Cut to length lines
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**FIMI LEVELING PHILOSOPHY**

When the matter was about leveling & stress relieving steel strip featuring minimum yield strength 700 N/mm² which nowadays is the lower edge of the HSS range.

FIMI designers faced new peculiar problems and physical limits on the mechanics, which should be solved with a completely new process approach and new technologies compared to the ones applied to normal carbon steel.

In addition, the steel semi finished parts used for downstream manufactory processes are mainly produced using laser cutting and press forming lines, which demand strict requirements in sheets flatness & internal stresses relieving.

Since the first experiments made by Scandinavian steel producers, FIMI R&D department has been involved and took the leadership to drive all the other departments up to the practical application and consolidation of innovative solutions balancing leveling physical problematic and the containment of cost investment in terms of dimension, productivity and friendly operation of our Lines.

At the base of our approach there are simple concept:

» First, the customers have to flatten and stress relieve the material without modifying his physical and dimensional properties.

» Second, a single Line has to cover the widest range of thickness keeping high productivity and flexibility in switching over from one product to another: in fact our Lines can range from 1 to 27 mm with one pre-Leveler and two Levelers in cascade.

» Effectively leveling & stress relieving HSS primarily involves the geometry dimensions of the Levellers and the high torque transmission trough the cinematic chain. The force to be exercised between the upper and lower halves of the roller cassette, depending on the yield strength related to the thickness, can easily exceed 2200 tons, but surprisingly this is not the real issue.

Therefore, the main problem lies in the necessary torque transfer from the motor to each working roll. The removal of the material internal stress is given by the calculated percentage of plasticization generated by the steel strip flowing through a series of rolls dimensioned in number, diameter, inter axes distance and penetration. All these variables determine the curvature applied to the steel strip to obtain the correct plasticization, as consequence the diameter of the rolls has to be contained.

However, with HSS exceeding a certain ratio between yield strength and thickness, assuming a fixed width, the necessary pp's torque value to be transmitted to each working roll is exceeding the shaft dimensional and physical limits. Moreover, the torque demand is not uniformly distributed on each roll but the peak is on the ones at the Leveler entrance and decreases on the followings with a formula depending on the inclination angle between the lower and upper halves of the roller cassette.
The matter appears to be already quite complicated, but there is another variable affecting the process: the working rolls speed is not constant either, and to avoid material slipping and/or accumulation inside the Leveler, the exit side working rolls have to rotate faster than the ones at the entry side.

FIMI solution is to equip each working roll with sliding coupling thus when the maximum torque load is reached on the first roll, the coupling starts to slide transmitting the exceeding torque to the downstream roll. If on the downstream roll the torque calculated maximum value is exceeded again, the process repeats on the next roll.

This flowing of the torque downstream and in the same time reducing the speed in the opposite direction, automatically self adapt the correct values all along the rolls assembly. This is ensuring the perfect and continuous working torque/speed conditions in accordance to the preset plasticization.

**FIMI “TDDS” ™**

**Torque Dynamic Distribution System**

This is FIMI Patented System for Leveling HSS, High Strength Steel, with best care about Strip Surface of NON-ferrous material.

It has already been applied on several Lines including the last applications in Sweden, Germany and Great Britain.

Nowadays FIMI has commissioned Lines capable to level HSS coils with yield strength of 1200 N/mm² at 8 mm with a full laser cutting quality, which means less than a half of the minimum quality requirements indicated in the European Norms.
These kind of outstanding performances are also achieved by the application of a leveling philosophy consisting on progressive contribution of each Leveling machine.

Depending on the production range FIMI Lines are equipped with a minimum of two machines, pre-Leveler and Leveler, up to a maximum of three machines, pre-Leveler with two Levelers in cascade.

» The application of a calculated tension between the machines give a consistent contribution to the material plasticization, this working in tension of the Levelers takes advantage on FIMI experience with tension leveling concept.

» Highly advanced algorithms are presetting all the machines of the Line just inputting the material dimensions and yield strength. A powerful software with easy to understand HMI based on recalled flattening schedule stored in the system is the starting point for the operators to drive them in the process learning and optimization. Moreover self learning features are pacing FIMI know how with our Customers process philosophy.

Careful analysis and follow-up of the market demand together with a successful cooperation with our valued partners-customers has allowed FIMI to develop the state of the art process to level the strongest and thickest HSS with an astonishing ratio between investment and performances in term of quality, repeatability, availability, reliability and duration.

In addition the long tradition in details manufacturing accuracy and the specialized experience put FIMI at the glance in Cut to length lines process for ferrous and nonferrous metals.
CUT TO LENGTH LINES

During its 50 years of life, FIMI has developed an excellent expertise and know-how on CTL lines, that nowadays can be summarized as follows:

» CTL LINES FOR AUTOMOTIVE APPLICATIONS
» CTL TRAPEZOIDAL SHEET CUTTING
» CTL "BLANKING"
» CTL LINES FOR HOT ROLLED HSS (HIGH STRENGTH STEEL) AND UHSS (ULTRA HIGH STRENGTH STEEL)
» CTL LINES FOR HOT ROLLED HEAVY GAUGE STEEL
» CTL LINES FOR ALUMINIUM AND STAINLESS STEEL
» SHEET TO SHEET LEVELING LINES FOR LASER CUTTING QUALITY

CTL lines for automotive application

» CTL lines for automotive applications are especially designed to fulfil the surface quality needs and cutting shapes required by car manufacturers. The typical thickness range is 0,3-3,5 mm, while the requested shapes of cut sheets are: rectangular, trapezoidal and curved shape. The material processed is both steel and aluminium, even in High Tensile grade.
CTL, Trapezoidal sheet cutting

Blanking Line Automotive 0.5 – 2.6 x 2150 mm
**CTL, Trapezoidal Sheet Cutting**

- This Cut To Length Line is by definition equipped with a Rotary Shear “Vectronic” for Trapezoidal Cutting of the strip and a Stacker for Trapezoidal Sheets Stacking.
- This CTL finds its typical application with carbon steel automotive-grade gauging up to 3 mm.

**CTL, “Blanking”**

- Yet within Light Gauge and Medium Gauge families, the term “Blanking” identifies CTL for narrow metal strip, where “narrow” stands for strip width less than 1000 mm; metal processed are from stainless steel, for Household Applications, to carbon steel, for Car Wheels making.
CTL lines for Hot Rolled HSS (High Strength Steel) and UHSS (Ultra High Strength Steel)

CTL lines for Hot Rolled HSS and UHSS have been successfully developed to match the increasing demand of the market in reducing the thickness of the material while increasing its resistance. These lines take advantage of the patented TDDS® system developed by FIMI for its levelers in order to remove smoothly the internal tensions of the material. The typical applications are in structural engineering, cranes, lifting equipment in general, poles for wind turbines. The thickness range is 1-8 mm, but in some cases it can reach even 16 mm.
CTL lines for Hot Rolled Heavy Gauge Steel are becoming more and more popular in the recent years, due to the increasing demand for heavy plates from coils for structural engineering, wagons, ships, etc. Also these lines take advantage of the patented TDDS® system developed by FIMI for its levelers in order to remove smoothly the internal tensions of the material, even if in some special cases requested by the customers an Inline Skin Pass Mill can be added to the line for increasing the surface quality. These lines are designed for thickness up to 25.4 mm (1 inch).
Cut To Length Line for Aluminium & Stainless-steel

Cut To Length Line for Aluminium
This kind of CTL Lines, either for thin or thick gauge Aluminium, are featured by Machines, Devices and Technical Solutions very much dedicated to the nature of this metal, the way it is produced in the upstream processes and its fields of applications; just for citing few of the matters which are paid for attention:

Trimming
Edge Trimmer is to remove mill-edges; Scrap Cutter or Scrap Baller are either available to carry out scrap-chopping or scrap recovering as a ball.

Cleaning
Proper strip-cleaning is a need at entry of Leveling Machine.

Levelling
Six-high design of Levelling Cassettes is a must regardless thickness range. Levelling cassettes are equipped with chromium coated working rolls; intermediate rolls are helicoidal grooved.
Cut To Length Line for Stainless-steel

For Stainless-steel the Machines, Devices and Technical Solutions featured in CTL Line are same as the ones designed for Aluminium: very much the same is the need for Cleaning, Six-high designing of Levelling Cassettes, Ink-jet Printing and Stacking by Vacuum Stacker.

Printing
Ink-jet printing of every single sheet is a must when Aluminium is supplied for aircraft manufacturing.

Shearing
Know-how is a need to set proper blades angle cut. Maximum strip width today experienced 2850 mm is reflected in impressive wide Shears.

Stacking
Vacuum type is very much preferred.

Packaging
This is paid more attention than for other metals: more layers of plastic-film, paper and other protective materials are applied.
Our proven experience in Sheet-to-Sheet Leveling of High Strength and Heavy Gauge Steel is extended to Aluminium: a Single Leveler is provided with one to 3 roller-cassettes to perform “laser cut quality leveling” of the wanted thickness range; Cassette Change is featured semi or fully automatic. Entry and Exit pinch-rolls are to complete the Leveler for sheet multiple & reversing leveling. Our expertise covers also Scale Brushing & Vacuum Cleaning which is a must to be considered when leveling High Strength Steel. Entry and Exit Roller Conveyors are designed to mate with the wanted sheet length. Operators are benefitting from friendly HMI designed by FIMI.

Sheet-to-Sheet Leveling by Single Leveler
FUNCTIONS ACCOMPLISHED

Coil Stocking & Coil Loading

» The facility of Coil Stocking and the function of Coil Loading onto the Uncoiler’s Mandrel are commonly considered the latest issues, yet they are important features when lay-outing the Line as the narrow space might require special design to fit the relevant Units.

» We design Coil Stocking and Coil Loading in a variety of solutions aimed to time saving to provide benefit for production outcome.

Uncoiling & Coil Opening

» Uncouling is accomplished by a complete range of Uncoilers: from over-hanged to opposite Mandrels we have everything needed to comply with the range of materials and gauges processed into our Lines.

» Coil Opening is a simple yet tricky operation: we have the Coil Opening Table to open the thinnest and most delicate leading edge of the coil, as well as the Coil Opening Tooth to open coil of the thickest and toughest high strength steel.
Straightening of the leading edge of the coil

- This is an important function carried out at the Entry of the Line whatever the processed kind of material and range of gauges of the strip.
- Depending upon several figures like the quality of the strip surface, the range of gauges and the material strength, the Leading Edge of the Coil is simply bent, straightened or roughly leveled.
- Special regard is given to the heavy gauge high strength carbon steel as it is for the Rough Leveler in the picture here below featuring the complete extraction of the Roller Cassette.

Edge Trimming, Scrap Balling & Scrap Cutting

- Our Edge Trimmers are designed in a variety of types & sizes to accomplish edge trimming of metal strips featuring different grades as ferrous and non-ferrous, range of gauges rather than strip widths, and material strengths.
- Among our Edge Trimmers, a special type is designed to accomplish center line slitting of the strip.
- Every Edge Trimmer is complete with a Scrap Baller or a Scrap Cutter: these are to recover as a ball or to chop to pieces the scrap edges trimmed from the strip. As an option the Scrap Baller is featured with the automatic feeding of the scrap.
Edge trimmer with scrap cutter

Scrap cutter for medium gauge strip
Our Levelers are designed in a variety of types & sizes to exceed the top quality standards in leveling of metal strips featuring different grades as ferrous and non-ferrous, range of gauges rather than strip widths, and material strengths.

Metal strips processed are worth to be mentioned with reference to the most typical grades as stainless & carbon steel, painted steel, tin plate steel, automotive steel, high strength steel, aluminum, copper and brass.

Every Leveler can be fitted with a pair of different Cassettes: this is to extend the ability of the Leveler to perform over the widest range of gauges.

Cassette Change is featured in a variety of solutions to meet with the different Customers’ operational needs among manual, semi-automatic and fully-automatic (*).

(*) 8 minutes only to change the cassette after the touch of a single push button.

A number of Cassettes is available to fit into every size of the Levelers; every Cassette has an in-depth different design which is peculiar to the features of the metal strip to be processed.
Levelers into a heavy gauge CTL

Leveler for heavy gauge steel featuring total extraction of the roller cassette
Our Shears are designed in a variety of types & sizes to accomplish cutting of metal strips featuring different grades as ferrous and non-ferrous, range of gauges rather than strip widths, and material strengths.

Drum Shear “Rotronic”

The Drum Shear “Rotronic” is designed to perform cutting of tin plate steel typically gauging from 0,12 mm to 0,7 mm.

Rotary Shear “Vectronic” 4 mm

Our first Rotary Shear “Vectronic” delivered to a Customer date back the year 1989: the Shear is still running today with no need of maintenance other than a regular greasing.

To date the Rotary Shear “Vectronic” has been produced well over 100 units.
Rotary Shear “Vectronic” For Trapezoidal Cutting

This Rotary Shear is wanted for cutting trapezoidal sheet: the typical application of the trapezoidal shape is found with carbon steel automotive-grade sheets gauging up to 3 mm.

Rotary Shear “Vectronic” 8 mm

In the year 1996, the design of the Rotary Shear “Vectronic” 4 mm is upgraded to answer the demand from Customers for the performance of the Rotary Shear “Vectronic” extended to medium gage steel up to 8 mm: in the same year, the first Rotary Shear “Vectronic” 8 mm is delivered to a Customer.

Rotary Shear “Transtronic” 16 mm

In the year 2000, FIMI gives shape to the Rotary Shear “Transtronic” able to cut heavy gauge steel up to 16 mm. Highlights of this Rotary Shear are its compact design which allow ease of fitting into narrow spaces and the high production outcome when short sheets are cut.
Flying Shear “Flytronic” 10 mm, 16 mm & 25 mm

» These Flying Shears are designed to answer the demand from Customers for cutting heavy-gauge high-strength steel.
» The Flying Shears are characterized by a robust construction to guarantee long lasting operation.
» Thanks to our experience, the design of these Flying Shears guarantees ease of access for a safe and easy maintenance.

Crop Shear

» The Crop Shear is designed to perform in start-stop mode the cutting of head and tail strip.

Oscillating Crop Shear

» The Oscillating Crop Shear is designed to perform non-stop cutting of head and tail strip.
STACKING

» Our Stackers are designed in a variety of types & sizes to accomplish perfect stacking of metal sheets featuring different grades as ferrous and non-ferrous, range of gauges along with different sheet widths and lengths.

Vacuum Stacker

» Our Vacuum Stacker features design, construction and performances to comply with the high quality standard proper to our Company: this Stacker is very best suited for stacking of aluminum and light gauge stainless steel sheets.
» Belts provided with holes run in contact with vacuum chambers on one side while the other side is engaged with the sheet until this is dropped for stacking by shut-off the vacuum chambers and stop running the belts.
Magnetic Stacker

- Magnetic Stacker dates back long in the history of our Company; this Stacker is wanted mostly for stacking of carbon steel automotive-grade sheets up to include medium gauge steel.
- Belts run in contact with magnets on one side while the other side is engaged with the sheet until this is dropped for stacking by shutting off the power to the magnets and stop running the belts.
- Magnetic Stacker is also performing into Multi-Blanking Line.

Air Cushion Stacker

- At FIMI Air Cushion Stacker is made like nowhere among our Competitors. Also, when looking to the performance and ease of maintenance, these are difficult features to compete with for the other types of stackers.
- Steel sheets gauging up to 3 mm are actually floating onto nothing else than an air cushion.
- The most delicate materials like stainless steel BA grade, painted steel and aluminum are stacked without the least scratch.
- Air Cushion Stacker is also very best performing into Multi-Blanking Line to stack simultaneously up to no. 5 stacks of sheets.
Rackets Stacker

- Rackets Stacker is the most simple yet effective way for sheet stacking.
- Stacking is performed on steel sheet ranging into light to medium gauge up to no. 45 cycles = sheet drops per minute.
- No scratching is guaranteed on the most delicate materials.

Air Cushion & Rackets Stacker

- This Stacker is designed to combine the benefits from the Air Cushion Stacker and Rackets Stacker.
- Performances are very well proven on light to medium gauge stainless steel sheets.

Stacker For Trapezoidal Sheets

- This Stacker is successfully delivered to our Customers featured with both Magnets or Air Cushion; the Stacker also features no. 2 Stacking Platforms to perform non-stop stacking of trapezoidal sheets with non mirror-like shapes.
- Trapezoidal sheet stacking finds its typical application with carbon steel automotive-grade gauging up to 3 mm.
Bomb Doors Stacker

» Bomb Doors Stacker is wanted for stacking of heavy gauge steel sheets either stainless or carbon.
» Highlights of this Stacker are its robust construction to guarantee trouble free running with the least need of maintenance.
» The noise generated by the sheet stacking is lowered to the limits enforced by law with a noise proof isolation cabin designed to cover and enclose the Stacker completely.
COMPLEMENTARY DEVICES

Paper Recoiler

- Paper Recoiling is essential when stainless steel or aluminum coils are processed.
- Paper Recoilers are designed in a variety of solutions to meet with the different Customers’ operational needs: functions operated from control desk are to ensure quick operations when the Line is fully covered and enclosed.

Automatic Plastic Film Application

- Plastic Film Application is needed when stainless steel or aluminum coils are processed: the automation of this function set free the Line operator from the struggle of the manual application of the Plastic Film.

Paper application

- Paper Application in CTL is typically carried out underneath the strip; the paper is dried by heating rolls to be better stuck underneath the strip by electrostatic charge induced by powered electrostatic bars.
Book Opening Cassette

> The Book Opening Cassette is a simple yet essential device to allow the in depth cleaning of the Roller Cassette.

Machinery Tools Handling

> A wide range of Devices is produced within this family designed to guarantee safe and ease of use when changing the Shear Blades, the Scrap Cutter Rotors other than mounting the Spacers onto Mandrel etc.
Iron oxide strip coating. Scale in brief, as a typical feature of Hot Rolled steel, is abundant on High Strength carbon-steel. Scale powder produced in Cut To Length Lines due to strip leveling is removed by one to 3 Rotor Brushing Unit; top & bottom brush rotation is opposite to steel strip threading; Brushing Unit is moved transversal to line axis for even brush wearing. Perfect Scale Removal is essential to deliver clean steel-plates to the market and to preserve the machines in Cut To Length Lines from major wearing due to scale powder; Scale Removal is sometimes a need also in Heavy Gauge Slitting Line.

In nowadays market, perfect surface quality has become a need also when dealing heavy gauge plates; one mean to preserve the surface of the steel-plates is to monitor and maintain the rolls-cassette of Leveling Machines. While the cassette bottom halve is more easy to be accessed for inspection, the top halve need to be overturned for the ease & safe checking; we have a large experience in this field and have designed & produced Cassette Handling Devices to cover the extensive range of our Leveling Cassettes.
Cleaning of Rolls in Levelling Cassettes

Cleaning of rolls is essential to guarantee the surface of the metal strip is free from defects after leveling; as we range experiences through Aluminium to Stainless & Carbon Steel in the thickness range from 0,1 mm to 25,4 mm, we have complete knowledge of the matter; our Leveling Machines are case-by-case implemented with Spraying Nozzles and/or Felt Cleaning Device: the first, being able to limit surface strip from collecting debris floating in the air, the second, operated from time to time, is the mean to clean the rolls without the need to take out the Roller Cassette from the Leveler.

In Line Sheet Flatness & Dimensions Measuring System

In our CTL, we have successfully implemented Sheet Dimensions & Flatness Measuring System sorting out among the best Brands available on the market to complying with EN and/or ASTM standard; we have applied the Measuring System downstream the cut-to-length Shear so that checking both the Flatness and the Dimensions of the Sheet. Main benefits from In Line Measuring System:

» Sheet Flatness and Dimensions can be certified.
» Tuning of upstream Leveler can be improved on the basis of empiric data.
» Real Sheet data are available for downstream processes.
» Sheet Flatness and Dimensions are available for data analysis.