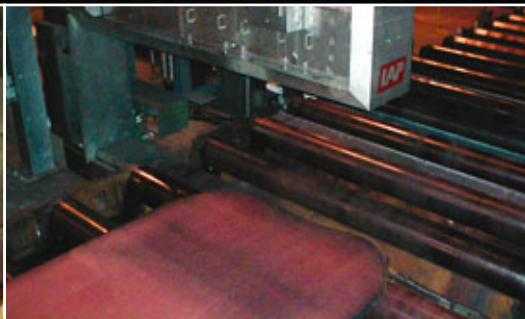
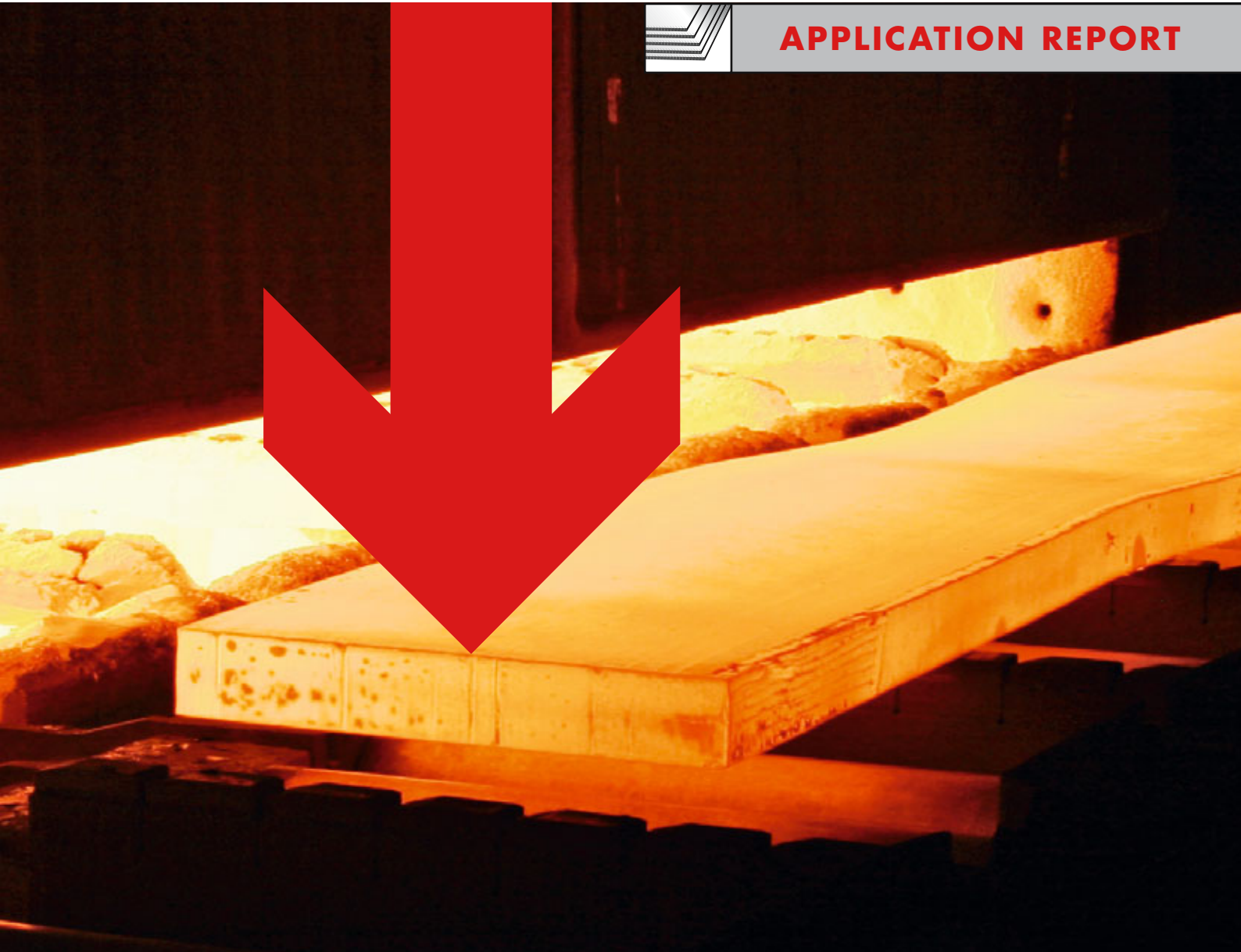


PLATE MEASURING SYSTEMS LAP PLATECHECK

THICKNESS PROFILE MEASUREMENT



APPLICATION REPORT



AG DER DILLINGER HÜTTENWERKE.



THE CUSTOMER.

The plate mill at Dillingen is one of the largest of its kind in the world. Slabs and blooms are rolled into plates of often unusual dimensions. Lengths of up to 120 feet (36 m), widths beyond 16 feet (5 m), and thickness above 1.5" (400 mm) are rolled frequently.

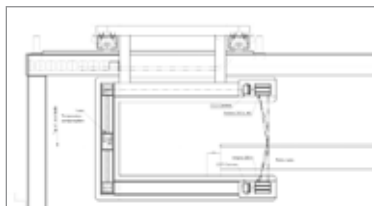
Key markets are plates for shipbuilding, mechanical engineering, boiler and apparatus construction. The annual production is 1.3 mio. tons.

THE REQUIREMENTS.

The thickness profile of plates between 0.4 and 20" (10 - 500 mm) thickness should be assessed behind the hot leveller in two tracks. Plates between 0.4 and 4" (10 - 100 mm) thickness are additionally measured by an isotope gauge. The application demanded a non-contact measurement system to measure the thickness from a safe distance. The results should be displayed in the control pulpit and archived for retrospective inspection. The position of the measurement tracks should be freely selectable. Due to the high material temperatures, thermal protection was extremely important for the design of the gauge.

THE SOLUTION: LAP PLATECHECK.

LAP laser triangulation sensors measure the thickness profile behind the hot leveller in two tracks, using two pairs of opposing laser sensors, incorporated in a traversable C-shaped measuring frame.



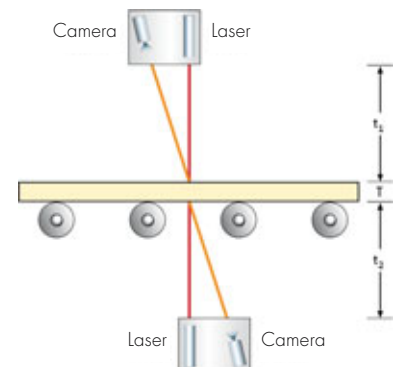
The system is designed to cover following plate dimensions:

- Thickness: 5 to 500 mm (0.2 to 20")
- Width: 1,600 to 5,400 mm (63 to 213")
- Length: 2,000 to 50,000 mm (6.5 to 164 ft.)
- Temperature 20 to 1,000 °C (70 to 1,800 °F)
- Transport speed: 0.2 to 2.0 m/s (39 to 394 fpm)

THE MEASUREMENT PRINCIPLE.

Differential Thickness Measurement with Laser Triangulation.

Laser beams aimed at the plate create visible spots on its surfaces. CCD line scan cameras arranged under an angle "view" these laser spots. Depending on the position of the surface the cameras "see" the spots under varying angles. By measuring these angles using the CCD cameras, the distance to the object top and bottom surfaces is calculated by the built-in DSPs (Digital Signal Processors). The plate thickness is then calculated as difference of the known sensor-to-sensor distance and the measured distance of top and bottom sensors. Thus, the true thickness is measured irrespective of position or vertical movement of the plates.



YES, WE

PRECISE THICKNESS DATA.

HIGH ACCURACY UNAFFECTED BY STEEL GRADES.

The LAP PlateCheck gauge measures the true thickness irrespective of the chemical composition of the measured material, assessing precise thickness data at production time and presenting the values immediately after the plate exits the hot leveler. Non-conforming plates are thus identified immediately, allowing corrections of the rolling parameters for the following plates and, if possible, reworking of the rejected plate.

INFORMATION ON-THE-FLY.

The measured results are displayed on an HMI computer as:

- Line chart with true length scaling showing the thickness profile along the plates
- Production statistics
- Numerical display
- System status and error message logging

Using the actual measured temperature along the plate and the steel grade specific shrinkage coefficient, the thickness values are converted to and displayed as cold dimensions.



PRODUCTION OPTIMIZATION.

Besides reporting of the production data, the measured thickness values can be used for optimization of the "Automatic Gauge Control" of the rolling stand. A systematic offline evaluation of all recorded data allows discovery of trends and the identification of error sources in the rolling process.

UNINTERRUPTED ARCHIVING.

The local real-time database of the gauge stores all raw data as well as condensed statistics over at least three months ensuring complete documentation of the production output. Even after shipment, production data can be easily retrieved, allowing reassessment of individual batches at a later time.

AUTOMATIC OPERATION.

By linking the gauge to the material tracking system, the operation sequence runs fully automatic: plate by plate, customer and product specific data needed for gauge setup, product evaluation, and data archiving are transmitted to the gauge.

LARGE MEASUREMENT RANGE, LOW INVESTMENT.

For the first time, a single laser thickness gauge covers the entire product thickness range from 5 through 500 mm, a performance impossible for traditional measurement principles.



Automatic Calibration Device with Rotating Disc



Sensors, Line Lasers, Projectors
Systems & Solutions

CAN

TECHNICAL DETAILS.

Gauging System

- Dual track thickness gauge with 2 encapsulated LAP ANTARIS distance sensors in each track, installed approx. 1.5 m behind the hot leveler, combined with other systems for profile measurement and surface inspection.
- Track to track distance 1,000 mm
- Thickness accuracy +/- 0.1 mm
- Laser-based reference system inside C-frame for compensation of deflections. Accuracy: 0.01 mm
- Recording of longitudinal plate position on roller table by encoder
- Position sensing of C-frame across roller table by time-of-flight laser measurement system

Mechanical Design

- Sensors in C-frame with approx. 4.5 m limb length
- Measurement location selectable from plate center to plate edge by manual or automatic traversing of C-frame

Designed for Rolling Mill Duty

- Double-walled stainless steel housing, thermally insulated to protect internal sensor support frame against even extreme heat radiation.
- All gauge parts facing the hot plate surface are covered by additional stainless steel heat shields to protect against radiated heat. This design prevents overheating of the sensors even in case of air cooling failure.

- Temperature monitoring inside C-frame with automatic over-temperature shut-off.
- Autonomous air supply with external recharger unit for cooling and air purging of the C-frame. No mill utilities required! Additional booster blower using unconditioned ambient air for extra-strong air purging of lower sensors.
- PCs and electronics in IP 54 (NEMA 3) rated cabinets

Measuring Sequence and Calibration

- Fully automatic measurement sequence triggered by the gauge detecting a new plate entering the gauge
- Fast and simple on-site calibration through integrated auto-calibration device with calibration software.
- Tracing of calibration results for proof of gauge accuracy

Integration in Level II Automation

- Transfer and activation of nominal sizes and customer data according to rolling schedule
- Local data base for storage of measured data
- Reporting of condensed measurement results to Level II automation system via Ethernet

Maintenance

- Availability: > 98 %
- Scheduled maintenance: Replacement of air filter cartridges approx. every 2 – 4 months

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