

CONTROLLED ELONGATION MACHINES FOR PROCESSING LINES

GREATER PERFORMANCE, INNOVATIVE
PROCESSES AND HIGHER QUALITY

COMMITTED TO CONTINUOUS IMPROVEMENT

YOUR CHALLENGE

Flat-rolled steel producers are facing a trend towards zero-defect tolerances regarding surface and shape quality. This trend is now becoming the standard in the whole steel industry: automotive, packaging, appliance, building, etc.

Such performance requires a perfect knowledge and control of the production. Yet, the development of new steel grades (e.g., ultra high strength steels) have introduced a lot of changes in the way steel is made, making this more difficult to achieve.

In addition, the push towards high throughput rates and yield requires fully automatic equipment running without operator assistance.

OUR SOLUTION

Primetals Technologies has been a leader in the iron and steel business for Controlled Elongation Machines (CEM) since 1953. Building on our expertise, we have created an ongoing global evolution program for all CEM types. Our CEMs continue to achieve all crucial applications in processing lines and are supported by numerous patents that result in higher performance, increased reliability and better adaptability to innovations in steel (high-strength steel, etc.).

Our CEM portfolio starts from the pickling line until the tin plate production.

With more than 320 references worldwide, we can offer you solutions with:

- Our proven design of Scale Breaker used on CPL, PLTCM, PPPL
- Our worldwide references Skin-Pass Mill and Tension Levellers for different applications
- Our last generation of multi-roll Tension Levellers for tinplate production

GOOD REASONS FOR CONTROLLED ELONGATION MACHINES

- **User-friendly operation**
All of our CEMs have been designed for easy use. An up-to-date HMI (human-machine interface) ensures efficient troubleshooting and facilitates easy operation control. Readily accessible components (cylinders, rolls, etc.) make maintenance and replacing parts easy and efficient
- **Mechatronic package for optimized functionality**
The mechatronic package is a combination of technological and electrical automation know-how for optimized functionality
- **Complete workshop testing**
Our CEMs are assembled and tested in our workshop in Montbrison, France. Testing includes mechanical adjustments, hydraulic pressure tests and automation. Every CEM is fine-tuned to make its integration into your facility as smooth as possible. Since 1994, Primetals Technologies workshop in Montbrison, France, has complied with the international quality standards (ISO 9002, ISO 9001, ISO 14001)
- **Perfect integration**
Our CEMs have been designed for a perfect integration into processing lines. The easy customizing through peripheral equipment and clear interfaces allows the installation in existing lines or own line design.

MAIN TASKS CONTROLLED ELONGATION MACHINES



- TEMPER MILL/SKIN-PASS MILL**
 - Metallurgical property improvement (YPE removal)
 - Roughness transfer
 - Flatness improvement
- TENSION LEVELLER**
 - Metallurgical property improvement (YPE removal)
 - Flatness improvement
- SCALE BREAKER (FOR HOT-ROLLED STEEL)**
 - Flatness improvement
 - Scale cracking
- MULTI-ROLL TENSION LEVELLER**
 - Flatness improvement
 - Internal stress removal by multi-roll unit

Tension leveller, Continuous galvanizing line

APPLICATION IN PROCESSING LINES

	Type of line	Skin-pass-mill	Tension leveller	Scale breaker	Multi-roll tension leveller
Carbon Steel	Continuous galvanizing line	Roughness transfer YPE removal	Flatness improvement YPE removal		
	Continuous annealing line				
	Continuous pickling line	Roughness transfer		Flatness improvement Scale breaking	
	Push-pull pickling line				
	Inspection line		Flatness improvement YPE removal		Flatness improvement Internal stress removal
	Skin-pass & leveling line	Roughness transfer YPE removal			
	Electrolytic galvanizing line		Flatness improvement		
	Electrolytic tinning line				Flatness improvement Internal stress removal
Stainless Steel	Skin-pass & leveling line	Roughness transfer YPE removal	Flatness improvement		
	Hot annealing & pickling line			Flatness improvement Scale breaking	
	Cold annealing & pickling line	Roughness transfer YPE removal	Flatness improvement YPE removal		
Aluminum	Leveling line		Flatness improvement		
	Inspection line				

ADVANTAGES OF STRIP PROCESSING UNDER CONTROLLED ELONGATION



Multi roll leveler, Electrolytic tinning line



Scale breaker section

Primetals Technologies has chosen the controlled elongation method because of the numerous advantages to be gained: direct elongation control permits the processing of metal strip with yield and tensile strengths close to each other, without the risk of strip break during processing.

Elongation remains constant for a given operation and is not influenced by any of the following factors:

- Variations in strip gauge
- Variations in strip width
- Mechanical and/or metallurgical properties of strip
- Variations in strip velocity
- Variation of the friction coefficient

It follows that during skin passing, whether or not in combination with tension leveling, the ratio of rolling tension can easily be modified while maintaining elongation to the target value and, therefore, obtain the desired quality.

CONTROLLED ELONGATION MACHINES

DRAW ON SIX DECADES OF EXPERTISE

As a globally active full-liner, we provide you with expertise that is unique in the steel production industry. Backed by our extensive experience, our product solutions ensure that every aspect of your production process is optimized.

Not only do we provide cutting-edge technology, we also offer top-notch service. In everything we do, our goal is to improve your plant's performance.

SKIN-PASS MILL

With Primetals Technologies, you benefit from the experience of a world leader in these technologies. Our solution range encompasses skin-pass mills that cover all applications. With rolling force capacities ranging from 500 to 1,500 tons, skin-pass mill stands can be of two-high or four-high design, thus providing a best-in-class solution, whatever your application.

		SPM 500	SPM 750	SPM 1000	SPM 1200	SPM 1500
Roll force	kN	5,000	7,500	10,000	12,000	15,000
Bending	kN	900	900	900	1,200	1,200
Work roll diameter	mm	415	415	450/600	450/650	450/650
Back-up roll diameter	mm	750	750	1,000	1,120	1,120
Maximum strip width	mm	1,700	1,700	1,850	2,100	2,100

TENSION LEVELLER

The purpose of the tension leveling stand is to improve product flatness by stretching all of the longitudinal structures in the metal strip to equal length. The operation consists of submitting the strip to an elasto-plastic deformation with controlled elongation, with several six-high leveling cluster assemblies. An anti-crossbow roll, located downstream of the leveling rolls, eliminates the crossbow and a dedicated anti-coil set roll can be proposed. The design of Tension Leveller is suitable for a wet or dry applications coilset induced by a strip passing over a small diameter roll.

		TL 12	TL 25	TL 35	TL 45
Tension	kN	120	250	350	450
Work roll diameter	mm	25	40	40	40
Anti cross bow roll diameter	mm	40	70	70	70
Back-up roll diameter	mm	47	74	74	74
Maximum strip width	mm	1,270	1,700	2,100	2,100

SCALE BREAKER

This is a time-tested technology from Primetals Technologies. The scale breaker is comprised of a stand (including two sets of two leveling units and an anticrossbow unit), a dust collection system (wet or dry process), as well as entry and exit tension bridles with their respective drive systems. More than 50 of these timetested machines are operating worldwide.

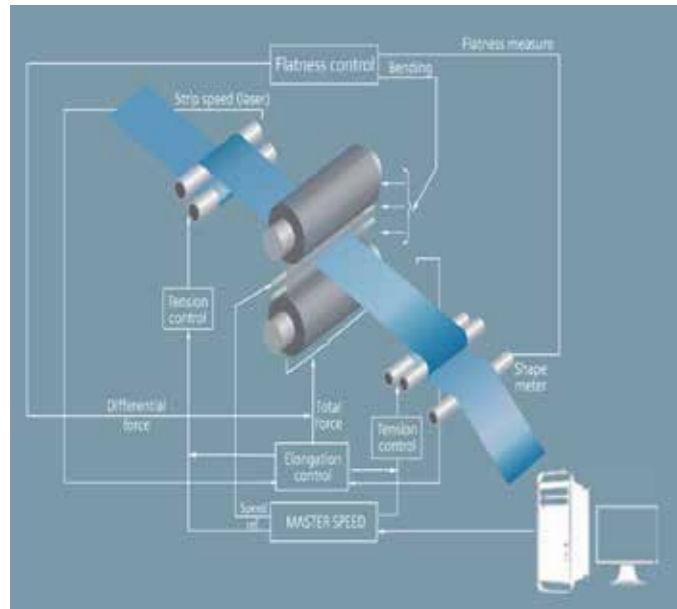
		SB 50	SB 75	SB 100
Tension	kN	500	750	1,000
Work roll diameter	mm	60	80	80
Anti cross bow roll diameter	mm	100	110	110
Back-up roll diameter	mm	100	120	120
Maximum strip width	mm	1,850	2,100	2,100

MULTI-ROLL TENSION LEVELLER

Due to increasing demand, tinplate producers are now supplying thinner average product gauges and double reduced (DR) materials that are difficult to level because of their light gauge, high yield strength and internal stress. To respond to these more stringent market requirements, a few years ago Primetals Technologies developed a new type of tension leveller specifically designed for high quality production in electrolytic tinning lines and tinplate inspection and leveling lines.

		MTL 65	MTL 85
Tension	kN	65	85
Work roll diameter	mm	25	25
Multi roll unit diameter	mm	40	40
Back-up roll diameter	mm	47	47
Maximum strip width	mm	1,270	1,400

SKIN-PASS MILL



Flatness close loop control



SPM 1200, Continuous galvanizing line

LOREM IPSUM

With more than 450 references worldwide, Primetals Technologies is undeniably the world leader in these technologies.

In most cases the equipment comprises four-high mills with one or two work roll diameters. The equipment integrates positive and negative bending blocks, an automatic pass-line adjustment device, a quick automatic work roll change system, efficient roll cleaning tools, high-performance automation and a wet rolling unit, when required.

Primetals Technologies offers an extensive range of skin-pass mills to cover all applications. With rolling force capacities ranging from 500 to 1,500 tons, skin-pass mill stands can be of two-high or four-high design, depending on the application.

PLANT DATA

Application	PPPL, CPL, CAL, CGL, APL, TM-TL lines
Function	Surface/roughness finishing and yield point removal
Product thickness	0.20 to 6.50 mm
Product width	500 to 2,100 mm
Line speed	Up to 600 mpm

As a mechatronic package, Primetals Technologies supplies the total automation system from the actuators up to the preset generation as well as supervision.

The main functions are:

- Level 1
 - Sequential control for auxiliaries
 - Drives control
 - Hydraulic screw-down control loops
 - Speed and tension controls
 - Flatness measurement and regulation using multivariable theories
 - Elongation control by force and/or tensions
 - Mill master which generates references for speeds and tensions
- Level 2
 - Preset generation based on mathematical models and/or neuronal models
 - Networks with self adaptation
 - Data logging and production reporting

TENSION LEVELLER



TL 25, Electrolytic galvanizing line



TL 25, Wet process for stainless steel processing line

Primetals Technologies is the world leader in these technologies with 35 tension levelers in the past five years. Tension leveling stands include several six-high leveling cluster assemblies on which the strip is subjected to elasto-plastic deformation under controlled elongation in order to stretch the strip's longitudinal structures to equal length and to eliminate residual crossbow and coilset.

Tension leveller entry and exit tension bridles can be driven with different systems (interconnecting gear boxes or all electrical drives) depending on the application. It is often desirable to combine the skin-pass and tension leveller with an intermediate tension bridle in a versatile system. This facilitates the production of different types of high-quality strip.

PLANT DATA

Application	CAL, CGL, APL, TM-TL lines, recoiling lines
Function	Flatness improvement and yield point elongation removal
Product thickness	0.2 to 5.0 mm
Product width	500 to 2,100 mm
Line speed	Up to 650 mpm

SCALE BREAKER



SB 50, Push pull pickling line



SB 75, Pickling line tandem cold mill

A time-tested technology from Primetals Technologies that has resulted in orders for more than 60 machines delivered worldwide since 1978. The scale breaker is composed of a stand (including two sets of two leveling units and an anti-crossbow unit), a dust collection system (wet or dry process), as well as entry and exit tension bridles with their respective drive systems. The strip in the stand is subjected to a series of alternating flexions under tension on the work rolls. This results in an elongation of the strip and corrects flatness defects. The oxide layer is cracked and partially removed from the strip, thus increasing the efficiency of the acid pickling process. The machine operates automatically in controlled elongation mode using a preset database system.

The scale breaker is also equipped with a quick work roll changing device which operates when the line is running, as well as a complete hooding of the stand to prevent pollution to the surroundings, and back-up rolls with built-in air blowing systems to prevent dust penetration.

The achieved strip flatness (correction of wavy edges, buckles, camber and crossbow) is sensational, with results of less than 5 I-units on processed strips. The improvement in pickling efficiency can lead to a capacity increase of 30%.

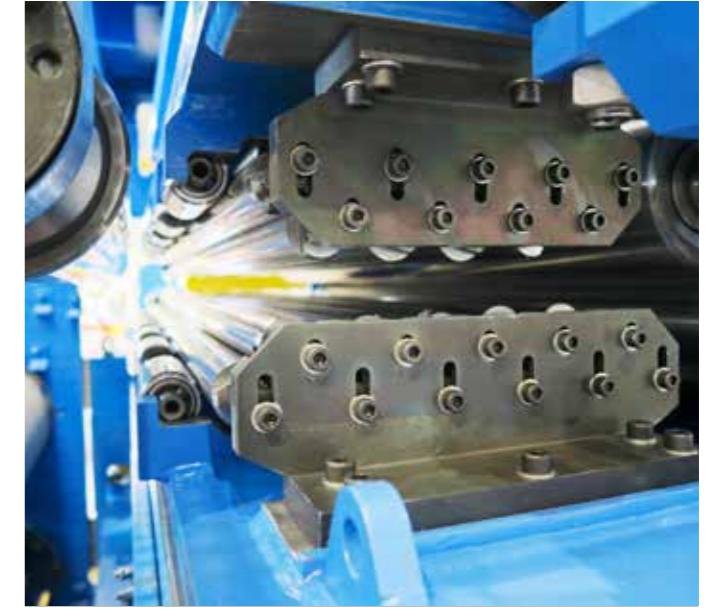
PLANT DATA

Application	Carbon steel: PPPL, CPL Stainless steel: CAL, APL
Function	Flatness improvement Increase in descaling and pickling
Product thickness	0.6 to 8.0 mm
Product width	500 to 2,100 mm
Line speed	Up to 500 mpm

MULTI-ROLL TENSION LEVELLER



MTL 65, Electrolytic tinning line



MTL 65, Electrolytic tinning line

Primetals Technologies has patented the design of a number of tension levellers and has supplied more than 50 tinplate units worldwide since 1969, including 20 of the multi-roll type in the last 15 years. The most recent generation is a compact and highly rigid machine with integrated tension bridles that operate automatically in a controlled elongation running mode based on a preset database system. Entry and exit tension bridles are interconnected and driven by a gearbox drive with differential. The drive enables a very slight and accurate reduction of the entry bridle speed in order to set the elongation. The leveling stand includes flexible tension leveling units and a multi-roll unit.

Nearly the entire elasto-plastic deformation of the strip is carried out in the flexible tension units. The aim of the multi-roll unit is to reduce coilset and finally to ensure that the internal residual stresses are balanced throughout the cross-section of the material. Since most tinplate tension levellers are able to address severe wavy edges, other shape characteristics such as crossbow, coilset and bow blanks remain critical for light-gauge hard products such as DR materials. These requirements are now met by the integrated multi-roll tension leveller from Primetals Technologies.

PLANT DATA

Application	ETL, ECCL, TL lines, recoiling lines
Function	Internal stress removal
Product thickness	0.1 to 0.8 mm
Product width	500 to 1,400 mm
Line speed	Up to 700 mpm

CONTROLLED ELONGATION TEST FACILITY



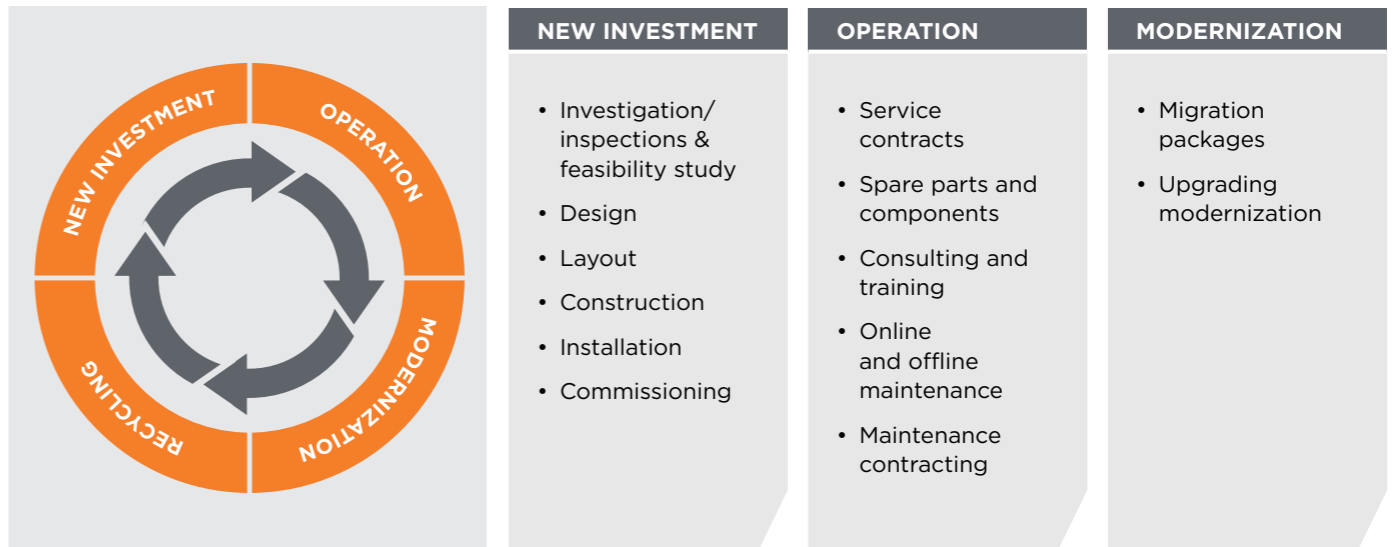
TEST FACILITY AT MONTBRISON

Primetals Technologies has designed a full-scale controlled elongation testing facility with enough versatility to be able to process a wide range of materials. It is used for conducting research and development work as well as testing customers' samples. It is designed to operate under conditions similar to those found in all applications that use controlled elongation technology. Machine components, such as flexing units, type and number of tension bridle rolls and interconnecting drive trains, can be adapted to simulate various strip finishing operations.

The test facility also features a cold-rolling or temper mill stand which can be configured as a two-high, with 300 mm diameter rolls, and as a four-high, with 140 mm diameter work rolls. Maximum rolling force is 1,200 kN with a maximum tension exerted on the strip of approximately 60 kN that is monitored by tensiometers.

LIFECYCLE MANAGEMENT PARTNERSHIP NEVER ENDS

CONSULTING | PLANNING | FINANCING



PRIMETALS TECHNOLOGIES LIFECYCLE SERVICES

As a Controlled Elongation Machine user, you have conflicting needs. On the one hand, your performance is measured each quarter against short-term profitability expectations. On the other hand, you have to think on a totally different time scale compared with the capital market. Depending on the lifetime of your Skin-Pass Mill and your Tension Leveller, you have to take 15 years or more into account. At the very least, that's 60 full quarters.

But thanks to our comprehensive expertise and integrated approach to solutions, you benefit both short-term and long-term from our lifecycle services.

In the short term: backed by our extensive experience with many reference plants, we provide you with the certainty of fast, dependable production start-up and shorter amortization periods.

In the long term: our master plan guarantees competitive performance for your plant and your Controlled Elongation Machine in every phase of its lifecycle. Whether we are providing 24/7 technical support, optimizing maintenance, or making permanent plant improvements, we are always working to ensure the cost effective operation of your plant and products. Thanks to our lifecycle supports organized in clusters (Europe, America and Asia), you will benefit from our worldwide presence.

THE FOLLOWING SERVICES ARE AVAILABLE TO OUR SKIN-PASS MILL AND TENSION LEVELLER:

- Spare parts management and supply, from a set of standard spares, with on-demand replacement and repair
- Preventive maintenance visit, organized periodically to prevent or detect at an early stage any efficiency loss of the equipment, on the basis of thorough diagnostics
- Expertise of the condition of the machine, report and refurbishment or upgrading proposal
- On-demand on-site intervention

EXCELLENCE FROM EXPERIENCE

SELECTED SUCCESS STORIES



SKIN PASS-MILL

Customer. Tata Steel IJmuiden BV, Netherlands
Plant type. SPM 1200 in Continuous Galvanizing Line
Our solution. 1.200 tons Skin-Pass Mill mechatronic package
The result. Good results in roughness transfer on strip for automotive
Technical data. Width: 900 - 2.050 mm; thickness: 0.60 - 2.50 mm
Other references. ArcelorMittal, Thyssen/Angang



TENSION LEVELLER

Customer. Pangang Group Chongqing Steel, Sheet Ltd., China
Plant type. TL in a Continuous Galvanizing Line
Our solution. 25 tons Tension Leveller
The result. Good flatness with wide products
Technical data. Max width: 1.650 mm; thickness: 0.50 - 3.00 mm
Other references. Masteel, ArcelorMittal, Tata Steel, Posco



SCALE BREAKER

Customer. U.S. Steel Košice, Ltd., Slovakia
Plant type. SB 75 on Continuous Pickling Line
Our solution. 75 Tons Scale Breaker
The result. Flatness improved and Higher Elongation on High Strength Steel
Technical data. Max width: 1.700 mm; thickness: 1.20 - 6.50 mm
Other references. HBIS Tangshan, Posco, ArcelorMittal, USS, Tata Steel, Bluescope



MULTIROLL TENSION LEVELLER

Customer. ThyssenKrupp Rasselstein, Andernach, Germany
Plant type. MTL 65 Continuous Electrolytic Tinning Line
Our solution. 6.5 tons multiroll Tension Leveller mechatronic package
The result. Internal stress removal on DR product
Technical data. Width: 900 - 1.400 mm; thickness: 0.10 - 0.70 mm
Other references. ArcelorMittal, Tata Steel, Posco, Shougang, Tosyali/Toyo

EXCELLENCE FROM EXPERIENCE

CONTROLLED ELONGATION MACHINES FOR PROCESSING LINES



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A joint venture of Mitsubishi Heavy Industries and partners

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