-reinforced plastic upright**
Inside paneling	**10 mm Polyethylene** (Fibreglass as optional)
Radius curve	**From 7 to 8.5 m**
Handrail	**Made of soft, blue Polymer (Also available in red)**
Kick plate	**12 mm** (thickness) **made of yellow polyethylene**
Entrance door	**0.8 m**
Type of anchoring	**Immersed adhesive anchors**
Machine gate	**On demand**

Player Protection System

Flexibility for injury prevention

PPS stands for Player Protection System, because flexible board systems are able to absorb the loading of a player at impact and to reduce the risk of injuries. At Engo, flexibility depends on a support post made of a special plastic-based composite that is reinforced with fiberglass.

What is unique about this product is the combination of a strong lower aluminum base, and a flexible, bendable upper part.
They are the core components that together make up this incomparable board. A soft, polymer handrail further adds to the injury prevention factor; especially against serious head injuries.



1 **15 mm acrylic shielding** with glazing posts, up to 2.400 mm high (above the handrail) or as alternative 15/12 mm tempered glass shielding

2 **External handrail** made of polymer

3 **Soft rounded handrail** in blue with air chambers (Red as optional)

4 **Dovetail shield fixation**

5 **Flexible board-upright** made of fiberglass-reinforced plastic

6 **Welded aluminum** frame

7 **Outside PE-HD 500** white paneling (5 mm thickness)

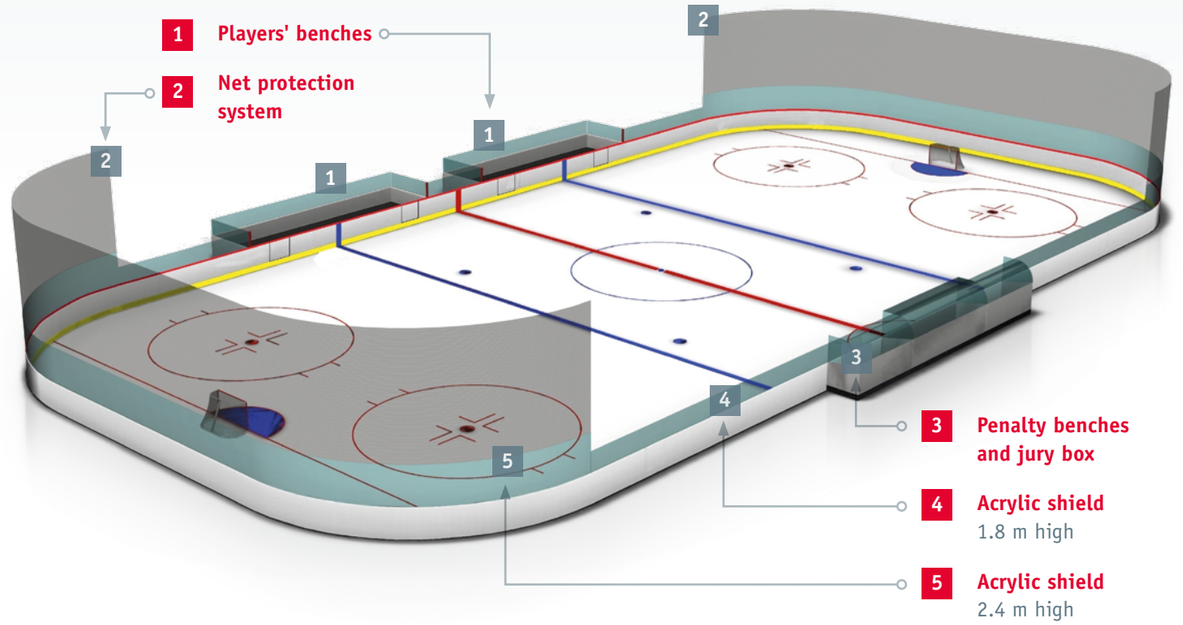
8 **Inside PE-HD 500** white paneling (10 mm thickness)

9 **Advertising panel** - polystyrene (1mm thickness) covered with a 4 mm layer of polycarbonate

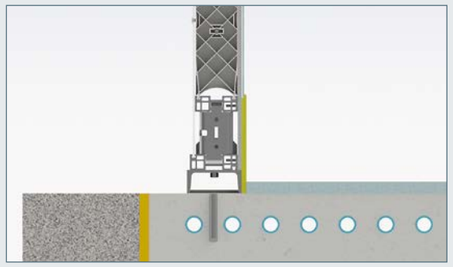
10 **Yellow kick plate** made of Polyethylene (12 mm thickness)

11 **Standard anchoring** with immersed adhesive anchors in the concrete

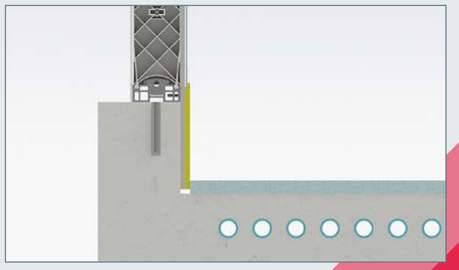
FlexBoard PPS on a standard ice hockey rink



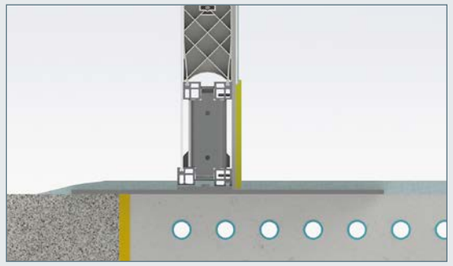
Different anchoring and installation possibilities



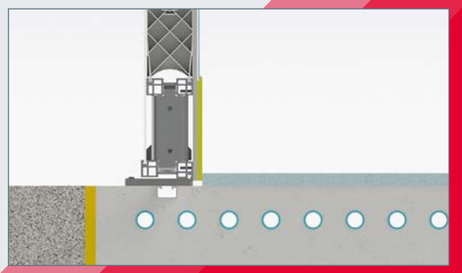
Anchoring system with ice dam



Installation system on a barrier



Installation into ice with steel plates



Anchoring system with immersed steel rail in the concrete

Test results

Analyzing the impact performance of flexible ice hockey boards

Ice hockey is associated with a high injury risk. Thus, it was analyzed whether new ice hockey board designs are able to reduce the loading of a player impacting the board. It was hypothesized that flexible boards deflect more than traditional designs, and that the loading of a player is thus reduced. In collaboration with scientific service providers, we performed different types of experiments to test this hypothesis on our board.

TEST 2013: Calculation of the energy absorption and board deformation

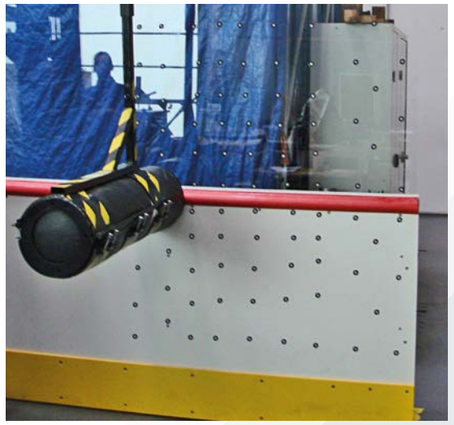
In 2013, we conducted laboratory test with the Leichtbau-Zentrum Sachsen GmbH (LZS) to determine the energy absorption and the displacement of one single element of our Flexboard PPS.

TEST PROCEDURE WITH 80 kg

Pendulum impact test

- **Pendulum weight: 80 kg**
- **Pendulum speed: 16.2 km/h**
- **Impact points: 1.10 and 1.55 m**

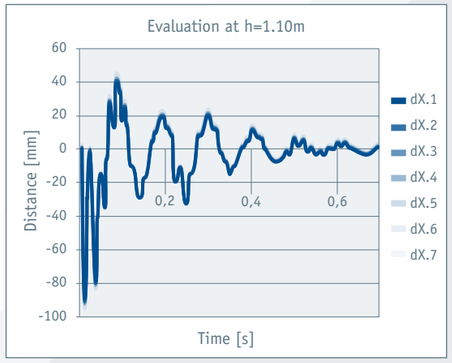
Comparing the impact velocity and the rebounce velocity of the pendulum indicates how much energy is absorbed in the board and the pendulum. The test series was carried out with “Pontos Deformation measurement”.
The deformation measurement was always carried out at both heights - at 1.10 m and at 1.55 m. The measurement methodology was applied at ESG (hardened steel glass) and acrylic glass (transparent plastic shields) in equal measures.



RESULTS

Restults of pendulum impact point of 1.55 m on acrylic shield

- Maximum acrylic glass deformation at 1.55 m: **169.51 mm**
- Maximum board deformation at 1.10 m: **91.80 mm**
- Energy absorption: **87%**



TEST 2017: Calculation of the energy absorption and board displacement

In 2017 the Working Group on Accident Mechanics (AGU Zurich) and the Swiss Competence and Coordination Centre for Accident Prevention (bfu) conducted laboratory tests to verify the energy absorption and displacement of one board element.

TEST PROCEDURE WITH 60 kg

Pendulum impact test

- **Pendulum weight: 60 kg**
- **Pendulum speed: 3.37 m/s and 4.6 m/s**
- **Impact points: 1 m and 1.40 m**

RESULTS

Energy absorption

Comparing the impact velocity and the rebounce velocity of the pendulum indicates how much energy is absorbed in the board and the pendulum.

- Energy absorption with steel glass: **95%**
- Energy absorption with acrylic glass: **92%**
- Maximum deformation with steel glass: **49.73 mm**
- Maximum deformation with acrylic glass: **68.80 mm**

Note: The results summarized here are an excerpt from the study which was published in a scientific journal in more detail in 2017.

Laboratory versus reality

The FlexBoard PPS keeps its promise

The tests we made in the past with our Flexboard PPS were carried out under laboratory conditions with a simplified set-up. Influences like the ice surface, low temperatures and longer dasher board elements were thereby not considered. In order to examine those influences on the behavior of our flexible dasher board, we tested again in 2019 with AGU Zurich, this time in an ice arena and under real conditions.

TEST 2019: Calculation of the energy absorption and board deformation in an ice arena

TEST PROCEDURE WITH 60 kg

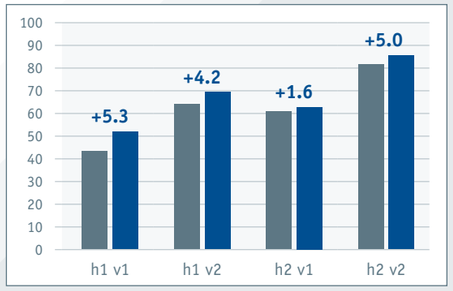
Pendulum impact test

- **Pendulum weight: 60 kg**
- **Pendulum speed: 3.37 m/s (V1) and 4.76 m/s (V2)**
- **Impact points: 1 m (H1) and 1.40 m (H2)**

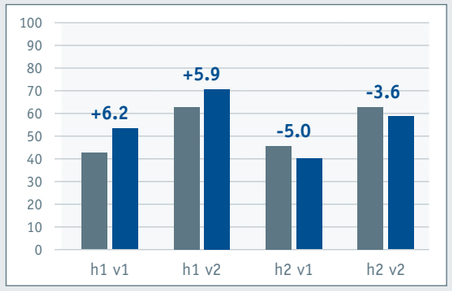
Note: The results summarized here are an excerpt from the study, which will be published in a scientific journal in more detail in 2020.

RESULTS 01

Max. displacement [mm] h=1.4 m



Max. displacement [mm] h=1.0 m



= Measured values from laboratory trials in 2017

= Measured values from the arena trials in 2019

Table 1: Comparison of the maximum displacement in laboratory and real conditions in the arena. The difference between the two tests is expressed as a number in millimeters.

Picture showing test in arena, 2019

Symbolic picture showing FlexBoard PPS in arena

Comparing different types of flexibilities

There is more than one way to achieve flexibility for dasher boards. On-site impact tests show that there is a marked difference between the values of the various types of boards. These two tables show the difference between the test results for our Flexboard PPS when compared with the results of another type of flexible board. The results confirm the extraordinary flexibility of the Flexboard PPS on both the straight- and the curved sections.

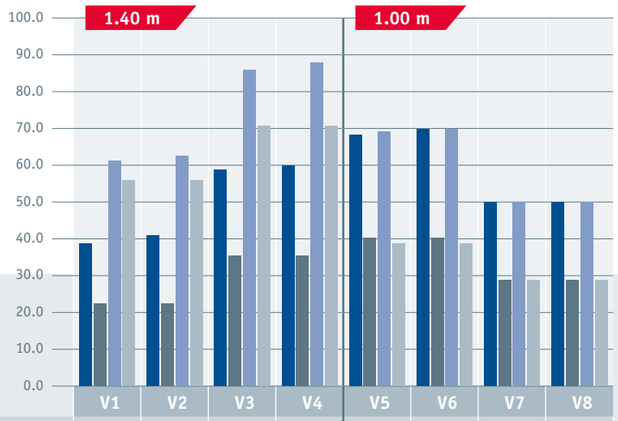
Table 2 + 3:
Comparison of the values of displacement in real conditions in the arena with the PPS board, and the values of another test with a similar flexible board, using the same test procedure and conditions.

RESULTS 02 / TEST 2019

VALUES ON STRAIGHT BOARD ELEMENT

Engo Flexboard PPS

Similar flexible dasher board



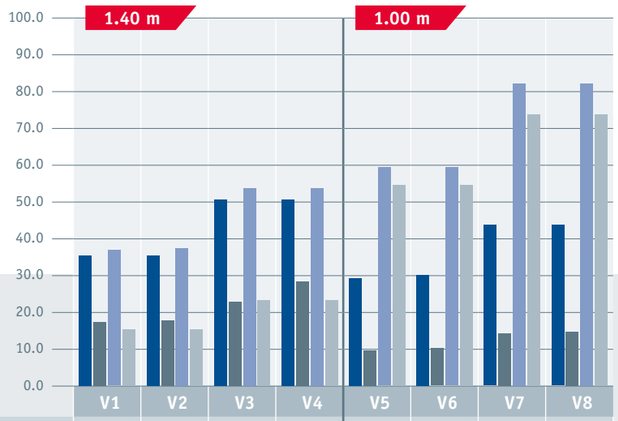
	V1	V2	V3	V4	V5	V6	V7	V8
Displacement [mm] of Flexboard PPS in arena / Peak (+) 1.0 m	37.8	41.1	58.7	60.6	68.6	70.0	50.1	50.7
Displacement [mm] of a similar flexible dasher board in arena / Peak (+) 1.0 m	23.9	24.6	36.6	36.9	40.4	41.0	28.0	28.6
Displacement [mm] of Flexboard PPS in arena / Peak (+) 1.4 m	62.1	63.5	85.8	87.4	69.4	69.7	49.9	50.5
Displacement [mm] of a similar flexible dasher board in arena / Peak (+) 1.4 m	55.1	54.7	71.1	71.1	38.8	39.5	28.2	28.3

RESULTS 03 / TEST 2019

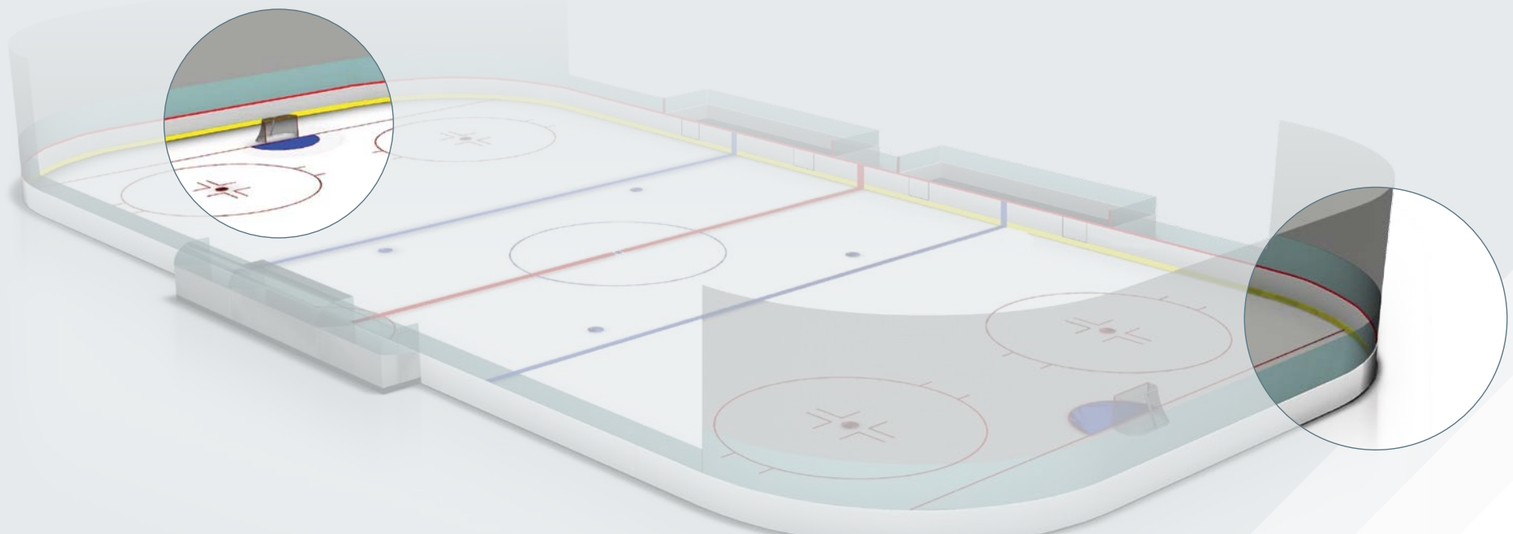
VALUES ON CURVED BOARD ELEMENT

Engo Flexboard PPS

Similar flexible dasher board



	V1	V2	V3	V4	V5	V6	V7	V8
Displacement [mm] of Flexboard PPS in arena / Peak (+) 1.0 m	35.3	35.6	50.8	50.6	29.6	30.0	43.5	43.6
Displacement [mm] of a similar flexible dasher board in arena / Peak (+) 1.0 m	17.3	17.5	22.71	28.5	9.7	10.02	14.4	14.7
Displacement [mm] of Flexboard PPS in arena / Peak (+) 1.4 m	37.0	37.2	53.7	53.8	59.5	59.0	82.0	81.9
Displacement [mm] of a similar flexible dasher board in arena / Peak (+) 1.4 m	15.2	15.1	22.94	23.5	54.7	54.42	73.8	73.5



AGU ZÜRICH

ClassicBoard

Board with stable double steel frame construction. It is equipped with 10 mm thick UV-resistant PE-HD 500 high density polyethylene panels with blue polyethylene handrail and impact rims.
Suitable for inline hockey, ice hockey, public ice skating and events.

What makes it special:

- **Extendable module construction, easy to install**
- **Variable radius curves**
- **Machine gate**
- **Entrance doors and gate are simple to replace**

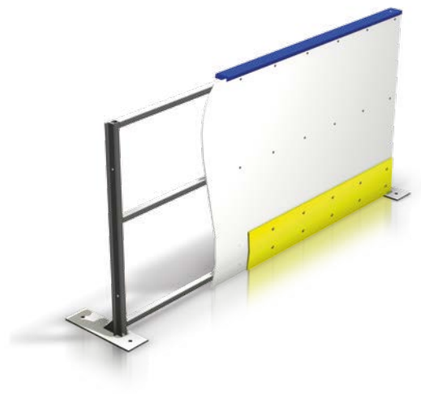
Optional equipment:

- **Ice dam**
- **Quick assembly system**
- **Advertising protection system**
- **Soundproofing protection system**
- **Red handrail**
- **Outside covering system**
- **ESG tempered glass shield**
- **Acrylic glass shield**
- **Net protection system**
- **Players benches**
- **Penalty benches**
- **Jury box**
- **Goal judge box**
- **Hockey goal light for goal judge**

Technical data	Engo ClassicBoard
Height of one single element	**1.100 mm**
Length of one single element	**2.400 mm**
Weight of one single element (without protective shield)	**94 kg**
Frame construction	**Hot galvanized steel frame**
Inside paneling	**10 mm Polyethylene** (Fiberglass as optional)
Radius curve	**From 7 to 8.5 m**
Handrail	**Polyethylene** (blue)
Kick plate	**12 mm** (thickness) **made of yellow polyethylene**
Entrance door	**0.8 m**
Type of anchoring	**Immersed adhesive anchors**
Machine gate	**On demand**

SmartBoard

SmartBoard with light single steel frame construction made of 8 mm thick white UV-resistant polyethylene (PE 500), high density panels with a blue polyethylene (PE 500) handrail.
Suitable for inline hockey, public ice skating and events.



What makes it special:

- **Extendable module construction, easy to install**
- **Robust, hot-dip galvanized steel frame**
- **Variable radius of curves available**
- **Machine gate**
- **Entrance doors and gates are simple to replace**

Optional equipment:

- **Quick assembly system**
- **Advertising protection system**
- **Soundproofing protection system**
- **Outside covering system**
- **Net protection system**

Technical data	Engo SmartBoard
Height of one single element	**1.000 – 1.250 mm**
Length of one single element	**2.400 mm**
Weight of one single element (without protective shield)	**70 kg**
Frame construction	**Hot galvanized steel frame**
Inside paneling	**8 mm Polyethylene** (Fiberglass as optional)
Radius curve	**From 2.0 to 8.5 m**
Handrail	**Polyethylene** (blue)
Kick plate	**8 mm** (thickness) **made of yellow polyethylene**
Entrance door	**0.8 m**
Type of anchoring	**Immersed adhesive anchors**
Machine gate	**On demand**

ice arena equipment

Engo Ltd
Via Forch 9
39040 Varna (BZ)
Italy

T +39 0472 057590
info@engo-ice.com

www.engo-ice.com

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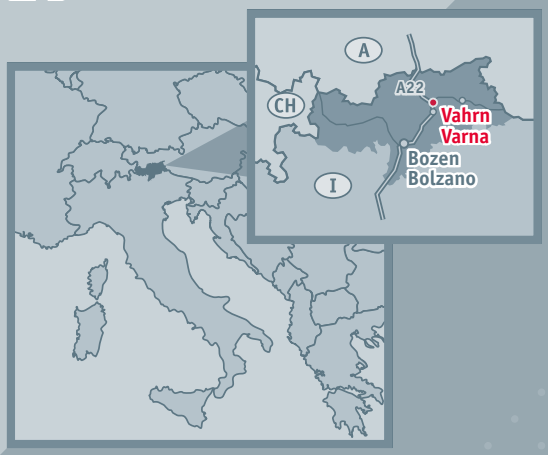

Engo Dealer

Certification

Member

Member of the TechnoAlpin Group

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Pictures: Archive Engo Ltd, Photographer: Christian Vorhofer, FOTO KLICK · Renderings: Christof Schiner
Graphic and print preparation: Augustin Lechner · Druck: Druckerei A.Weger, Brixen